Anne Arundel Medical Center

Comment to BWMC CON Application for Cardiac Surgery

Docketed June 26, 2015

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July 27, 2015

VIA EMAIL: Paul.Parker@maryland.gov
VIA HAND DELIVERY

Mr. Paul Parker
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Maryland Health Care Commission
4160 Patterson Avenue
Baltimore, Maryland 21215

Re: Anne Arundel Medical Center Comment on
University of Maryland Baltimore-Washington Medical Center
Proposal to Change the Type and Scope of Health Care Services
Offered to Include Cardiac Surgery: Docket # 15-02-2361

Dear Mr. Parker:

Anne Arundel Medical Center ("**AAMC**") hereby submits to the Maryland Health Care Commission (the "**Commission**") the following written comments to the Certificate of Need ("**CON**") application (the "**Application**") of the University of Maryland Baltimore Washington Medical Center ("**BWMC**") for the establishment of a cardiac surgery program (the "**Proposed Program**"). AAMC is the other applicant in this comparative review.[1]

[1] AAMC is an interested party pursuant to subsections (a) and (e) of COMAR 10.24.01.01(B)(20).

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I. Summary of Comments

A review of the Application demonstrates that the Commission should prefer AAMC over BWMC in this comparative review according to the standards set forth in the State Health Plan for Facilities and Services: Specialized Health Care Services – Cardiac Surgery (the "**SHP**").

BWMC will not likely attain and sustain the 200 cases need to meet the need and minimum volume standards of the SHP. This is in part due to its inferior case on the SHP's access standard: although Anne Arundel County suffers from inadequate access to cardiac surgery, for adults in BWMC's proposed cardiac surgery service area, more live closer to the University of Maryland Medical Center ("**UMMC**") or AAMC than BWMC. Similarly, unlike AAMC, BWMC saves patients and the health care system little or no money. Moreover, the Application projects that BWMC's Proposed Program will not be self-sustaining. Finally, other comparative review factors – such as quality and cardiac education and outreach – weigh in favor of AAMC rather than BWMC.

II. Volume

BWMC will not likely attain and sustain 200 cardiac surgery cases by the second full year of operation of the Proposed Program, as required by the SHP.[2] The Application states that the Proposed Program will achieve just 204 cases in FY 2017 and 228 cases in FY 2018, relying heavily on volume redirected from UMMC.[3] But under its own assumptions, BWMC can only

[2] COMAR 10.24.17.05(A)(1)(a), COMAR 10.24.17.05(A)(6)(a).

[3] Application Exhibit 23. Note that BWMC identifies FY 2017 as the second year of operation of the Proposed Program. Application at p. 43-44.

capture at most 17.92% of UMMC's cardiac surgery caseload.[4] And even then, these projections rely on unproven or faulty assumptions regarding (1) BWMC's ability to redirect UMMC patients, (2) BWMC's ability to capture non-UMMS patients, and (3) the case mix of cardiac surgery cases in its proposed service area. If the Application is even slightly incorrect in any of these assumptions, the Proposed Program would fall under the 200 case threshold for FY 2017 (and likely FY 2018 as well).

1. The Application's UMMC/BWMC Market Shift Assumptions are Arbitrary

The Proposed Program's cardiac surgery case projections rely heavily on a shift in cases from UMMC to BWMC. Market shifts from UMMC to BWMC for FY 2017 and FY 2018 amount to 71.1% and 66.2% of BWMC's volume in those years, respectively.[5] When fully established, BWMC expects the Proposed Program to shift to BWMC 80% of all minor to moderate severity cases in BWMC's service area that UMMC would otherwise expect to perform.[6] But, as revealed by Commission staff's completeness questions, this 4 to 1 division of cases is a guess as to patient and physician preferences when weighing the benefits of geographic

[4] BWMC notes that only 27% of UMMC's cases originate in BWMC's service area. Application at p. 45 ("In FY14, of the 828 cardiac surgery discharges at UMMC, 27% originated from UM BWMC's service area..."). Of those, only 83% are "non-severe" cases, meaning those cases that BWMC would perform under the division of labor between UMMC and BWMC whereby UMMC will retain all cases deemed "severe" per pre-operative screening. BWMC's 5-6-15 Response to Second Round of Completeness Questions ("**Completeness II**") at p. 2. Of those in-area, non-severe cardiac surgery cases that UMMC otherwise would perform, BWMC expects UMMC to retain 20% of such cases for various reasons. Completeness II at p. 3. Thus, BWMC does not expect to perform more than 17.92% of all cases UMMC would perform: 17.92% = 27% x 83% x 80%. *See* Completeness II at p. 3.

[5] Application Exhibit 23.

[6] Completeness II at p. 3. For FY 2017, BWMC assumes it would capture 70% of such cases.

proximity to care for the patient against a possible preference for UMMC or familiarity with UMMC.[7] And the Application gives multiple reasons to doubt the 80% figure.

First, BWMC, in projecting volume by zip code, assumes that the 80% figure would apply to patients in each of its proposed cardiac surgery service area zip codes.[8] But five of these zip codes (the "UMMC Proximate Zip Codes") are in fact closer to UMMC than BWMC, including 21225 (Baltimore), 21090 (Linthicum Heights), 21226 (Curtis Bay), 21227 (Halethorpe), and 21075 (Elkridge).[9] As shown in the below chart, the projected FY 2017 cases fall to about 195 – below the minimum threshold – if one assumes that the patients who live closer to UMMC will prefer UMMC to the same degree that the Application assumes patients who live closer to BWMC will prefer BWMC in that year:

COMMENT CHART 1

FY 2017 Market Shift from UMMC to BWMC (Alternative Assumptions)

	Step	Result
1	UMMC FY 2014 Cardiac Surgery Cases (Non-Extreme Severity) from the UMMC Proximate Zip Codes	23
2	BWMC Projected Cardiac Surgery Use Rate Decline (Cumulative):	~ 7.7%

[7] Completeness II at p. 3. BWMC cites to letters of support from (1) certain local cardiologists indicating a potential interest in the Proposed Program, and (2) former UMMC patients indicating a preference for a local treatment option.

[8] Application Exhibit 23.

[9] See enclosed Exhibit 1(a), charts showing the distance (in miles) of AAMC, BWMC, and UMMC to AAMC/BWMC proposed cardiac surgery service area zip codes, as well as Exhibit 1(b), a service area map reflecting the data contained in Exhibit 1(a). Like BWMC's taxi trip analysis (Completeness I at p. 17 – Table 23 fn. 1), the distance for each zip code was calculated by entering the zip code into Google Maps to (a) pinpoint a central location within the zip code, and (b) obtain driving routes from that central location to each of UMMC and BWMC. Unlike BWMC's taxi trip analysis, only the "shortest distance" route was used. Google Maps' estimate of driving time varies substantially depending on the time of day specified for the journey and associated traffic conditions. Only "shortest distance" is consistent across all times of day.

	FY 2014 – FY 2017	
3	UMMC FY 2017 Cardiac Surgery Cases (Non-Extreme Severity) from UMMC Proximate Zip Codes (**Prior to Market Shift**): [1] x [2]	~ 21
4	Percentage FY 2017 Market Shift to BWMC from UMMC of Cardiac Surgery Cases (Non-Extreme Severity) for UMMC Proximate Zip Codes: BWMC Assumption[10]	70%
5	Cases Shifted under BWMC Assumption: [3] x [4]	16
6	Percentage FY 2017 Market Shift to BWMC from UMMC of Cardiac Surgery Cases (Non-Extreme Severity) for UMMC Proximate Zip Codes: Parallel Alternative Assumption[11]	30%
7	Cases Shifted under Parallel Alternative Assumption: [3] x [6]	~ 7
8	Decline in Cases under Parallel Alternative Assumption: [4] – [7]	~ 9
9	BWMC Projected FY 2017 Cardiac Surgery Cases: BWMC Assumption	204
10	BWMC Projected FY 2017 Cardiac Surgery Cases: Parallel Alternative Assumption [9] – [8]	~ 195

If patients residing closer to UMMC than BWMC continue to use UMMC, BWMC would not reach the 200 case minimum volume threshold in FY 2017.

Second, BWMC relies on attracting patients who are closer to UMMS affiliate Prince George's Hospital Center ("**PGHC**") than to BWMC. For example, BWMC's FY 2017 volume projection includes 5 cases from two zip codes in Laurel (20723 and 20724), including one case from UMMC.[12] If those cases were instead performed at PGHC, BWMC's volume for FY 2017

[10] BWMC assumes that in FY 2017 it will perform 70% of UMMC's non-extreme severity cases originating in BWMC's proposed cardiac surgery service area, as part of a ramp up from 30% of such cases in FY 2016 to 80% of such cases in FY 2019 and beyond. Application Exhibit 23.

[11] The parallel alternative assumption is that 70% of cases originating in zip codes closer to UMMC than BWMC would remain at UMMC. This alternative assumption is a conservative one since, of course, UMMC's long-established cardiac surgery program would not be in a "ramp up" phase in FY 2017.

[12] Application Exhibit 23.

would drop to 199 cases. This is part of the overall tension between UMMS' drive to revitalize cardiac surgery at PGHC on the one hand, and the Application's implicit marginalization of cardiac surgery at PGHC – "One Program, **Three** Locations" – on the other.

Third, the Application does not demonstrate a strong organic source of cardiac surgery cases for the Proposed Program in light of the 80% figure. Table 3 of the Application (as revised) states that, based on a survey of four local cardiology practices and the UM SOM Division of Cardiovascular Medicine, the "Estimated Referrals of Cardiac Surgery Cases to UM BWMC" from those five sources should amount to 259.[13] But Revised Table 3 fails to discount that estimate properly:

- For at least those cases referred to UMMC, Revised Table 3 does not apply the same 20% discount for patient and physician preference to remain at UMMC that BWMC applied for BWMC's yearly projections (Application Exhibit 23).[14]
- Revised Table 3 does not discount the estimate for expected decline in volumes in the health planning region, which BWMC's own Exhibit 23 estimates at a cumulative 7.7% decline from FY 2014 to FY 2017.[15]

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[13] Completeness II at p. 2 – Revised Table 3. BWMC candidly acknowledged, as has AAMC, that not every cardiac surgery referral results in cardiac surgery. *See* Application at p. 45.

[14] This failure to discount is shown by footnote 3 to Revised Table 3 on page 2 of BWMC's 3-30-15 Response to First Round of Completeness Questions ("**Completeness I**") The footnote states that in FY 2014, the UM SOM Division of Cardiovascular Medicine made 200 direct referrals to the UM Division of Cardiac Surgery resulting in a cardiac surgery discharge. Revised Table 3 counts 45 of those cases. Revised Table 3 arrives at the number by discounting for the expected proportion of those patients from BWMC's proposed cardiac surgery service area (27%) and the proportion of those patients with minor to moderate severity (83%). Applying those discounts results in the 45 cases identified by BWMC (45 = 200 x 0.83 x 0.27). Therefore, the methodology used could not have discounted for patient preference or projected volume declines in the region.

[15] See previous footnote.

- Cases estimated from the Heart Center of Northern Anne Arundel County, P.A. include a speculative "10% increase based on the projected addition of another physician to the practice."[16] This does not represent a tangible referral source and should not be counted.

When these discounts are applied to Revised Table 3 for FY 2017, for example, the "Estimated Referrals of Cardiac Surgery Cases to UM BWMC" declines to about 163 cases, as demonstrated below:

COMMENT CHART 2

FY 2017 Estimated Referrals of Cardiac Surgery Cases to BWMC from Selected Cardiology Practices (Alternative Assumptions)

	Step	Result
1	BWMC Estimated Total Referred Cases – Before Severity Adjustment (Application Original Table 3)	312
2	Cases Attributable to Speculative Physician Addition by The Heart Center of Northern Anne Arundel County, P.A.: (Application Original Table 3)	9[17]
3	BWMC Estimated Total Referred Cases Without Speculative Addition – Before Severity Adjustment; [2] – [1] (Application Original Table 3)	303
4	Proportion of Cases Remaining After Severity Adjustment	83%
5	Proportion of Cases Remaining After Use Rate Decline Adjustment	92.3%[18]
6	Proportion of Cases Remaining After Adjustment for Patient/Physician Preference	70%
7	BWMC Estimated Total Referred Cases After Adjustments: [3] x [4] x [5] x [6]	163

[16] *See* Completeness I at p. 2 - Revised Table 3 (footnote 2). It is a bit like saying that one should expect the overall population of Maryland to increase next year because people expect babies to be born here next year. Of course, practices add physicians; physicians also leave practices and sometimes unexpectedly.

[17] Or, 10% of 89.

[18] After the 7.7% use rate decline is applied.

Thus BWMC has overestimated the number of cases it can expect to receive from sources internal to UMMS or affiliated with UMMS.

Further, the most fundamental difference between BWMC's projections and AAMC's projections for cardiac surgery is BWMC's reliance on projected demand vs. AAMC's reliance on existing, in-house demand at AAMC. In FY 2014, only about 97 patients reportedly received cardiac catheterization at BWMC and later required "procedures that could have been performed at UM BWMC if cardiac surgery services were available."[19] In contrast, in the previous year, 162 AAMC inpatients, and 72 AAMC outpatients evaluated in AAMC's cardiac catheterization laboratory, needed transfer to a hospital with cardiac surgery.[20] Stated simply, AAMC has documented a total of 234 patients who were served at AAMC and required transfer to a cardiac surgery performing hospital; this does not represent projected or possible demand, but represented current demand by patients who have chosen AAMC and are being served already by AAMC clinicians.

2. BWMC Lacks a Basis for Capturing Non-UMMS Patients

BWMC expects to rely increasingly on market shifts from hospitals other than UMMC to maintain volume above 200 cases as use rates decline.[21] As noted above, BWMC's own assumptions dictate that it can capture at most only 17.92% of UMMC's cardiac surgery caseload. This ceiling gains significance as the Commission predicts overall volumes in the

[19] Completeness I at p. 18.

[20] See Chart 45 in AAMC's response to its first round of completeness questions (March 30, 2015).

[21] Application Exhibit 23.

planning region to decline over the next decade. Under BWMC's projections, cases shifted to BWMC from UMMC peak in FY 2019 at 157 and decline in each of the next two years.[22] BWMC would then increasingly rely on greater market shifts from non-UMMS hospitals.[23] But BWMC does not set forth any basis to support the projected increase in shifted cases from non-UMMS cardiologists and BWMC.[24]

BWMC confirms as much in its completeness response. When the Commission staff asked BWMC to provide the assumptions behind the non-UMMC market shifts predicted by BWMC, BWMC replied that it had worked backward from an assumption of 50% BWMC market share for its proposed cardiac surgery service area by FY 2021, first estimating the size of the market shift from UMMC, and then distributing "market shift evenly among programs other than UMMC."[25] Essentially, BWMC admits it has no basis - such as referral patterns - to differentiate between non-UMMS hospitals in estimating market share shifts in apportioning the volume associated with the 50% market share assumption.

Moreover, the 50% market share assumption is questionable. BWMC reasoned that "when its cardiac surgery program is mature, its overall cardiac surgery market share in its projected cardiac surgery service area would approximate UM BWMC's current cardiology

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[22] Application at p.45, Table 4.

[23] Non-UMMS cases shifted to BWMC would grow from 29% of BWMC's caseload in FY 2017 to 45% of its caseload in FY 2021. *See* Application at p. 45, Table 2.

[24] In contrast, AAMC-affiliated cardiology practices – practices which support AAMC's application – currently refer cases to the hospitals from which AAMC expects to shift volume (Johns Hopkins Hospital, Washington Hospital Center, and UMMC). *See* AAMC application at pp. 90-91.

[25] Completeness II at p. 4.

market share percentage in its HSCRC service area."[26] But BWMC proposes to serve cardiac surgery patients from a far larger area than its HSCRC service area, extending to zip codes in Prince George's County, zip codes in AAMC's HSCRC service area in southern Anne Arundel County, and Eastern Shore zip codes over 90 miles away from BWMC.[27] In that service area, BWMC had about 24% of the total inpatient cardiology market share in CY 2013 and CY 2014, according to the HSCRC.[28] Even for Anne Arundel County, BWMC had less than 36% of such market share. For the Eastern Shore counties, it had less than 1.5% of such market share in each county. Accordingly, BWMC has offered no credible basis for assuming BWMC will have 50% of the cardiac surgery market in its proposed cardiac surgery service area, and the basis cannot be BWMC's current market share in cardiology in that area.

3. BWMC Uses Unreliable Case Mix Assumptions

BWMC has stated that the Proposed Program would perform only those cardiac surgery cases preoperatively assessed as non-extreme in severity (per the Society of Thoracic Surgeons Risk Calculator tool) while extreme severity cases "will continue to be performed at UMMC."[29] The Application projects that 17% of all cases in the proposed service area will be of extreme severity through FY 2021.

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[26] Completeness II at p. 4.

[27] *See* Exhibit 1(a) to this comment.

[28] For the data underlying this paragraph's analysis, see generally Exhibit 2 to this comment, enclosed.

[29] Completeness II at p. 2, fn 1.

This 17% figure, while it may reflect UMMC's historical experience in FY 2014, should be expected to rise. High-risk cases are becoming a greater proportion of cardiac surgery cases, even as mortality has declined. A recent study (enclosed as Exhibit 3) tracked "changes in the predictors of hospital mortality among patients undergoing cardiac artery bypass graft (CABG) during a span of 18 years" (1991-2008) and found that "[t]he prevalence of most risk factors for mortality increased over the 18-year period of this study" even as actual mortality declined.[30] Similarly, a widely-cited study published in the early 2000s (enclosed as Exhibit 4) showed increasing severity of pre-operative risk profiles over a ten year period using information from the Society of Thoracic Surgeons' own database.[31] Finally, the Application's own assumption is that a majority of cases in BWMC's service area will be of moderate severity, one step below extreme severity.[32]

Even a small difference in the ratio of extreme to non-extreme cases would cause the Proposed Program to drop near or below minimum volume thresholds. If extreme severity cases comprised just 20% (rather than 17%) of FY 2017 caseloads in BWMC's proposed service area, for instance, BWMC's caseload would fall to 196 or 197 cases, again below the minimum volume threshold:

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[30] Algarni, Khaled D., et al. "Decreasing prevalence but increasing importance of left ventricular dysfunction and reoperative surgery in prediction of mortality in coronary artery bypass surgery: Trends over 18 years." *The Journal of thoracic and cardiovascular surgery* 144.2 (2012): 340-346.

[31] Ferguson, T. Bruce, et al. "A decade of change—risk profiles and outcomes for isolated coronary artery bypass grafting procedures, 1990–1999: a report from the STS National Database Committee and the Duke Clinical Research Institute." *The Annals of Thoracic Surgery* 73.2 (2002): 480-489.

[32] Completeness II at p. 2.

COMMENT CHART 3

FY 2017 Market Shift from UMMC to BWMC (BWMC Exhibit 23 Assumptions)

	Step	Result
1	BWMC Projected Proportion of Non-Extreme Severity Cases	83%
2	Alternative Projection of Non-Extreme Severity Case Ratio	80%
3	Percentage Decrease Under Alternative [1 – (2)/(1)]	3.61%
4	BWMC Projected Cardiac Surgery Cases	204
5	Case Decrease Under Alternative [(3) x (4)]	~ 7
6	Alternative BWMC Projected Cardiac Surgery Cases [(4) - (5)]	197

Applying the same reasonable alternative assumption would cause the Proposed Program's projected caseload to fall to 220 in FY 2018 and 240 in FY 2019. BWMC's reliance on a static 17% figure threatens to place the Proposed Program below the minimum volume threshold of the SHP.

Each of the above individual analyses indicates that BWMC's cases would fall below 200 in FY 2017. Cumulatively, the effect would drop BWMC's cases far below 200, and dangerously close to 200 in FY 2018 and beyond. The Application has not shown that the Proposed Program would meet the need and minimum volume standards of the SHP.

III. Cost

1. Cost Effectiveness

BWMC saves patients and the health care system as a whole little or no money.[33] Savings from market shifts to BWMC from UMMC go directly into UMMS' pocket.

[33] "An applicant shall provide an analysis of how the cost of cardiac surgery services for cardiac surgery patients in its proposed service area and for the health care system will change as a result of the proposed cardiac surgery program…." COMAR 10.24.17.05(A)(4)(b). "An applicant shall provide information and analysis with respect to the impact of the proposed project…on costs to the health care delivery system." COMAR 10.24.01.08(G)(3)(f).

First, BWMC would charge cardiac surgery patients per case ($51,952) more than AAMC would charge ($37,501), even though BWMC and AAMC would perform cases of about the same severity/acuity.[34]

Second, the Application states straightforwardly that "[r]evenue associated with patients who move from UMMC to BWMC will remain within UMMS."[35] Cardiac surgery revenue forgone by UMMC will be recovered by UMMS through charges to patients other than BWMC cardiac surgery patients.[36]

Third, BWMC does not apply the 50% volume cost factor to either its own charge per case or other Maryland hospital's charges per case. When UMMS savings are excluded and the 50% volume cost factor is applied, BWMC's system-wide savings in FY 2018 are not $2,411,104, but rather $128,998.[37] Moreover, because BWMC would relocate 30 cases to Maryland from the District of Columbia, BWMC would increase revenue at Maryland hospitals in the aggregate by $650,282. These conclusions are demonstrated below:

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[34] Compare AAMC's CMAD per case of 3.42 (AAMC application at p. 168) to BWMC's CMAD of about 3.40 (Application Exhibit 43). In addition, AAMC's projected charge per case at a CMI of 1.0 ($10,962) compares favorably to that of BWMC's ($11,911.19).

[35] Application at p. 62.

[36] For instance, although BWMC claimed that it would save patients money through a shorter average length of stay at BWMC than at UMMC (Application at p. 63), BWMC acknowledged in completeness that the Proposed Program would cause the average length of stay for UMMC's remaining cases to lengthen, given that BWMC would take only non-extreme severity cases. (Completeness I at p. 18).

[37] That said, a program at BWMC would likely realize some savings from the shift of cases from higher-cost D.C. hospitals, which savings are not estimated in BWMC's Application.

COMMENT CHART 4

FY 2018 Effect of Market Shift to BWMC on Maryland Hospital Revenue[38]

	Step	Result
1	BWMC Claimed Savings from Market Shift	$2,411,104
2	Savings Attributable to Market Shift from UMMC	$2,153,109
3	Savings from Market Shift from Hospitals other than UMMC: [(1) – (2)]	$257,995
4	Market Shift Adjustment Factor (BWMC Assumption)	50%
5	Net Savings: [(3) x (4)]	$128,998
6	Cases Shifted to BWMC from D.C. Hospitals	30
7	BWMC Charge Per Case	$51,952
8	Net Increase in Maryland Hospital Revenue Caused by Shift of D.C. Cases to BWMC: [4] x [6] x [7]	$779,280
9	Aggregate Increase in Maryland Hospital Revenue Caused by BWMC Proposed Program: [8] – [5]	$650,282

Not only is the assertion of $2,411,104 in savings misleading, as noted above, but the $2,411,104 itself was calculated in error. The $2,411,104 was based on comparing BWMC's charge per case for cardiac surgery against that of other Maryland hospitals by multiplying (a) the hospitals' charge per revenue center by (b) the RVUs per revenue center per case for BWMC's expected case mix.[39] But a hospital's allowable charge per case may be less than the product of RVUs multiplied by rates. Under the GBR system, a hospital's allowable charge per case amounts to the product of (i) its case mix adjusted discharge CMAD for that case, and (ii) its charge per CMAD.[40]

[38] Unless otherwise noted, data from this chart is from Application Exhibit 43 and Application at p. 55 – Table 5.

[39] Completeness I – p. 13.

[40] AAMC used this method in its application. BWMC also uses this method for calculating its own revenue (vs its own charges). *See* Completeness II Exhibit 43.

2. Financial Feasibility

The Application does not show that BWMC can create a sustainable cardiac surgery program within three years of the establishment of BWMC's proposed program, as required by the SHP.[41]

First, BWMC's own projections state that the Proposed Program will not sustain itself financially, but will in fact lose millions of dollars every year.[42] In FY 2017, the first full year of operation, the Proposed Program will generate a net loss of $1,875,522. The rate of loss will grow every year of the projection: by FY 2021, the Proposed Program will generate a net loss of $2,734,562 per year.

Second, BWMC likely overstates UMMC's savings by attributing the decrease in certain variable costs at UMMC – namely, the reduction of two cardiac operating room teams – to the Proposed Program. In response to a completeness question, however, BWMC admitted that factors other than market shift to BWMC would reduce the need for the UMMC OR teams,

[41] An applicant must show that "[w]ithin three years or less of initiating a new or relocated cardiac surgery program, it will generate excess revenues over total expenses for cardiac surgery, if utilization forecasts are achieved for cardiac surgery services." COMAR 10.24.14.05(A)(7)(b)(iv).

[42] *See generally* Application Table K (revised 3/30/15). BWMC's position is that under the GBR system, "it is not possible to achieve financial feasibility of a new stand-alone cardiac surgery program because revenue can only be achieved through market share adjustments and certain other adjustments to revenues." Application at p. 61, fn. 9. AAMC disagrees. The HSCRC has indicated that, for new services, it has the flexibility to provide targeted funding through the annual update process for individual hospital budgets. (Enclosed as Exhibit 5 is the HSCRC staff's May 2015 presentation entitled "Global Budget Revenue Contracts Market Shift Adjustments Draft Technical Report"). The HSCRC has used this process to fund, in part, Holy Cross Germantown Hospital. This makes sense: if approved, a new cardiac surgery program at AAMC or BWMC should be funded. And neither program would have the historical volume the HSCRC's market share algorithm uses to project allowed market share on a service-line by service-line basis. Therefore, AAMC expects the HSCRC to permit a cardiac surgery program in Anne Arundel County to increase revenue at a level equivalent to 85% of charges rather than the new 50% variable cost factor for market shift adjustments. Nevertheless, this comment applies the 50% figure used by BWMC for the sake of consistency between the analysis of financial viability and cost to the health care system, both of which are affected by the choice of variable cost factor.

including the transfer of non-cardiac cases from UMMC to other UMMS hospitals and the overall decline in cardiac surgery volumes projected for the planning region.[43]

Moreover, to the extent that BWMC overestimates the extent to which current UMMC personnel can adequately serve equivalent roles in the Proposed Program, BWMC underestimates personnel cost. BWMC plans to minimize these costs by using certain existing UMMC personnel on a part-time basis, including a part-time director of perfusionist services, shared perfusionists between UMMC/SJMC/BWMC, support and training services from UMMC cardiac team nurses, and contracting for cardiac surgery coverage with UMMS surgeons.[44]

Third, BWMC undercounts the capital cost of the Proposed Program by $5,157,195. The Proposed Program will occupy two operating rooms that BWMC otherwise needs for more and longer non-cardiac surgery cases.[45] To compensate, BWMC plans to replace three smaller ORs with three larger ORs at a cost of $5,157,195.[46] But BWMC does not count that $5,157,195 as part of the cost of the Proposed Program.[47] That position is equivalent to an argument that one can add water to a full bucket without causing it to overflow, so long as the water is added to the bottom of the bucket.

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[43] Completeness I at pp. 18-19.

[44] *See* Application at p. 20.

[45] *See* Completeness I at p.2, Table 18 (showing a trend of more cases and more minutes per case for non-cardiac surgery at BWMC).

[46] Application at p. 23.

[47] *See, e.g.,* Application Table B.

An examination of BWMC's operating room capacity confirms that this full capital investment of $6,416,323 is required. BWMC asserts that (a) if the Proposed Program is approved, (b) the Proposed Program occupies 2 operating rooms, and (c) BWMC replaces the three smaller ORs with the three larger ORs for non-cardiac cases, then BWMC would have one to two ORs of extra capacity, and therefore, the Proposed Program should not be charged for the cost of that extra capacity.[48] However, BWMC will not have overcapacity. The minutes per case for surgery performed at BWMC climbed from 102.4 minutes in FY 2012 to 106.8 minutes in FY 2013 to 110.0 minutes in FY 2015, a growth rate of over 3% per year.[49] Yet BWMC projects minutes per case will **fall** in FY 2015 (to 108.4 minutes) and remain at that level through FY 2020. If instead a 3% growth rate is applied[50] – a more reasonable assumption given the historical trend of the metric and the trend toward pushing lower-acuity surgery off the hospital campus – BWMC would reach 120 minutes per case by FY 2017, the first full year of the cardiac surgery program.[51] Applied across the 10,982 cases projected for that year, this in turn would increase total minutes by 127,391 that year – enough to decrease remaining capacity to 60,275 minutes, about half an operating room worth of capacity.[52]

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[48] Completeness I at p.2 – Table 18.

[49] Completeness I at p.2 – Table 18.

[50] BWMC projects 10,723 cases in FY 2015 and steadily climbing caseloads in later years, making 10,500 a conservative assumption. *See* Completeness I at p. 2 – Table 18.

[51] Multiply 110.0 minutes by 1.03 to the third power (for the three years between FY 2014 and FY 2017).

[52] Completeness I at p.2 – Table 18.

Since the future replacement of the three operating rooms with larger rooms is necessary to the Proposed Program, the capital costs associated with the replacement should count as a cost of the Proposed Program.[53]

Finally, BWMC's projected decline in charity care expense, noted below, will decrease BWMC's revenue and thus its ability to absorb losses from the cardiac surgery program. Under the HSCRC's global budget revenue methodology, a reduction in a hospital's charity care expense forces the hospital to decrease its revenues proportionately. However, the Application does not account for this decline in revenues.[54] Therefore, the Application substantially overstates both the revenue and net income of BWMC.

IV. Access

On one fundamental matter, we are not in dispute with the other applicant in this review: Anne Arundel County needs a cardiac surgery program. However, BWMC's Proposed Program will deliver only marginal improvements to access when compared to a cardiac surgery program at AAMC, for the following reasons.

First, most of the adults living in the relevant proposed service area are actually closer to UMMC and to AAMC, than to BWMC. For zip codes in BWMC's proposed cardiac surgery service area, about 44,000 fewer adults live in zip codes closest to BWMC (283,828) than live in

[53] BWMC points out that the Commission issued a non-coverage determination for the replacement of the operating rooms (the determination of non-coverage is enclosed as Exhibit 6) because the replacement did not exceed the threshold for capital expenditure triggering CON review. *See* Application at p. 23. Nevertheless, when the Commission evaluates a CON for a proposed project, the costs of the project are accounted for regardless of whether the costs meet the capital expenditure threshold or not.

[54] See Application Table G (revised 3/30/15).

zip codes closer to either AAMC or UMMC (327,677); for zip codes in the combined proposed cardiac surgery service areas of BWMC and AAMC, more adults live in zip codes closest to AAMC (527,815) than live in zip codes closer to UMMC or BWMC **combined** (387,405).[55]

Furthermore, many patients in economically challenged locations in BWMC's primary service area – such as Brooklyn – are likely to find it easier to access UMMC than BWMC, as BWMC's own taxi cab analysis shows.[56] That same analysis also shows that the primary access barrier BWMC identified for cardiac surgery in its service area – lack of car ownership – is not solved by BWMC's Proposed Program: the average person without a car in BWMC's primary service area would only save about **$15** on a **round-trip**, **tip-included** taxicab fare to BWMC vs. the same fare to UMMC.[57]

Second, BWMC lacks the strong transfer considerations present in AAMC's case. Although BWMC rightly states that transfers from one hospital to another for cardiac surgery increases mortality risk through the disruption of care coordination and the stress of the transfer itself, BWMC does not quantify the number of inpatients transferred. In contrast, in the previous year, 162 AAMC inpatients needed transfer to a hospital with cardiac surgery.[58]

Third, BWMC also lacks the strong care coordination considerations present in AAMC's case. Although BWMC is correct that pre-operative and post-operative care coordination is vital

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[55] *See* Exhibit 1(a) to this comment.

[56] Completeness I at p. 17 – Table 23.

[57] Completeness I at p. 17 – Table 23. ($59.16 to UMMC; $45.44 to BWMC).

[58] AAMC application at p. 80

in the cardiac surgery context, BWMC cannot explain how BWMC's Proposed Program will improve care coordination over the status quo integration of cardiology across UMMS. "A patient/family focused system of discharge and follow-up care is currently in place for all UMMS facilities..."[59] Moreover, UMMS could "establish an outpatient clinic at UM BWMC with surgeries being performed primarily at UMMC..."[60] BWMC's arguments that BWMC's Proposed Program will nevertheless do more to improve care coordination are not persuasive:

- To the extent that non-surgeon practitioners involved in patient care have privileges at BWMC and not at UMMC, UMMC could grant such privileges to such providers.
- Even if BWMC's care coordination team is more familiar with local resources for follow-up care, why can't the BWMC team coordinate care for UMMC cardiac surgery patients in BWMC's GBR service area?
- Why can't UMMS providers offer follow-up care at BWMC for surgery performed at UMMC?[61]

Ultimately, the case for improved care coordination boils down to the geographic proximity of BWMC for patients and their families. But, as explained above, for most of the patients BWMC seeks to serve, BWMC is actually farther from those patients than UMMC or AAMC.

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[59] Completeness II at p.5.

[60] Completeness II at p. 6.

[61] In contrast, AAMC is an independent hospital, part of neither the MedStar system nor the Hopkins network, which together receive most of AAMC's cardiac surgery transfers.

Finally, note that BWMC declined to state that access barriers exist in the Baltimore/Upper Shore health planning region, or to present a detailed plan for addressing access barriers in that region, despite the SHP's express invitation to do so.[62]

V. Other Factors

1. Preference in Comparative Review – Outreach and Education

BWMC documents admirable education and outreach efforts in its service area; however, the efforts it documents mostly related to non-cardiac health conditions, despite the express focus of this standard on whether BWMC has an established record of **cardiac** education and outreach.[63] When BWMC does document its cardiac-related outreach, it mixes impactful programs (such as vascular screenings) with activities that can barely be described as outreach, such as the appearance of BWMC physicians in local news articles about cardiac issues.[64] The Commission should carefully compare AAMC and BWMC on the impact and effectiveness of their existing cardiac education and outreach efforts in their communities.

2. Charity Care

Relative charity care budgets between AAMC and BWMC should not be a significant factor in this review. [65]

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[62] Application at p. 58.

[63] Examples include an extensive discussion of pregnancy and prenatal health programs, such as "Healthy Babies" and "Stork's Next." Application at p. 82.

[64] Application at pp. 75, 89.

[65] No standard of the SHP makes relative charity care provision a factor in comparative reviews. Rather, the SHP simply requires that each Maryland hospital have a charity care policy that is publically available, that is appropriate to the needs of the service area population, and that provides for prompt determination of a patient's probable eligibility for assistance. *See* COMAR 10.24.10.04(A)(2).

First, the charity care policies of AAMC are no different than those of BWMC. Both use the same criteria for measuring financial need to ensure access for all individuals seeking care. Both commit to determining eligibility for assistance promptly.

Second, Maryland's unique rate setting system levels the playing field such that no hospital is burdened more than any other hospital because of charity care provided. The HSCRC subsidizes hospital's charity care through hospital rates and other direct support under its Uncompensated Care Policy. Uncompensated care includes bad debt and charity care. Under the policy, Maryland hospital rates account for expected uncompensated care provision by Maryland hospitals, and Maryland hospitals experiencing relatively higher levels of such care draw funding from a financial pool paid into by hospitals experiencing relatively lower levels. The policy effectively spreads the burden of providing charity care across Maryland hospitals.

Third, health reform – the implementation of Maryland's Medicaid expansion and the individual mandate of the Affordable Care Act – has decreased the proportion of uninsured in Maryland and will continue to do so, especially among low-income Marylanders. The HSCRC staff has explained that as the number of uninsured has decreased, the burden of charity care provision on Maryland hospitals has also declined.[66]

BWMC's own projections highlight this decline. Although BWMC trumpets its FY 2013 charity care expenditure relative to AAMC, BWMC projects its expenditure to decline by over

[66] Enclosed as Exhibit 7 is the HSCRC staff's May 2015 presentation entitled "Final Recommendations on Uncompensated Care Policy for 2016." Those recommendations were approved by the HSCRC at its May 13, 2015 meeting.

two-thirds by FY 2015, from $25,709,000 (7.05% of FY 2013 total expenses) to $8,068,000 (2.3% of FY2015 total expenses).[67]

For the above reasons, relative charity care provision should not take precedence in this review.

3. Quality

BWMC's proposed quality assurance and performance improvement process for cardiac surgery, at least as outlined in the Application, suffers from being overly entwined with UMMC's existing quality processes. Entwinement could muddle lines of authority and accountability. It could create vulnerability to a lack of management attention.[68]

For example, UMMS' cardiac Quality Assurance and Performance Improvement Plan ("**QAPI**") is coordinated by a nurse from "**UMMC's** Division of Quality and Safety" who reports directly to the "**UMMC** Director of Quality and Safety."[69] Would this same nurse also attempt to manage QAPI at BWMC, presumably while still based at UMMC? Similarly, could the UM Division of Cardiac Surgery bimonthly quality forum adequately review BWMC's "quality of care…protocols and guidelines…outcomes data, and….clinical and process improvement projects"[70]?

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[67] Application Table G (revised 3/30/15).

[68] "BWMC will participate in the **same** quality assurance and performance improvement programs that are used in the existing cardiac surgery program at UMMC…" Application at p.49 (emphasis added).

[69] Similarly, BWMC's organizational chart identifies as cardiac surgeons with authority over the program James Gammie, M.D. – UMMS Division of Cardiac Surgery chief and the chair of UMMC's cardiac surgery program operating council – and "to be determined." Application at p. 19.

[70] Application at p.49.

This vulnerability is heightened given that the UM Division of Cardiac Surgery would have its resources and time divided between four hospitals performing cardiac surgery. Competing with BWMC for attention would be Prince George's Hospital Center and St. Joseph's Medical Center[71] as those programs attempt to grow. "[U]nder an agreement with Dimensions Healthcare System, the UM Division of Cardiac Surgery provides surgeon staffing as well as clinical and administrative support for the cardiac surgery program at Prince George's Hospital Center in Cheverly, Maryland." [72]

The Application suggests that BWMC proposed quality improvement and assurance programs for cardiac surgery may lack sufficient independence from UMMC (and UMMS generally) to be effective.

VI. Conclusion

The Commission should find that BWMC has not met the minimum volume, need, access, cost effectiveness, and financial feasibility standards of the SHP. The Commission should also find that AAMC meets such standards and would outperform BWMC on such standards, in preferring AAMC in this comparative review.

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[71] Application at p. 10 (discussing "One Program, Three Locations" model as applied to UM SJMC).

[72] "[U]nder an agreement with Dimensions Healthcare System, the UM Division of Cardiac Surgery provides surgeon staffing as well as clinical and administrative support for the cardiac surgery program at Prince George's Hospital Center in Cheverly, Maryland." Application at p. 8 fn. 1.

Thank you for your attention.

Respectfully Submitted,

Jonathan Montgomery

cc: Mr. Ben Steffen
Mr. Kevin McDonald
Ms. Ruby Potter
Suellen Wideman, Esq.
Tom Dame, Esq.
Anne Arundel Medical Center (Internal Distribution)

ANNE ARUNDEL MEDICAL CENTER

COMMENT TO BWMC CON APPLICATION FOR CARDIAC SURGERY

DOCKETED JUNE 26, 2015

Attestation by Robert Reilly

Affirmation: I hereby declare and affirm under the penalties of perjury that the facts stated in Anne Arundel Medical Center's July 27, 2015 Comment to the Baltimore Washington Medical Center CON application and its attachments are true and correct to the best of my knowledge, information, and belief.

Mr. Robert Reilly

July 27, 2015
Date

Chief Financial Officer
Title

4281954.1 46208/124959 07/27/2015

EXHIBIT 1

EXHIBIT 1(a)

Zip Codes Closest to Baltimore Washington Medical Center

Zip Code	Service Area	City Name	Miles To AAMC[1]	Miles To UMMC[1]	Miles To BWMC[1]	Population 18 Years and Over[2]
21060	BWMC - Primary	Glen Burnie	18.1	11.5	4.7	23,556
21061	BWMC - Primary	Glen Burnie	17.4	13.7	1.4	41,739
21122	BWMC - Primary	Pasadena	16.8	21.1	9.9	46,500
21144	BWMC - Primary	Pasadena	15.1	14.3	4.3	23,447
21054	BWMC - Secondary	Gambrills	10.4	19.6	8.6	7,286
21076	BWMC - Secondary	Hanover	22	12.4	7.8	10,811
21108	BWMC - Secondary	Millersville	11.8	16.5	5.4	13,732
21113	BWMC - Secondary	Odenton	15.8	20.5	9.3	23,491
21146	BWMC - Secondary	Severna Park	9.1	19.3	7	19,714
20723	BWMC - Other	Laurel	25.9	22.2	18	21,588
20724	BWMC - Other	Laurel	18.5	19.6	11.9	12,210
20755	BWMC - Other	Fort Meade	18.6	16.2	9	6,385
20763	BWMC - Other	Savage	22.9	18.5	15	1,325
20794	BWMC - Other	Jessup	24.9	15.6	13	12,515
21056	BWMC - Other	Gibson Island	21	25.8	14.6	195
21114	BWMC - Other	Crofton	9.9	22.2	4.3	19,334
BWMC Service Area Population Subtotal						**283,828**
20701	AAMC	Annapolis Junction	23	16	12.8	108
21062	AAMC	Glen Burnie	16.9	13.7	1.8	n/a
21077	AAMC	Harman's	18.1	11.9	5.4	155
21123	AAMC	Pasadena	16.2	14.1	9.2	n/a
21240	AAMC	BWI Airport	21.6	9.9	6.7	0
20708	AAMC	Laurel	21.6	23.2	19.5	18,539
AAMC Service Area Population Subtotal						**18,802**
TOTAL POPULATION FOR ZIP CODES CLOSEST TO BWMC						**302,630**

[1] The distance (in miles) for each zip code was calculated by entering the zip code into Google Maps to (a) pinpoint a central location within the zip code, and (b) obtain driving routes from that central location to each of UMMC and BWMC. The "shortest distance" route was used.

[2] 2013 Population estimate. Source: U.S. Census Bureau, 2009-2013 5-Year American Community Survey, retrieved from http://factfinder.census.gov

Zip Codes Closest to University of Maryland Medical Center

Zip Code	Service Area	City Name	Miles To AAMC[1]	Miles To UMMC[1]	Miles To BWMC[1]	Population 18 Years and Over[2]
21225	BWMC - Primary	Baltimore	23.1	5.9	9	24,710
21090	BWMC - Secondary	Linthicum Heights	23.8	7.5	7.9	7,880
21226	BWMC - Secondary	Curtis Bay	19.9	10.2	10.3	5,681
21227	BWMC - Secondary	Halethorpe	24.5	6.1	10.4	26,762
21075	BWMC - Other	Elkridge	26.9	11.7	12.7	19,742
					BWMC Population Subtotal	**84,775**
					TOTAL POPULATION FOR ZIP CODES CLOSEST TO UMMC	**84,775**

[1] The distance (in miles) for each zip code was calculated by entering the zip code into Google Maps to (a) pinpoint a central location within the zip code, and (b) obtain driving routes from that central location to each of UMMC and BWMC. The "shortest distance" route was used.

[2] 2013 Population estimate. Source: U.S. Census Bureau, 2009-2013 5-Year American Community Survey, retrieved from http://factfinder.census.gov

Zip Codes Closest to Anne Arundel Medical Center

Zip Code	Service Area	City Name	Miles To AAMC[1]	Miles To UMMC[1]	Miles To BWMC[1]	Population 18 Years and Over[2]
20711	BWMC - Other	Lothian	15.8	41.4	29.4	5,058
20733	BWMC - Other	Churchton	15.6	41.2	30.2	2,119
20751	BWMC - Other	Deale	16.2	41.8	30.8	1,861
20764	BWMC - Other	Shady Side	16.5	42.1	31	3,398
20776	BWMC - Other	Harwood	10.6	36.3	24.3	2,966
20778	BWMC - Other	West River	12.8	38.4	27.4	1,622
21012	BWMC - Other	Arnold	8	22.2	11	15,451
21032	BWMC - Other	Crownsvile	6.2	20.8	9.3	6,748
21035	BWMC - Other	Davidsonville	8.6	32.2	18	5,726
21037	BWMC - Other	Edgewater	5.3	30.9	19.8	16,182
21140	BWMC - Other	Riva	4.8	29.4	18.3	2,587
21401	BWMC - Other	Annapolis	3.1	29.7	15.5	30,277
21403	BWMC - Other	Annapolis	5.3	31.3	20.2	24,342
21409	BWMC - Other	Annapolis	6.4	33	15.1	15,064
21601	BWMC - Upper Shore	Easton	41.3	67.8	50	18,761
21607	BWMC - Upper Shore	Barclay	45.1	71.7	53.9	464
21609	BWMC - Upper Shore	Bethlehem	46.7	73.2	55.4	n/a
21610	BWMC - Upper Shore	Betterton	58.7	85.2	67.4	346
21612	BWMC - Upper Shore	Bozman	58.7	85.2	67.4	241
21617	BWMC - Upper Shore	Centreville	30.7	57.3	39.5	7,379
21619	BWMC - Upper Shore	Chester	18	44.5	26.7	4,455
21620	BWMC - Upper Shore	Chestertown	49	75.6	57.7	10,442
21623	BWMC - Upper Shore	Church Hill	37.5	64.1	46.3	1,546
21624	BWMC - Upper Shore	Claiborne	55.3	81.9	64	124
21625	BWMC - Upper Shore	Cordova	37.4	64	46.1	2,099
21628	BWMC - Upper Shore	Crumpton	48.2	74.8	56.9	412
21629	BWMC - Upper Shore	Denton	45.8	72.3	54.5	7,120
21632	BWMC - Upper Shore	Federalsburg	57.8	84.3	66.5	4,204
21635	BWMC - Upper Shore	Galena	55.8	78.8	64.6	1,750
21636	BWMC - Upper Shore	Goldsboro	51.1	77.7	59.8	936
21638	BWMC - Upper Shore	Grasonville	21.2	42.2	30	3,982
21639	BWMC - Upper Shore	Greensboro	46.5	73.1	55.2	3,528

Zip Codes Closest to Anne Arundel Medical Center

21640	BWMC - Upper Shore	Henderson	47.1	68.4	55.9	1,012
21641	BWMC - Upper Shore	Hillsboro	36.4	62.9	45.1	30
21644	BWMC - Upper Shore	Ingleside	43.2	69.7	51.9	97
21645	BWMC - Upper Shore	Kennedyville	55.5	82.1	64.2	764
21647	BWMC - Upper Shore	McDaniel	54.7	81.2	63.4	208
21649	BWMC - Upper Shore	Marydel	49.5	76.1	58.3	1,374
21650	BWMC - Upper Shore	Massey	57.3	82.4	66.1	61
21651	BWMC - Upper Shore	Millington	55.1	81.7	63.9	2,442
21652	BWMC - Upper Shore	Neavitt	60.7	87.2	69.4	136
21653	BWMC - Upper Shore	Newcomb	46.8	73.4	55.5	50
21654	BWMC - Upper Shore	Oxford	49.7	76.2	58.4	818
21655	BWMC - Upper Shore	Preston	48.8	75.3	57.5	4,050
21657	BWMC - Upper Shore	Queen Anne	36.8	63.4	45.6	688
21658	BWMC - Upper Shore	Queenstown	28.9	49.9	37.6	2,986
21660	BWMC - Upper Shore	Ridgely	41.5	68.1	50.3	3,267
21661	BWMC - Upper Shore	Rock Hall	63.6	90.2	72.4	2,231
21662	BWMC - Upper Shore	Royal Oak	52	78.6	60.8	707
21663	BWMC - Upper Shore	St. Michaels	51.2	77.8	60	2,962
21665	BWMC - Upper Shore	Sherwood	61.7	88.3	70.5	194
21666	BWMC - Upper Shore	Stevensville	19.3	40.3	28	9,683
21667	BWMC - Upper Shore	Still Pond	56.8	83.4	65.6	201
21668	BWMC - Upper Shore	Sudlersville	46.7	73.2	55.4	1,381
21670	BWMC - Upper Shore	Templeville	49.8	76.4	58.6	n/a
21671	BWMC - Upper Shore	Tilghman	64.5	91.1	73.3	891
21673	BWMC - Upper Shore	Trappe	54.8	81.3	63.5	2,644
21676	BWMC - Upper Shore	Wittman	59.8	86.3	68.5	405
21678	BWMC - Upper Shore	Worton	59	85.6	67.7	2,077
21679	BWMC - Upper Shore	Wye Mills	31.9	53	40.7	353
					BWMC Service Area Population Subtotal	**242,902**
20758	AAMC	Friendship	21.8	45.1	34.1	480
20765	AAMC	Galesville	11.7	37.4	26.3	438
20779	AAMC	Tracey's Landing	20.3	45	34.9	n/a
21106	AAMC	Mayo	8.5	34.1	23.1	n/a
21402	AAMC	Annapolis	5.2	26.3	15.1	5,849

Zip Codes Closest to Anne Arundel Medical Center

21404	AAMC	Annapolis	3.3	27.6	15.3	n/a
21405	AAMC	Sherwood Forest	5.2	25.1	14.1	370
21411	AAMC	Annapolis	3	28.1	15.8	n/a
21412	AAMC	Annapolis	2.5	28.1	17.1	n/a
20610	AAMC	Barstow	36.1	60.4	49.4	n/a
20639	AAMC	Huntingtown	29.5	53.8	42.8	10,717
20678	AAMC	Prince Frederick	36.8	61.2	50.1	9,161
20689	AAMC	Sunderland	29.5	51.2	40.2	1,213
20613	AAMC	Brandywine	33.8	49.3	38.3	10,828
20706	AAMC	Lanham	20.5	29.3	25.7	27,890
20715	AAMC	Bowie	15.2	26.7	15.6	21,306
20716	AAMC	Bowie	14.2	30	19	15,790
20720	AAMC	Bowie	17.4	29.9	18.9	16,596
20721	AAMC	Bowie	18.8	33.9	22.4	19,616
20735	AAMC	Clinton	32.5	46.2	43	28,520
20769	AAMC	Glenn Dale	17.6	28.7	19.1	4,595
20770	AAMC	Greenbelt	22.7	26.8	23.1	19,183
20771	AAMC	Greenbelt	21	26.3	21.4	n/a
20772	AAMC	Marlboro	22.9	38.8	27.7	33,395
20773	AAMC	Upper Marlboro	20.8	36.6	25.5	n/a
20774	AAMC	Largo/Kettering	21.5	37	26	33,553
20623	AAMC	Cheltenham	29.3	44.8	33.8	2,207
21656	AAMC	Price	37.4	63.9	46.1	n/a
20714	AAMC	North Beach	24.6	50.2	39.3	3,363
20732	AAMC	Chesapeake Beach	29.1	53.8	42.8	7,440
20736	AAMC	Owings	25.2	48.6	37.6	7,206
20754	AAMC	Dunkirk	22.2	44.7	33.6	5,197
					AAMC Service Area Population Subtotal	**284,913**
					TOTAL POPULATION FOR ZIP CODES CLOSEST TO AAMC	**527,815**

[1] The distance (in miles) for each zip code was calculated by entering the zip code into Google Maps to (a) pinpoint a central location within the zip code, and (b) obtain driving routes from that central location to each of UMMC and BWMC. The "shortest distance" route was used.

[2] 2013 Population estimate. Source: U.S. Census Bureau, 2009-2013 5-Year American Community Survey, retrieved from http://factfinder.census.gov

EXHIBIT 1(b)

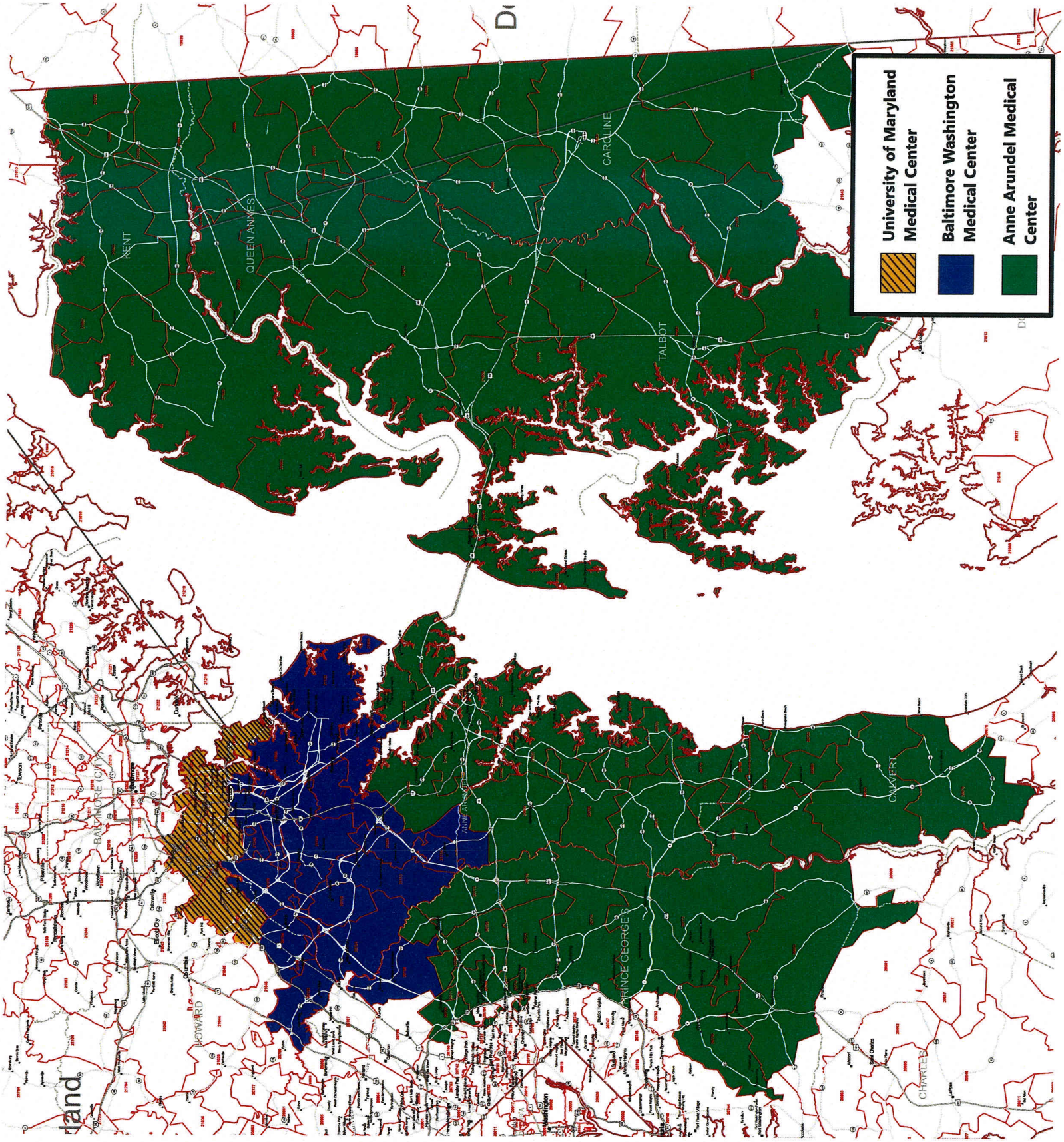
University of Maryland Medical Center
Baltimore Washington Medical Center
Anne Arundel Medical Center
KENT
QUEEN ANNES
CAROLINE
TALBOT
BALTIMORE CITY
HOWARD
ANNE ARUNDEL
PRINCE GEORGES
CALVERT
CHARLES

EXHIBIT 2

UM BWMC MARKET SHARE OF CARDIAC DISCHARGES, PATIENTS AGE 15+ YEARS
IN BWMC-DEFINED SERVICE AREA FOR CARDIAC SURGERY
CY2013-2014

			Medical Cardiology	EP/Chronic Rhythm Mgmnt	Myocardial Infarction	Invasive Cardiology	**TOTAL INPATIENT CARDIOLOGY**	
Anne Arundel County	(29 zip codes)	CY2013	35.7%	43.7%	34.8%	32.3%	**35.2%**	
		CY2014	35.5%	45.0%	36.3%	33.6%	**35.6%**	
Howard County	(4 zip codes)	CY2013	10.2%	0.0%	15.6%	7.1%	**9.9%**	
		CY2014	12.7%	0.0%	8.3%	3.6%	**9.7%**	
Baltimore City/Cnty	(2 zip codes)	CY2013	10.5%	12.5%	6.1%	6.9%	**9.3%**	
		CY2014	9.4%	20.0%	12.2%	14.0%	**11.3%**	
Talbot County	(16 zip codes)	CY2013	0.3%	0.0%	0.0%	0.0%	**0.2%**	
		CY2014	0.3%	0.0%	0.0%	1.2%	**0.5%**	
Kent County	(8 zip codes)	CY2013	0.5%	0.0%	0.0%	0.0%	**0.4%**	
		CY2014	0.7%	0.0%	0.0%	0.0%	**0.0%**	
Queen Anne's County	(12 zip codes)	CY2013	0.9%	0.0%	2.5%	2.1%	**1.3%**	
		CY2014	1.1%	6.7%	0.0%	1.4%	**1.3%**	
Caroline County	(11 zip codes)	CY2013	0.4%	7.7%	0.0%	0.0%	**0.6%**	
		CY2014	0.8%	0.0%	0.0%	0.0%	**0.6%**	
TOTAL SERVICE AREA	(82 zip codes)	CY2013	23.5%	30.4%	23.8%	23.1%	**23.7%**	
		CY2014	23.5%	32.1%	25.3%	23.7%	**24.1%**	
TOTAL SERVICE AREA	(82 zip codes)	FY2015, 6 mos						**OUTPATIENT CARDIAC 22.2%**

Source: HSCRC Abstract Database
Notes: (1) Service area definition based on Certificate of Need Application, Exhibit 4
(2) Categories defined by APR DRG groupings adopted by HSCRC for product line definitions and EAPGs for outpatient volume
(3) Outpatient volume includes cardiac procedures, diagnostics, and cardiac rehab

EXHIBIT 3

ACD

Decreasing prevalence but increasing importance of left ventricular dysfunction and reoperative surgery in prediction of mortality in coronary artery bypass surgery: Trends over 18 years

Khaled D. Algarni, MD, MHSc, Abdelsalam M. Elhenawy, MD, PhD, Manjula Maganti, MSc, Susan Collins, BSc, and Terrence M. Yau, MD, MSc, FRCSC

Objectives: The number of patients referred for coronary artery bypass grafting (CABG) has fallen, whereas their risk profile appears to be increasing. We evaluated changes in the predictors of hospital mortality among patients undergoing CABG during a span of 18 years.

Methods: Data were collected prospectively for all patients undergoing isolated CABG (n = 23,445) from 1991 to 2008. To examine the effect of time on patients' risk profiles and outcomes, we divided patients into 3 time cohorts (1991-1996, n = 8280; 1997-2002, n = 9801; 2003-2008, n = 5364). We used multivariable logistic regression model to identify predictors of mortality in the entire cohort and in each time cohort.

Results: Hospital mortality declined from 2.4% (1991-1996) to 1.2% (2003-2008; $P < .0001$). Urgent or emergency surgery, left ventricular dysfunction, reoperative CABG, increased age, female gender, hypertension, cardiogenic shock, congestive heart failure, peripheral vascular disease, left main disease, and earlier year of operation (1991-1996) were independent predictors of hospital mortality. The prevalence of most risk factors for mortality increased over the 18-year period of this study. In contrast, the prevalence of severe left ventricular dysfunction and reoperative CABG decreased significantly; however, their associated odds of mortality increased with time.

Conclusions: Whereas the prevalence of most risk factors increased with time, left ventricular dysfunction and reoperative CABG became significantly less common. However, the odds of mortality associated with these 2 predictors increased, indicating that although they occur less commonly, these 2 risk factors paradoxically play an increasingly important role in determining patient outcomes. (J Thorac Cardiovasc Surg 2012;144:340-6)

Supplemental material is available online.

During the past 2 decades, increasingly older patients with more comorbidities have been referred to cardiac surgeons for coronary artery bypass grafting (CABG). Despite increasing patient risk factors over time, many studies have shown consistent improvement in operative outcomes.[1-4]

Over the past decade, however, many cardiac centers have noted decreasing volumes of isolated CABG. Aldea and colleagues[5] reported a decrease of 37% in CABG volume, while the volume of percutaneous coronary interventions (PCIs) increased by 71%. This reduction in CABG volumes may have multiple effects, including an impact on hospital outcomes. A number of studies have reported associations between hospital volumes and outcomes,[6-8] although this relationship remains controversial. In the context of decreasing volumes and increasing risk profiles for patients undergoing isolated CABG, we analyzed our experience during an 18-year period to evaluate changes in patient risk profiles, document their outcomes, and determine changes in the independent predictors of hospital mortality.

METHODS

Data Collection and Definitions

Clinical, operative, and outcome data were collected prospectively in a computerized database for 23,445 consecutive patients undergoing isolated CABG at our institution between January 1, 1991, and December 31, 2008. Patients undergoing CABG with other concomitant procedures were excluded.

The study was approved by our institutional research ethics board. The primary outcome was hospital mortality, which was defined as any postoperative death during the index hospitalization. Variables collected included age, sex, left ventricular (LV) grade (by LV ejection fraction [LVEF]: grade 1, LVEF ≥ 60%; grade 2, LVEF 40%-59%; grade 3, LVEF 20%-39%; grade 4, LVEF < 20%), previous CABG, urgency of operation (semiurgent, indicating an operation during the same admission as a cardiac

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Abbreviations and Acronyms

BMI	= body mass index
CABG	= coronary artery bypass grafting
LV	= left ventricular
LVEF	= left ventricular ejection fraction
OPCAB	= off-pump coronary artery bypass grafting
OR	= odds ratio
PCI	= percutaneous coronary intervention

catheterization or a cardiac event; urgent, indicating an operation within 72 hours of an event; emergency, indicating an operation within 12 hours of an event), number of diseased coronary arteries, presence of greater than a 50% stenosis of the left main coronary artery, and severity of angina, among other data.

Statistical Analyses

All statistical analyses were performed with SAS version 9.2 (SAS Institute, Inc, Cary, NC). To examine the effect of time on patient risk profiles and outcomes, we divided patients into 3 groups according to the year of operation (1991-1996, 1997-2002, and 2003-2008). Contingency table analysis was then used to evaluate changes with time in prevalence of preoperative, intraoperative, and postoperative variables. Univariate analyses were performed with χ^2 or Fisher's exact test for categorical variables and analysis of variance for continuous variables. Variables that had a univariate P value less than .25 or those of known clinical importance were submitted to a multivariable logistic regression model using a stepwise backward elimination method to calculate risk-adjusted mortality and factor-adjusted odds ratios (ORs). Model discrimination was evaluated by the area under the receiver–operator characteristic curve, and calibration was assessed with the Hosmer-Lemeshow goodness-of-fit statistic. The model was evaluated for multicolinearity with the variance inflation factor where variance inflation factor less than 2.5 indicates multicolinearity.

RESULTS

Baseline Characteristics and Survival

A total of 23,445 patients underwent isolated CABG between 1991 and 2008. A trend in volume of isolated CABG over the 18-year span is depicted in Figure 1. The number of patients increased progressively from 1991, peaked in 1998 (n = 1829), and then decreased substantially, by almost 70%, from 1998 to 2008.

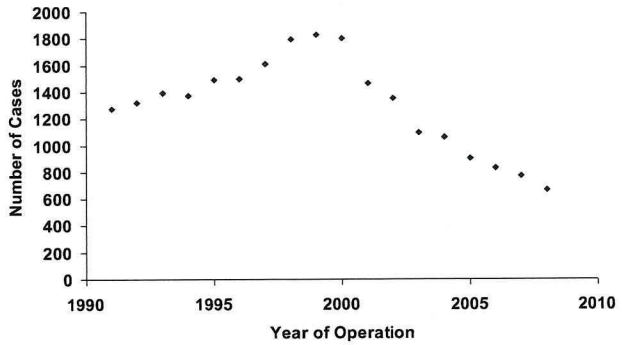

FIGURE 1. Trends in number of patients undergoing isolated coronary artery bypass grafting between 1991 and 2008.

Preoperative patient characteristics are detailed in Table 1. The prevalence of most risk factors increased steadily. The rate of left main disease almost doubled between the first and the last time cohort (18.6% vs 33.3%). The number of patients undergoing semiurgent surgery has increased over the last 2 cohorts, whereas the number of patients undergoing elective, urgent, or emergency surgery has declined significantly. The prevalence of patients with LV dysfunction (LVEF < 60%) has decreased over time, from 70% in the first time cohort to 50% in the last one. The prevalence of reoperative CABG declined as well. The changing risk profile of patients undergoing CABG during this 18-year span is depicted in Figure E1.

Intraoperative variables and postoperative outcomes are detailed in Table 2. The overall in-hospital mortality declined significantly from 2.4% in the first time cohort to 1.2% in the last one. Although the duration of intensive care unit stay has fluctuated, the duration of hospital stay declined significantly with time. Trends of postoperative outcomes are shown in Figure 2.

Predictors of Hospital Mortality

Analysis of the 23,445 patients undergoing operation during the entire 18-year period of the study using stepwise multivariable logistic regression showed the following factors to be independent predictors of hospital mortality: increased age, female gender, hypertension, peripheral vascular disease, LV dysfunction, cardiogenic shock, congestive heart failure, reoperative CABG, left main disease, urgency of surgery, and earlier year of operation (Table E1). Emergency CABG carried the most significant risk (OR, 4.5), followed by LVEF less than 20% (OR, 4.2) and then reoperative CABG (OR, 3).

Trends in Multivariable Risk Factors for Hospital Mortality

The changing trends in independent predictors of hospital mortality by time cohort are detailed in Table 3. Unadjusted hospital mortality associated with individual predictors is shown in Figure E2.

LV dysfunction. Moderate (LVEF 20%-39%) and severe (LVEF < 20%) LV systolic dysfunction were predictors of hospital mortality in the first time cohort. In the second cohort, however, LVEF did not predict mortality. LV systolic dysfunction then reappeared as a significant predictor of mortality in the last time cohort. The overall mortality for patients with an LVEF less than 20% declined significantly from 11.1% in the first time cohort to 6.4% and 6.3% in the second and the third time cohorts, respectively. Similarly, for patients with an LVEF of 20% to 39%, the observed mortality declined from 3.6% in the first time cohort to 1.8% in the second and 2.3% in the last time cohort.

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TABLE 1. Preoperative patient's baseline characteristics by year group

Variable	1991-1996	1997-2002	2003-2008	*P* value
No. of patients	8280	9801	5364	
Age (y) mean ± SD	62 ± 9.8	63.6 ± 9.9	65.3 ± 10.1	<.0001
Less than 65 (%)	56.4	49.9	45.3	<.0001
65-74 (%)	34.5	36.5	35.1	
≥75 (%)	9.0	13.6	19.7	
BMI (mean ± SD)	27.5 ± 4.8	27.9 ± 5.1	28.3 ± 5.2	<.0001
Female (%)	20.7	21.5	21.2	.40
Diabetes mellitus (%)	24.5	30.7	37.3	<.0001
Hypertension (%)	50.8	58.7	72.9	<.0001
Hyperlipidemia (%)	56.7	73.8	91.2	<.0001
Positive family history (%)	66.5	61.03	59.3	<.0001
Angina (%)				
Stable	33.8	35.8	37.2	<.0001
Crescendo	33.4	32.0	29.7	
Acute coronary insufficiency	30.8	29.9	24.9	
Preoperative MI (%)	16.8	21.5	23.3	<.0001
Preoperative cardiogenic shock (%)	1.3	1.2	1.2	.7
Congestive heart failure (%)	8.9	9.3	10.1	.04
Preoperative IABP (%)	3.8	3.1	3	.01
LVEF (%)				
>60%	29.7	36.8	49.1	<.0001
40%-60%	45.1	41.6	33.2	
20%-40%	22.0	19.0	16.0	
<20%	3.2	2.6	1.8	
Left main disease (%)	18.6	21.2	33.3	<.0001
Triple-vessel disease (%)	74.4	76.1	82.3	<.0001
Preoperative stroke (%)	8.2	8.5	8.7	.6
Peripheral vascular disease (%)	14.2	16.4	20.3	<.0001
Reoperative CABG (%)	6.9	4.0	2.6	<.0001
Previous PCI ± stents	10.4	8.7	10.5	<.0001
Urgency of surgery (%)				
Elective	54.6	49.4	50.6	<.0001
Semiurgent	29.6	41.4	40.1	
Urgent	14.4	8.6	9.4	
Emergency	1.4	0.5	0.5	

SD, Standard deviation; *BMI,* body mass index; *MI,* myocardial infarction; *IABP,* intra-aortic balloon pump; *LVEF,* left ventricular ejection fraction; *CABG,* coronary artery bypass grafting; *PCI,* percutaneous coronary intervention.

Although the prevalence of LVEF less than 20% declined significantly with time, the associated ORs for mortality increased over the past decade, from 2.5 in the second time cohort to 3.8 in the last one.

Reoperative CABG. The prevalence of reoperative CABG decreased from 6.9% in the first cohort to 2.6% in the last one. In contrast, the risk of hospital mortality in this group, relative to patients undergoing primary CABG, has increased over time (ORs, 2.8, 3.1, and 3.5 in the first, second and third time cohorts, respectively). Inasmuch as the mortality of reoperative CABG did not change significantly during the entire span of this study, this increase in ORswas driven largely by improving outcomes in patients undergoing first-time operations.

Urgency of surgery. Observed mortality for patients undergoing urgent surgery declined in the most recent cohort. Similarly, mortality for patients undergoing elective or semiurgent surgery declined significantly during the 18-year span of this study. In contrast, patients requiring emergency CABG continued to be at increased risk. The OR for mortality associated with emergency surgery has fluctuated over the 3 time cohorts. It was lowest in the first cohort (OR, 3.5) and higher in the later cohorts (ORs, 12.7 and 7.1).

Age and gender. Patients aged 75 years and older had significantly higher hospital mortality than those younger than 75 years, but the mortality for elderly patients decreased substantially from 5.8% in the first time cohort to 2% in the last one. Hospital mortality also declined in younger (<70 years) patients, falling from 1.7% in the first cohort to 0.8% in the last one.

In the last cohort, hospital mortality among female patients fell to 1.5% compared with 4% in the first cohort.

TABLE 2. Operative data and postoperative outcomes by year group

Variable	1991-1996	1997-2002	2003-2008	*P* value
Intraoperative variables				
LITA use (%)	86.1	89.6	91.3	<.0001
RITA use (%)	2.2	5.7	7.9	<.0001
Radial artery use* (%)	—	4.1	2.1	<.0001
No. of grafts	3.6 ± 0.9	3.5 ± 0.9	3.4 ± 0.9	<.0001
CPB time (min)	86 ± 29.2	85 ± 32.6	81.1 ± 33.4	<.0001
Crossclamping time (min)	61.7 ± 18.6	63.2 ± 24.2	62.9 ± 28.1	<.0001
Cardioplegia technique (%)				
Intermittent cold antegrade	71.7	74.1	86.3	<.0001
Warm or tepid cardioplegia	16.9	10.6	1.6	
Retrograde	6	1	0.2	
Off pump	0.1	5.1	8.5	
Postoperative outcomes				
Mortality (%)	2.4	1.4	1.2	<.0001
Inotrope use >30 min (%)	33.8	33.1	38.1	<.0001
Low-output syndrome (%)	8.0	4.8	2.9	<.0001
Postoperative IABP (%)	4.9	3.2	2.2	<.0001
Postoperative MI (%)	2.8	2.7	2.4	.3
Postoperative stroke (%)	1.4	1.2	1.1	.4
Postoperative renal failure (%)	0.8	1.0	1.2	.2
Pulmonary complications (%)	9.9	7.5	8.4	<.0001
Sternal wound infection (%)				
Superficial	1.9	1.6	1.2	.006
Deep	0.9	0.8	0.6	
Sepsis	0.7	1	1.6	<.0001
Resternotomy for bleeding (%)	1.4	2.4	2.8	<.0001
Transfused patients (%)	50.6	44.3	62.2	<.0001
Units of packed RBC transfused	1.4 ± 2.7	1.2 ± 2.8	1.9 ± 2.7	<.0001
Duration of ventilation (h)	22.6 ± 63.5	14.7 ± 49.7	17.2 ± 60.6	<.0001
Duration of ICU stay (h)	52.8 ± 98.5	45.4 ± 76.4	52.6 ± 129	<.0001
Postoperative hospital stay (d)	9.4 ± 9.4	7.9 ± 9.5	7.7 ± 7.9	<.0001

LITA, Left internal thoracic artery; *RITA,* right internal thoracic artery; *CPB,* cardiopulmonary bypass; *IABP,* intra-aortic balloon pump; *MI,* myocardial infarction; *RBC,* red blood cells; *ICU,* intensive care unit. *Radial artery data was not collected during the first time cohort (1991-1996).

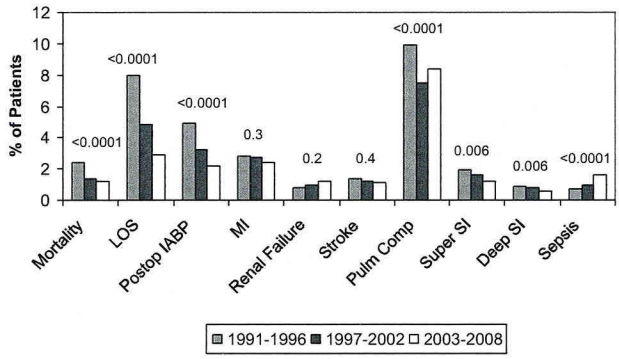

FIGURE 2. Trends in hospital outcomes: operative mortality, low-output syndrome *(LOS),* postoperative intra-aortic balloon pump *(IABP)* use, perioperative myocardial infarction *(MI),* postoperative renal failure, stroke, pulmonary complications *(Pulm Comp),* superficial sternal incision infection *(Super SI),*deep sternal infections *(Deep SI),* and sepsis. *P* values are included in the figure.

Furthermore, in the last cohort (2003-2008), there was no significant difference in observed mortality between men and women, 1.1% and 1.5%, respectively ($P = .2$). Female gender was a predictor of hospital mortality during the first and second time cohorts but not in the last one.

DISCUSSION

We found in this study that the prevalence of most risk factors that have consistently predicted in-hospital mortality in previous studies[2-4,9-12] increased steadily with time. These factors included advanced age, female gender, hypertension, left main disease, preoperative myocardial infarction, congestive heart failure, and peripheral vascular disease. This was not a surprise for us; indeed, we and others have previously reported similar findings.[2-4,10-12] What was surprising, however, was the decrease in prevalence of LV dysfunction and reoperative CABG and the associated increase in risk of death for these subgroups in our most recent cohort. This reduction in the prevalence of reoperative CABG and LV dysfunction, with an

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TABLE 3. Changing trends in multivariable risk factors by year group (odds ratios)

Variable	1991-1996*	1997-2002†	2003-2008‡
Emergency surgery§	3.5	12.7	7.1
Urgent surgery	—	6.5	3.6
Reoperative CABG	2.8	3.1	3.5
LVEF <20%	6.6	—	3.8
LVEF 20%-40%	2.7	—	2.6
Congestive heart failure	1.7	2.3	2.5
Age	1.050	1.039	1.044
Female sex	1.6	1.7	—
Hypertension	1.5	1.8	—

CABG, Coronary artery bypass grafting; *LVEF,* left ventricular ejection fraction. The numbers in the last three columns represent odds ratios. *The area under the ROC curve was 0.78. The Hosmer-Lemeshow goodness-of-fit *P* value was .5. †The area under the receiver–operator characteristic curve was 0.82. The Hosmer-Lemeshow goodness-of-fit P value was 0.75. ‡The area under the receiver–operator characteristic curve was 0.79. The Hosmer-Lemeshow goodness-of-fit *P* value was .32. §Emergency patients from catheterization laboratories or emergency units of same or other hospitals.

associated and apparently paradoxical increase in their odds of death, has not to our knowledge been reported before.

The independent predictors of in-hospital mortality in our cohort are generally similar to those previously described by Davierwala, Maganti, and Yau[2] with the exception of diabetes, which was not found to be a predictor of in-hospital mortality in our series. Emergency surgery carried the highest risk of mortality in our overall series (OR, 4.5; 95% confidence intervals [CI], 2.4-8.4), followed by severe LV dysfunction (LVEF < 20% [OR, 4.2; 95% CI, 2.7-6.5]) and then reoperative CABG (OR, 3; 95% CI 2.2-4.0). These findings are in agreement with those of Abramov and colleagues,[4] who reported urgency of surgery as the strongest predictor of CABG mortality (OR, 4.5), followed by reoperative CABG and then LVEF less than 35%. Similarly, Jones and associates[10] reported urgency of surgery as the most significant predictor of mortality after CABG. Davierwala, Maganti, and Yau[2] found LVEF less than 20% as the most significant predictor of in-hospital mortality, followed by emergency surgery and then reoperative CABG.

LV Dysfunction

Contrary to our initial assumptions, the prevalence of patients with moderate to severe LV dysfunction (LVEF < 40%) decreased steadily with time. We hypothesized that this decline might be related to a shift of patients with poor LV function from isolated CABG to combined CABG and valvular surgery, particularly mitral surgery. Exploratory analyses of our institutional data demonstrated a similar reduction in the prevalence of LV dysfunction in patients undergoing combined aortic valve surgery and CABG (prevalence of LVEF < 40% of 22.8%, 20.7%, and 13.8% for the first, second, and third time cohorts, respectively). In contrast, the prevalence of LVEF less than 40% among patients who underwent combined mitral valve surgery and CABG has increased progressively with time (30.6%, 32.8%, and 38.7% for the first, second, and third time cohorts, respectively). This shift of patients with LVEF less than 40% from the isolated CABG group to the combined CABG and mitral valve surgery group over the past 2 decades appears to explain most of the reduced prevalence of moderate to severe LV systolic dysfunction in our patients with isolated CABG. However, our data cannot clarify whether there was a simultaneous decrease in the referral of patients with LV dysfunction for CABG in favor of PCI.

Hospital mortality in patients with significant LV dysfunction (LVEF < 40%) fell by almost 50%, from 4.5% in the first cohort to 2.3% in the second one, but was essentially unchanged (2.7%) in the last cohort. Surprisingly, the ORs for mortality associated with LV dysfunction increased over the past decade, from 2.5 in the second cohort to 3.8 in the last one. Thus, although LV dysfunction is observed less commonly in patients with isolated CABG, its relative importance in determining survival has increased rather than decreased over the past decade.

Whereas moderate (LVEF 20%-39%) and severe LV dysfunction (LVEF < 20%) were both independent predictors of in-hospital mortality for the entire cohort of 23,445 patients, neither level of LV dysfunction was predictive of mortality in the second cohort (1997-2002), despite the large sample size of 9801 patients. Other investigators have also reported that LV dysfunction was no longer predictive of mortality in the middle of this last decade. Filsoufi and colleagues[13] reported that LVEF less than 30% was not an independent predictor of early mortality (OR, 1.43; 95% CI, 0.72-2.86; $P = .3$). Similarly, Davierwala and associates,[2] who analyzed the impact of LVEF on patients undergoing CABG during 3 time periods from 1990 to 2001, showed that the impact of LVEF on early mortality declined over time so that low LVEF no longer predicted mortality in the last period of their study. Sabik and associates[14] also found that later date of operation decreased mortality in patients with LV dysfunction ($P = .05$), and by the end of their study, poor LV function was no longer associated with hospital death. In contrast, the most recent cohort of our current series suggests that as overall results improve, and despite the decreasing prevalence of LV dysfunction, its relative importance in determining outcomes is again increasing.

Reoperative CABG

Although the proportion of reoperative CABGs increased over the 1990s in many centers,[14,15] we observed a steady decrease in reoperative CABG over the past 18 years. This decline may have been related to more aggressive use of PCI in patients with graft atherosclerosis, and perhaps to greater graft longevity, with the near-universal adoption of aggressive lipid-lowering agents as well as

other secondary prevention measures. However, our data do not permit more than speculation as to these causes.

Similar to our findings in patients with LV dysfunction, the ORs for mortality associated with reoperative CABG increased over time, from 2.8 in the first cohort to 3.5 in the last cohort, even as the prevalence of redo surgery fell. Unadjusted mortality among patients undergoing reoperative CABG decreased from 5.8% in the first time cohort to 3.3% and 3.6% in the second and third cohorts, so it appears that overall improvements in outcomes are unmasking a more predictive role of reoperative surgery.

Many studies, including reports from multicenter registry data, suggest that redo CABG is still a significant undertaking, with many centers reporting mortality rates from 5% to 12%.[14-18] A recent multicenter study by Yap and associates[18] reported results similar to ours, with operative mortality of 4.8% for redo CABG compared with 1.8% for first-time CABG ($P < .001$). After adjustment, redo surgery remained a predictor for operative mortality (OR, 2.1; 95% CI, 1.3-3.6).

Urgency of Surgery

The proportion of patients referred for urgent CABG declined in our series from 14.4% in the first cohort to 9.4% in the last one, whereas the prevalence of truly emergency or salvage operation decreased from 1.4% to 0.5%. Ferguson and colleagues[12] have reported a similar reduction in the prevalence of emergency and salvage operations. This decline is likely attributable to the advances in PCI with increased operator experience and widespread adoption of coronary stents,[19-21] use of glycoprotein IIb/IIIa agents,[22,23] upfront loading with clopidogrel,[24] and the more recent introduction of percutaneous ventricular assist devices for high-risk coronary interventions,[25] all occurring over the time span of this series.

Although emergency CABG is less common now, as cardiologists using catheterization are increasingly able to stent their way out of trouble, patients now meeting the criteria for emergency surgery may represent an even higher-risk subset in which initial salvage attempts have been unsuccessful and in whom hemodynamic instability has been prolonged. In this series, the unadjusted mortality for emergency surgery increased from 7.6% in the first cohort to 10.3% in the last one, and the OR for mortality increased from 3.5 in the first cohort to 12.7 and 7.1 in the subsequent cohorts. Whereas the markedly elevated ORs, particularly in the second cohort, were associated with a relatively small number of events even in this large group, and therefore with wide CIs, it is clear that the importance of emergency CABG in determining survival is increasing rather than decreasing over time. This trend of decreasing prevalence of emergency CABG but increasing mortality was also reported by Haan and colleagues[26] in a study of the Society of Thoracic Surgeons database, in which they found that the proportion of isolated CABGs performed on an emergency basis after PCI decreased over the period from 1994 to 1999 from 2.9% to 0.8%, whereas operative mortality increased from 8.0% to 9.3% ($P < .001$).

Other Trends Occurring During the Time Frame of This Study

The 3 time periods evaluated in this 18-year study corresponded generally to periods of increasing use of balloon angioplasty, bare metal stents, and drug-eluting stents, respectively. These trends in use of PCI have influenced the rate of, and risk profile of, patients referred for CABG in many institutions. We therefore chose to divide this period of study into 3 equal eras of 6 years.

The prevalence of off-pump CABG (OPCAB) in our institution increased slightly but steadily over the last 2 eras of this study, representing 5.1% and 8.5% of CABG cases in the second (1997-2002) and the latest (2003-2008) eras, respectively. The overall risk profile of patients who underwent OPCAB was comparable with that of patients who underwent on-pump CABG, but the prevalence of peripheral vascular disease was markedly higher in the OPCAB group (35.8% vs 16.4% and 42.4% vs 20.3% in the second and the latest eras, respectively). Mortality in OPCAB patients compared favorably with that in the on-pump group (0.8% vs 1.4% and 0.9% vs 1.2% in the second and the latest time cohorts, respectively). Despite the higher prevalence of peripheral vascular disease among patients undergoing OPCAB, the prevalence of postoperative stroke was low, 0% (0/503) and 0.2% (1/455) in the second and the latest eras of this study, respectively.

There was a small but significant increase in the mean body mass index (BMI) of our patients over the span of this study (27.5 ± 4.8, 27.9 ± 5.1, and 28.3 ± 5.2 in the first, second, and third eras, respectively; $P < .0001$). Most patients (93%) had a BMI in the 18 to 35 range. About 6% of patients had a BMI greater than 35 and a few patients (<1%) had a BMI less than 18. Extremely high BMI (>35) was associated with higher morbidity, manifested mainly as a higher prevalence of postoperative superficial (4.1%) and deep (2.2%) sternal infections. As well, these patients tended to have a slightly higher mortality (2.1%), although this difference did not reach statistical significance. Patients with extremely low BMI (<18) had a significantly higher risk of mortality (5.2%, 4/77) and stroke (3.9%, 3/77) compared with other patients ($P = .008$).

Despite the prospective nature of the data collection, this study remains a retrospective review of a single center's experience and therefore has all of the caveats of such a study. Although the experience of other cardiac surgical units over the past 2 decades may have varied to some degree, we believe that the trends observed at our institution are likely representative of those occurring in other tertiary and quaternary institutions. Two decades of coronary surgery

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were included in this study, during which both surgical and medical therapy for coronary disease changed. A long observation period has advantages as well, including many years of data available for analysis and the ability to evaluate the potential effects of gradual changes in referral patterns and surgical approaches. Because our data do not include information on all patients evaluated by the cardiologists, however, we cannot separate the effects of changes in referral patterns from cardiologists from changes in acceptance for surgery by surgeons. Finally, although our database accurately captures LV systolic dysfunction, it unfortunately does not permit analysis of diastolic dysfunction, which may explain the limited correlation between poor LVEF and the prevalence of congestive heart failure.

In summary, our study showed a decreasing prevalence of the 3 risk factors previously identified as most predictive of hospital mortality, including LV systolic dysfunction, reoperative CABG, and emergency surgery. Despite their declining prevalence, the ORs for mortality associated with all 3 predictors increased over the 18-year span of this series, as overall results continued to improve in the past decade, but the results in these 3 subgroups of patients remained constant. Despite previous advances in the care of patients with LV dysfunction and those who need reoperative or emergency CABG, these patients remain a challenge to cardiac surgeons and require novel strategies to improve outcomes further.

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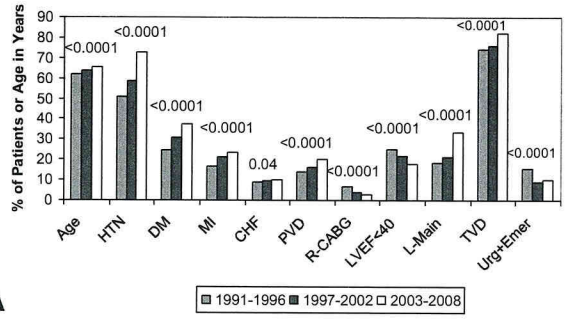
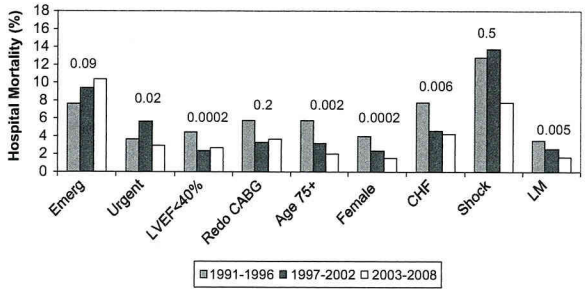


A

FIGURE E1. Risk profile of patients undergoing isolated coronary artery bypass grafting *(CABG)* stratified by era of surgery. Patient age, hypertension *(HTN)*, diabetes mellitus *(DM)*, preoperative myocardial infarction *(MI)*, congestive heart failure *(CHF)*, peripheral vascular disease *(PVD)*, left main disease *(L-Main)*, and triple-vessel disease *(TVD)* increased significantly with time. Reoperative CABG *(R-CABG)*, patients with poor left ventricular ejection fraction (*LVEF* < 40%), and urgent/emergency operations *(Urg+Emerg)* decreased significantly with time. *P* values are included in the figure.



B

FIGURE E2. Observed operative mortality for all patients undergoing emergency *(Emerg)*, coronary artery bypass grafting *(CABG)*, urgent CABG *(Urgent)*, patients with left ventricular ejection fraction *(LVEF)* less than 40%, reoperative *(Redo)* CABG), patients 75 years or older, female patients, patients with congestive heart failure *(CHF)*, cardiogenic shock, and left main disease *(LM)*. *P* values are included in the figure.

ACD

TABLE E1. Multivariable predictors of mortality in the entire cohort (n = 23,445)

Variable	n	Regression coefficient	OR	95% CI	*P* value
Constant		–9.36 ± 0.48			
Age*	—	0.04 ± 0.01	1.0	1.0-1.1	<.0001
Female gender	4,956	0.46 ± 0.12	1.6	1.3-2.0	<.005
Hypertension	13,856	0.44 ± 0.12	1.6	1.2-2.0	.01
Cardiogenic shock	289	0.69 ± 0.24	2.0	1.3-3.2	.004
Congestive heart failure	2,190	0.61 ± 0.14	1.8	1.4-2.4	<.0001
Peripheral vascular disease	3,869	0.56 ± 0.12	1.8	1.4-2.2	<.0001
Reoperative CABG	1,108	1.09 ± 0.16	3.0	2.2-4.0	<.0001
Left main disease	5,400	0.33 ± 0.12	1.4	1.1-1.8	.004
LVEF†					
<20%	609	1.43 ± 0.23	4.2	2.7-6.5	<.0001
20%-40%	4,534	0.69 ± 0.16	2.0	1.5-2.7	<.0001
40%-60%	9,584	0.39 ± 0.15	1.5	1.0-2.0	.008
Urgency of surgery					
Semiurgent	751	0.80 ± 0.23	2.2	1.4-3.5	.0004
Urgent	2,537	0.80 ± 0.15	2.2	1.7-3.0	<.0001
Emergency	200	1.50 ± 0.32	4.5	2.4-8.4	<.0001
Year of operation 1991-1996‡	8,280	–0.80 ± 0.16	2.2	1.6-3	<.0001

OR, Odds ratio; *CI*, confidence interval; *CABG*, coronary artery bypass grafting; *LVEF*, left ventricular ejection fraction. The area under the receiver–operator characteristic curve was 0.8. The Hosmer-Lemeshow goodness-of-fit *P* value was .19. *Age is a continuous variable. †Odds ratios were calculated by comparing against LVEF ≥ 60%. ‡Odds ratios were calculated by comparing against the 2003-2008 time cohort.

EXHIBIT 4

A Decade of Change—Risk Profiles and Outcomes for Isolated Coronary Artery Bypass Grafting Procedures, 1990–1999: A Report From the STS National Database Committee and the Duke Clinical Research Institute

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The Society of Thoracic Surgeons National Database Committee, Chicago, Illinois, and the Duke University Clinical Research Institute, Durham, North Carolina

Background. The Society of Thoracic Surgeons National Adult Cardiac Database is the largest voluntary clinical database in medicine. Using this database we examined changes in the risk profile of patients undergoing isolated coronary artery bypass grafting (CABG) and their outcomes during the decade 1990 to 1999.

Methods. Trends in 23 preoperative risk factors were tracked for CABG cases during this decade. Using a multivariate logistic risk model, we also determined the degree to which operative risk and risk-adjusted operative mortality changed during this 10-year interval.

Results. Between 1990 and 1999, 1,154,486 patient records were harvested by the Society of Thoracic Surgeons National Adult Cardiac Database for isolated CABG procedures performed at 522 Society of Thoracic Surgeons participant sites in the United States and Canada. Over time, CABG patients were more likely to be older (mean age 63.7 in 1990, 65.1 in 1999), of female gender (25.7% women in 1990, 28.7% in 1999), and have a history of smoking, diabetes mellitus, renal failure, hypertension, stroke, chronic lung disease, New York Heart Association functional class IV, and three-vessel disease ($p < 0.0001$). Patients' predicted operative risk increased by 30.1%, from 2.6% in 1990 to 3.4% in 1999. Despite higher risk, observed operative mortality decreased by 23.1%, from 3.9% in 1990 to 3.0% in 1999 ($p < 0.0001$). During the decade, a Medicare-aged subset (n = 629,174) experienced similar increases in risk and declines in mortality.

Conclusions. Patients referred for isolated CABG are significantly older, sicker, and have a higher risk than a decade ago. Despite this, CABG mortality rates have declined substantially. These results highlight the excellent progress in the care of CABG patients achieved during the past decade.

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Cardiothoracic surgeons have the impression that the patients now referred for surgical revascularization procedures are substantially "older and sicker" than those on whom they performed coronary artery bypass grafting (CABG) a decade ago (1990 to 1999). Several reasons for this include: (1) documentation during the decade that surgical procedures can be safely performed on extremely aged [1] and high-risk [2] subsets; (2) documentation that patients with impaired ventricular function but reversible ischemia often benefit the most from surgical intervention [3]; (3) selective referral of lower risk patients (including single- and two-vessel disease patients) to percutaneous cardiovascular intervention or medical therapy, resulting in a greater percentage of surgical candidates with triple-vessel disease [3], and (4) compelling data from clinical trials documenting that patients with a higher baseline risk (including more extensive coronary disease and diabetic patients) are better treated by surgical rather than percutaneous intervention or medicine [4].

Empiric data to support this impression have come from single-institution studies, but multisite analyses are lacking. We used the Society of Thoracic Surgeons National Cardiac Database (STS NCD) [5] to examine the changes in risk profile for patients undergoing isolated CABG during the past decade as determined by the changes in risk factor trends. These changes were then compared with the changes in actual operative mortality for isolated CABG between 1990 and 1999. We also examined the change in major postoperative morbidities during the decade. Finally, because the Medicare population is America's largest healthcare payment outlay, we

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examined the changes in risk profiles and outcomes in this population as well.

Material and Methods

The Society of Thoracic Surgeons National Cardiac Database

Currently, patient data are harvested semiannually from the individual participant site providers contributing to the NCD [5]. Data are uploaded to a central warehouse facility, the Duke Clinical Research Institute. Certain data quality standard benchmarks need to be met both locally and nationally before a site's data are included on the aggregate national set. Aggregate data are analyzed twice a year for site-specific feedback reporting, and benchmarked against regional and national standards. These reports are designed for use in local and regional CABG Quality Improvement efforts by identifying areas for process improvement. An Executive Summary of the Semi-Annual report is posted at http://www.sts.org/database.

Outcomes performance measures are risk-adjusted using a series of statistical models developed by the STS National Database Committee [6–10]. Current models include mortality and major morbidity for CABG, valve and CABG/valve procedures, as well as risk-adjusted postoperative length of stay for each procedure classification.

Study Population

Between 1990 and 1999, a total of 1,517,715 adult cardiac procedures were harvested into the STS NCD from patients in the United States and Canada. A total of 522 sites contributed data to the STS NCD over this time interval. From this total, we excluded those patients undergoing isolated valve or other cardiac procedures, combined (CABG + valve, CABG + other) procedures, or data that failed to meet the data quality standards for inclusion in the NCD. This left a subset of isolated CABG patients that were used for the present analysis (n = 1,154,486).

Data Definitions

The elements and definitions used in the STS NCD have remained generally constant across this entire 10-year period [5, 7]. Detailed definitions for these outcomes can be found on the Society's web page (http://www.sts.org/database).

For this analysis, operative mortality included all in-hospital deaths as well as all out-of-hospital deaths occurring within 30 days of the procedure.

Analysis

Initial data descriptions included means for continuous risk variables and percentages for discrete variables. The statistical significance of time trends in risk factor prevalence during the 10-year period was determined by linear regression for continuous variables and logistic regression for discrete variables.

Table 1. Annual Harvest Data for the Total Population, Isolated CABG Population, and Medicare-Age Subset

Year	Total No. Patients	Isolated CABG Patients	Isolated CABG Patients 65+ (yr)	Cumulative No. of Sites
1990	31,444	22,945	11,770	106
1991	52,027	38,678	20,509	152
1992	80,250	60,544	32,220	209
1993	104,643	79,265	42,344	266
1994	148,519	113,617	61,014	340
1995	198,691	152,325	82,563	409
1996	233,400	181,467	99,209	461
1997	250,054	190,552	104,369	493
1998	236,280	178,763	99,657	519
1999	182,407	136,330	75,519	522
Total	1,517,715	1,154,486	629,174	

CABG = coronary artery bypass grafting.

We specifically considered the 28 risk variables that had been previously identified as independent predictors for operative mortality in any of the previous CABG models. Of these 28 variables, 23 had consistent definitions during the entire decade. We also calculated absolute and relative percentage changes in these risk factors between 1990 and 1999.

We developed a new, composite risk-adjusted logistic model based on the entire data set. This model allowed one to calculate a patient's summary predicted risk based on all 23 preoperative risk factors. These model estimates were also used to calculate the annual observed-to-expected (O/E) ratios for mortality as well as risk-adjusted mortality rates observed for the decade. Finally, results were analyzed to determine whether the time trend from 1990 to 1999 was statistically significant.

For purposes of the overall dataset analysis, missing data (data value for element not recorded) were assigned a null value (normal, absent) for all 23 variables used in the risk model.

Given that the quantity of missing data were not constant over time, as a secondary analysis we recalculated these temporal changes among a subset of isolated CABG patients, subject to the following rules: (1) for discrete variables, more than 20% missing for any variable disqualified that site's data for that year; (2) exceptions included data for child variables (eg, intraaortic balloon pump timing, myocardial infarction timing), and New York Heart Association functional classification; in these instances, if these variables were 100% missing, these sites were excluded; and (3) variables for ejection fraction and body surface area were not subject to any threshold because these continuous variables were imputed to means in the model.

Results

Table 1 documents the annual harvest data for the entire patient dataset from 1990 to 1999. A total of 1,154,486

CABG patient records were included in this analysis. Both the cumulative aggregate total record numbers and the aggregate Medicare population numbers are shown (n = 629,174). The cumulative aggregate number of harvest sites has grown fivefold during this decade.

Table 2 displays the changes in risk factor frequency during this time interval. For display purposes, we concentrated on the years 1990 and 1999, although time trends demonstrated consistent changes throughout the entire period. Table 2 also displays the relative and absolute change that occurred during this time period for each risk factor. Overall, the percentage of missing data (referred to as unknown in the Table) declined significantly during the decade. By 1999, the only variables with more than 6% missing data included pulmonary hypertension (14.7%), chronic obstructive pulmonary disease (14.4%), ejection fraction (13.3%), and New York Heart Association functional classification (14.7%).

The mean age of patients undergoing CABG increased from 63.7 years in 1990 to 65.1 years in 1999 ($p < 0.0001$ for the decade time trend) as did the percentage of women (25.7% versus 28.7%, $p < 0.0001$). The frequency of comorbid conditions including diabetes, renal failure, hypertension, preoperative stroke, chronic obstructive pulmonary disease, cardiogenic shock, and triple vessel disease all increased ($p < 0.0001$ for the time trend). Preoperative intraaortic balloon pump use increased by 33.9% as well. A decline in reoperations (before CABG or combined procedure) and a decline in emergent and salvage procedures occurred by the end of the decade.

Table 3 shows the similarly formatted data for the Medicare population. Again, univariate analysis documented that the change in the incidence of these risk factors was significant ($p < 0.0001$) for all variables during the time trend 1990 to 1999 except for previous cardiac operations ($p = 0.0054$), myocardial infarction timing more than 21 days ($p = 0.0022$), and salvage status ($p = 0.0067$).

To address the issue of missing data trends over time, a subanalysis of the entire dataset was performed as outlined above. Table 4 illustrates the number of isolated CABG patients (overall and Medicare-aged) and number of sites per year after the missing data criteria had been applied. The percentage of sites that dropped out of the analysis due to these rules declined substantially from 65% in 1990 to only 15% in 1999.

Table 5 presents this subset analysis formatted as in Table 2, for the entire population. By design, the percentage of missing data is dramatically reduced and is consistent across the time trend. The univariate trends, however, are similar in the subanalysis to the overall dataset ($p < 0.0001$ for the decade trend except for the variables noted) for the entire population. Similarly, the univariate trends for the missing data subanalysis of the Medicare subset were significant ($p < 0.0001$ except for salvage status ($p = 0.0051$), preoperative intraaortic balloon pump ($p = 0.06$) and New York Heart Association functional class IV ($p = 0.0681$)) (data not shown).

For the overall population, Figure 1 displays the changes in expected (predicted risk) mortality, in observed operative mortality, and risk-adjusted mortality during the decade using the model developed for this analysis. During this time interval, the observed operative mortality declined by 0.9%, a relative decrease of 23.1% ($p < 0.0001$ for the time trend). Risk-adjusted operative mortality similarly declined from 4.8% to 2.9% during the decade, also highly significant. In contrast, patient's predicted relative risk for operative mortality increased by 30%, from 2.6% in 1990 to 3.4% in 1999 ($p < 0.0001$ for the time trend).

Figure 2 shows the O/E ratio trend during the decade for the overall analysis (total isolated CABG group) and for the missing data subanalysis. The observed and expected data for each year for both analyses are shown in the Appendix. Although elimination of missing data from the analysis reduced the number of patients and sites available for the analysis, primarily in the early years (compare Table 1 and Table 4), the O/E trend was similar and both trends were significant for the decade analyzed. In addition, the O/E ratio data for the Medicare subgroup are shown, and tracked the "All CABG" and subanalysis curves.

Figure 3 demonstrates data similar to Figure 1 for the Medicare-aged population. Observed operative mortality rates in patients 65 years and older undergoing CABG declined from 5.4% to 4.1%, a relative decrease of 24.1%. The risk-adjusted mortality also declined from 5.2% to 3.1%, a relative decrease of 41%. In contrast, the predicted operative mortality risk for those aged 65 years and older increased by 33.3%, from 3.3% in 1990% to 4.4% in 1999 ($p < 0.0001$ for the time trend).

In addition, Figure 3 is a composite benchmarking the overall analysis mortality trend data (expected and risk-adjusted) for the Medicare-aged subset against average Medicare reimbursement for a standard three-vessel bypass procedure (current procedural terminology (CPT) code 33512 in 1990 to 1992, CPT code 33533 + 33518 in 1993 to 1999). During the decade, predicted reimbursement declined from $3,698 to $2,276 on average per case, a relative percentage decline of 38.4%. This occurred although mortality outcomes improved during the decade despite a significant increase in predicted risk.

Comment

Operative Mortality Trends Over Time

The present study is the first published report from a multisite national dataset (in contrast to reports from large, single-institution databases [11–15]) analyzing trends in CABG mortality. These results confirm that during the past decade patients undergoing CABG are older and with more comorbidities. Despite this, there has been a significant decline in overall operative mortality and risk-adjusted mortality for CABG during the decade from 1990 to 1999 (Fig 1).

Changing Risk Profile in CABG

The present study also importantly evaluates concomitant changes in the risk profile of patients undergoing

Table 2. Univariate Data for Variables Used in the Risk Adjustment, 1990–1999: All CABG Patients (n = 1,154,486) and Absolute and Relative Changes in Selected Risk-Adjustment Variables, 1990 Versus 1999[a]

Risk Factor	1990	1999	Absolute Change	Relative % Change
Demographics				
Patient age (y)				
Mean	63.7	65.1	1.4	
Median	65	66		
Gender				
Female (%)	25.7	28.7	3.0	11.6
Unknown (%)	0.0	0.4		
Race				
Non-Caucasian (%)	5.6	10.2	4.6	82.1
Unknown (%)	17.7	4.7		
Comorbidities				
Body surface area (m^2)				
Mean	1.90	1.95	0.05	
Median	1.92	1.96		
Unknown (%)	41.0	2.3		
Diabetes mellitus				
Yes (%)	21.4	32.7	11.3	52.7
Unknown (%)	17.6	2.6		
Renal failure				
Yes (%)	3.0	4.6	1.6	51.8
Unknown (%)	18.0	3.6		
Hypertension				
Yes (%)	50.7	68.9	18.2	35.9
Unknown (%)	14.1	2.1		
Pulmonary hypertension				
Yes (%)	0.8	3.0	2.2	275.0
Unknown (%)	38.4	14.7		
Cerebrovascular accident				
Yes (%)	3.8	7.1	3.2	84.9
Unknown (%)	31.4	3.4		
COPD				
Yes (%)	8.2	14.0	5.8	71.0
Unknown (%)	31.2	14.4		
Previous interventions				
Prior cardiac operations				
Yes (%)	10.6	8.4	−2.2	−21.0
Unknown (%)	1.2	2.4		
Cardiac status				
Cardiogenic shock				
Yes (%)	1.3	4.4	3.1	243.0
Unknown (%)	24.1	3.6		
MI timing				
0–21 days	16.2	23.7	7.5	46.3
> 21 days	20.5	21.9	1.4	6.8
Unknown (%)	22.3	3.4		
Unstable angina				
Yes (%)	55.8	43.2	−12.6	−22.6
Unknown (%)	6.3	1.6		
Arrhythmia				
Yes (%)	14.9	11.8	−3.1	−20.8
Unknown (%)	21.4	3.5		

Table 2. Continued

Risk Factor	1990	1999	Absolute Change	Relative % Change
NYHA class IV				
Yes (%)	13.2	23.1	9.9	75.0
Unknown (%)	57.2	14.7		
Hemodynamics and Cath				
Triple vessel disease				
Yes (%)	55.8	68.5	12.6	22.7
Unknown (%)				
Left main > 50% stenosis				
Yes (%)	15.6	23.4	7.8	50.0
Unknown (%)	30.2	3.4		
Ejection fraction (%)				
Mean	52.7	50.7	−2.0	−3.8
Median	54	50		
Unknown (%)	31.4	13.3		
Operative				
Procedure status				
Elective	67.3	60.8	−6.5	−9.7
Urgent	17.6	32.9	15.3	86.9
Emergent	7.1	5.5	−1.6	−22.7
Salvage	0.6	0.5	−0.2	−28.1
Unknown (%)	7.5	0.4		
CPB and support				
Preoperative IABP				
Yes (%)	4.9	6.5	1.7	33.9
Unknown (%)	6.2	2.6		

[a] Trends in all variables were statistically significant (at the $p < 0.0001$ level) over the decade, except salvage status ($p = 0.0003$).

COPD = chronic obstructive pulmonary disease; IABP = intraaortic balloon pump; MI = myocardial infarction; NYHA = New York Heart Association.

surgical intervention in a large, nationwide dataset. We used statistical modeling techniques that permit a longitudinal time trend analysis of the change in surgical risk over time, based on preoperative risk factors. Table 2 illustrates the preoperative risk factor trends during the decade. These trends include increasing age, increased female patient cohort, more comorbidities, more extensive surgical disease, and more patients with abnormal ventricular function. Interestingly, the incidence of emergent and salvage patients declined, in part probably due to the use of coronary stents for acute intervention and for vein graft restenosis, and perhaps due to more aggressive use of preoperative intraaortic balloon pump placement. In summary, this risk profile change resulted in a 30% increase in expected risk during the decade, highly significant for the time trend.

Increased Risk Versus Decreased Mortality

Figure 2 demonstrates a significant decrease in the observed mortality/expected mortality ratio (O/E ratio) for the overall and Medicare analysis groups during the decade. In the overall population the O/E ratio decreased below 1.0 in 1995, whereas it declined below this benchmark in 1998 for the Medicare-aged subset. Because

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Table 3. Univariate Data for Variables Used in the Risk Adjustment, 1990–1999: Medicare-Age Subset (n = 629,174) and Absolute and Relative Changes in Selected Risk-Adjustment Variables, 1990 Versus 1999[a]

Risk Factor	1990	1999	Absolute Change	Relative % Change
Demographics				
Patient age (y)				
Mean	71.7	73.1	1.4	
Median	71	73		
Gender				
Female (%)	31.3	33.7	2.3	7.5
Unknown (%)	0.0	0.4		
Race				
Non-Caucasian (%)	4.6	8.6	4.0	87.0
Unknown (%)	17.7	4.7		
Comorbidities				
Body surface area (m^2)				
Mean	1.85	1.90	0.05	
Median	1.87	1.91		
Unknown (%)	41.9	2.3		
Diabetes mellitus				
Yes (%)	22.3	32.5	10.2	45.5
Unknown (%)	18.2	2.6		
Renal failure				
Yes (%)	4.3	5.4	1.2	27.3
Unknown (%)	18.2	3.6		
Hypertension				
Yes (%)	53.3	72.2	18.9	35.4
Unknown (%)	14.2	1.9		
Pulmonary hypertension				
Yes (%)	1.0	3.5	2.5	250.0
Unknown (%)	38.8	15.0		
Cerebrovascular accident				
Yes (%)	4.5	8.9	4.3	95.1
Unknown (%)	32.0	3.3		
COPD				
Yes (%)	8.9	15.4	6.5	73.0
Unknown (%)	31.6	14.6		
Previous interventions				
Prior cardiac operations				
Yes (%)	10.8	10.0	−0.8	−7.7
Unknown (%)	1.8	6.0		
Cardiac status				
Cardiogenic shock				
Yes (%)	1.4	4.5	3.1	222.6
Unknown (%)	24.7	3.6		
MI timing				
0–21 Days	15.3	23.2	7.9	51.6
> 21 Days	20.6	21.9	1.3	6.3
Unknown %	23.5	3.4		
Unstable angina				
Yes (%)	55.9	43.3	−12.6	−22.5
Unknown (%)	6.1	1.5		
Arrhythmia				
Yes (%)	17.7	15.2	−2.5	−14.1
Unknown (%)	21.8	3.4		
NYHA class IV				
Yes (%)	14.3	23.4	9.1	63.4
Unknown (%)	57.9	14.5		

Table 3. Continued

Risk Factor	1990	1999	Absolute Change	Relative % Change
Hemodynamics and Cath				
Triple vessel disease				
Yes (%)	58.1	70.8	12.7	21.8
Unknown (%)	17.1	4.9		
Left main > 50% Stenosis				
Yes (%)	15.6	23.4	7.8	50.0
Unknown (%)	30.2	3.4		
Ejection fraction (%)				
Mean	52.4	50.4	−2.0	−3.8
Median	51	50		
Unknown (%)	31.8	13.3		
Operative				
Procedure status				
Elective	67.3	60.8	−6.5	−9.7
Urgent	17.6	32.9	15.3	86.9
Emergent	7.1	5.3	−1.7	−24.3
Salvage	0.7	0.5	−0.2	−28.7
Unknown (%)	7.5	0.4		
CPB and support				
Preoperative IABP				
Yes (%)	5.4	6.4	1.1	19.8
Unknown (%)	6.2	2.6		

[a] Trends in all variables were statistically significant (at the $p < 0.0001$ level) over the decade, except prior cardiac operations ($p = 0.0054$), MI timing >21 days ($p = 0.0022$), and salvage status ($p = 0.0067$).

Abbreviation as in Table 2.

during the decade this baseline mortality risk in fact increased in severity, this outcomes benchmark not only improved but improved against a negative trend in preoperative surgical risk.

This measurement of outcomes evaluation (O/E ratio) has been used in a number of other analyses from both

Table 4. Annual Harvest Data Results After Subjecting the Isolated CABG Dataset to the Missing Data Selection Rules Process

Year	All Patients	Patients 65+ Yrs	Cumulative No. of Sites	% Total Sites
1990	8,432	4,052	38	35%
1991	18,579	9,443	66	43%
1992	30,718	16,018	104	50%
1993	46,908	24,878	156	59%
1994	70,746	37,871	218	64%
1995	98,378	53,281	282	69%
1996	132,894	72,420	357	77%
1997	140,817	76,614	396	80%
1998	127,403	64,529	434	84%
1999	91,136	33,820	443	85%
Total	766,011	392,926		

Same format as in Table 1. The number of sites expressed as a percentage of the total number of sites for that year, and increased from 35% in 1990 to 85% in 1999.

Table 5. Univariate Data for Variables Used in the Risk Adjustment, 1990–1999, After Missing Data Subanalysis and Absolute and Relative Changes in Selected Risk-Adjustment Variables, 1990–1999[a,b]

Risk Factor	1990	1999	Absolute Change	Relative % Change
Demographics				
Patient age (y)				
Mean	63.4	65.1	1.7	
Median	65	66		
Gender				
Female (%)	25.8	28.7	2.9	11.2
Unknown (%)	0.0	0.1		
Race				
Non-Caucasian (%)	6.3	11.0	4.7	74.6
Unknown (%)	0.8	0.7		
Comorbidities				
Body surface area (m^2)				
Mean	1.89	1.96	0.1	
Median	1.92	1.96		
Unknown (%)	0.8	0.7		
Diabetes mellitus				
Yes (%)	24.6	32.5	7.9	32.1
Unknown (%)	0.5	0.2		
Renal failure				
Yes (%)	2.8	4.6	1.8	64.3
Unknown (%)	0.5	0.4		
Hypertension				
Yes (%)	58.4	70.2	11.8	20.2
Unknown (%)	0.5	0.2		
Pulmonary hypertension				
Yes (%)	1.3	3.7	2.4	184.6
Unknown (%)	0.6	1.8		
Cerebrovascular accident				
Yes (%)	3.6	7.4	3.8	105.6
Unknown (%)	0.6	0.3		
COPD				
Yes (%)	11.3	16.5	5.2	46.0
Unknown (%)	0.5	0.4		
Previous interventions				
Prior cardiac operations				
Yes (%)	10.5	8.3	−2.2	−21.0
Unknown (%)	0.0	0.2		
Cardiac Status				
Cardiogenic shock				
Yes (%)	1.5	4.4	2.9	193.3
Unknown (%)	0.2	0.3		
MI timing				
0–21 days	22.0	24.7	2.7	12.3
> 21 days	26.3	22.3	−4.0	−15.2
Unknown (%)	7.8	2.1		
Unstable angina				
Yes (%)	44.1	42.8	−1.3	−2.9
Unknown (%)	4.7	0.7		
Arrhythrnia				
Yes (%)	18.5	12.4	−6.1	−33.0
Unknown (%)	1.6	0.8		

Table 5. Continued

Risk Factor	1990	1999	Absolute Change	Relative % Change
NYHA class IV				
Yes (%)	22.4	23.3	0.9	4.0
Unknown (%)	31.0	9.9		
Hemodynamics and Cath				
Triple vessel disease				
Yes (%)	64.9	71.6	6.7	10.3
Unknown (%)	2.0	1.8		
Left main > 50% stenosis				
Yes (%)	16.5	21.8	5.3	32.1
Unknown (%)	0.9	0.4		
Ejection fraction (%)				
Mean	52.3	50.8	−1.5	−2.9
Median	55	50		
Unknown (%)	18.3	10.0		
Operative				
Procedure status				
Elective	72.3	58.7	−13.6	−18.8
Urgent	18.4	35.1	16.7	90.8
Emergent	8.3	5.7	−2.6	−31.3
Salvage	0.7	0.5	−0.2	−28.6
Unknown (%)	0.4	0.2		
CPB and support				
Preoperative IABP				
Yes (%)	6.1	6.6	0.5	8.2
Unknown (%)	1.7	0.7		

[a] The stable missing data values across the decade for all variables except for child discrete variables of MI timing and IABP timing and for NYHA class. Body surface area and ejection fraction are continuous variables imputed to the means in the model and not subjected to threshold of completeness. Abbreviations are the same as in Table 2.

[b] Trends in all variables were statistically significant (at the $p < 0.0001$ level) over the decade, except salvage status ($p = 0.0051$), preoperative IABP ($p = 0.0600$), and NYHA class IV ($p = 0.0681$).

voluntary and mandatory databases (Shroyer ALW, personal communication, October 2000) [16–20]. Time trend data similar to that reported here from the STS have been collected but not reported from the VA Cardiac Surgical Program, also a nationwide, multisite but mandatory cardiac surgery database (Shroyer ALW, personal communication, October 2000) [21]. In this VA analysis, a significant decrease in the O/E ratio was demonstrated for the 13-year interval between 1988 and 1999, using a slightly different time trend analysis than the present study (Shroyer ALW, personal communication, October 2000). Thus, the two nationwide cardiac surgical databases, one voluntary (STS) and one mandatory (VA), have demonstrated a decline in operative mortality in the face of increased surgical risk during the decade of the 1990s. The similarity of results from the STS and VA analyses suggests again that voluntary data collection and analysis programs can yield results that are of quite similar validity and scientific merit as compared to mandatory programs for collection and analysis, provided the

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2002;73:480–90

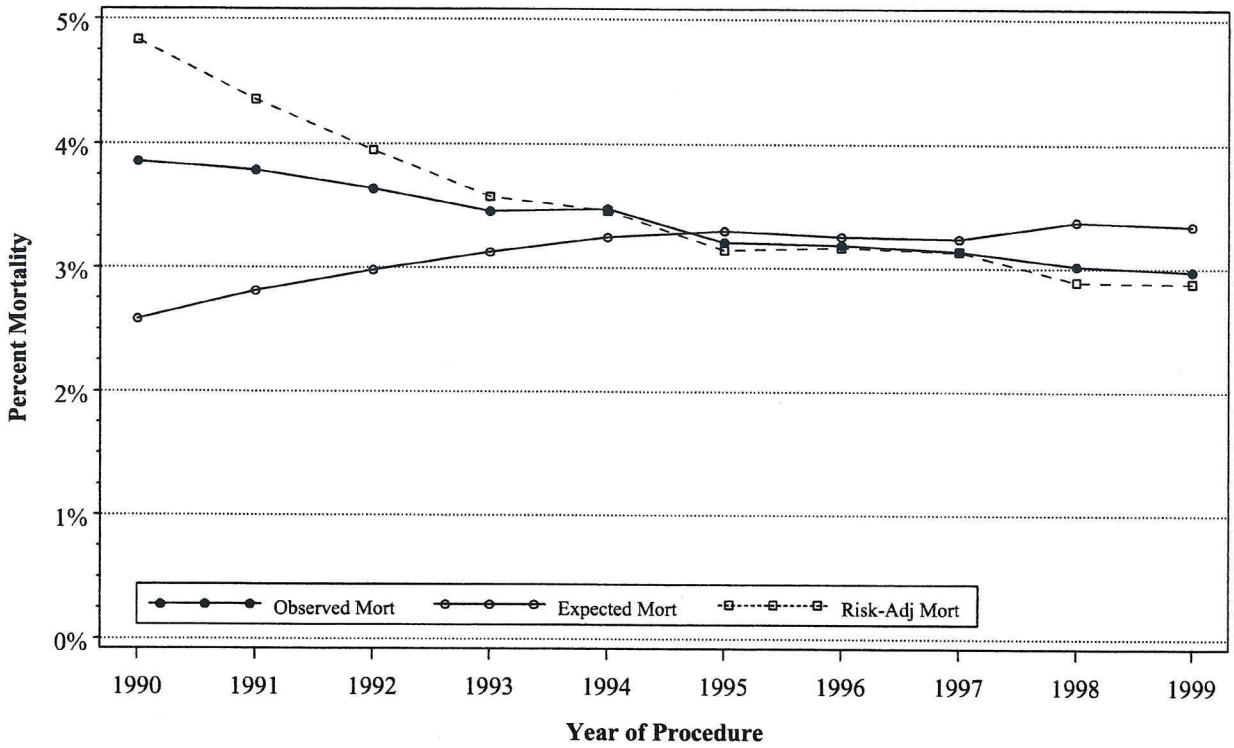

Fig 1. Observed, expected and risk-adjusted mortality, 1990 to 1999. Entire coronary artery bypass grafting population (n = 1,154,486).

data are collected by highly motivated physicians educated in the benefits of outcomes analyses.

Possible Reasons for the Improved Mortality Despite the Increased Risk

Efforts to continually improve the outcomes after CABG have been the hallmark of cardiothoracic surgeons for the past 30 years [5, 9, 17]. A number of reasons can be postulated for the continued improvement in operative mortality during the past decade. First, the *process* of CABG has undergone a significant evolution, with implementation of care paths and cardiac surgical service lines, both major efforts at improving the coordination of care for the CABG patient. Second, formation of cardiac surgical teams with dedicated cardiothoracic anesthesiologists, nursing personnel, and allied health personnel has greatly contributed to the efficiency of care. Third, technical improvements have occurred, both in cardiac surgery (eg, cardiopulmonary bypass and myocardial protection improvements) as well as in cardiology (eg, stenting of previous bypass grafts). Fourth, new pharmacologic agents and perioperative techniques have allowed for early extubation protocols and "fast-track" management of a majority of CABG patients [22]. Fifth, selection criteria and techniques have been developed to safely and successfully intervene in an increasingly elderly patient population [1, 2, 23].

Perhaps as important as these structural and technical changes, implementation of quality improvement programs has had a profound effect on improving mortality after CABG during the past decade. Physician-championed voluntary data collection and analysis efforts in northern New England [17], Minnesota [24], and Alabama [25] have demonstrated this, and the STS has recently embarked on a nationwide effort in quality improvement [5]. All these efforts have in common the feedback, local analysis of processes and outcomes, and regional information exchange that can favorably impact outcomes after CABG. It can be anticipated that continued efforts in quality improvement in CABG will produce sustained improvements in surgical outcomes after CABG during the first decade of the new millennium.

Missing Data in the STS NCD

As shown in Tables 2 and 3, the percentage of missing data was relatively high in the early years of the NCD. Importantly, the percentage of missing data declined during the decade to levels commensurate with other voluntary and mandatory database efforts. However, this change in the baseline level of missing data would be expected to affect the risk evaluation and expected mortality analyses in particular over time. Therefore, we repeated this analysis after exclusion of sites with more than 20% missing data for any of the 23 variables used in the trend mortality analyses. As shown in Table 4 this resulted in a smaller patient population, from a smaller number of participant sites. However, Table 5 shows that the variability in the percentage of missing data was

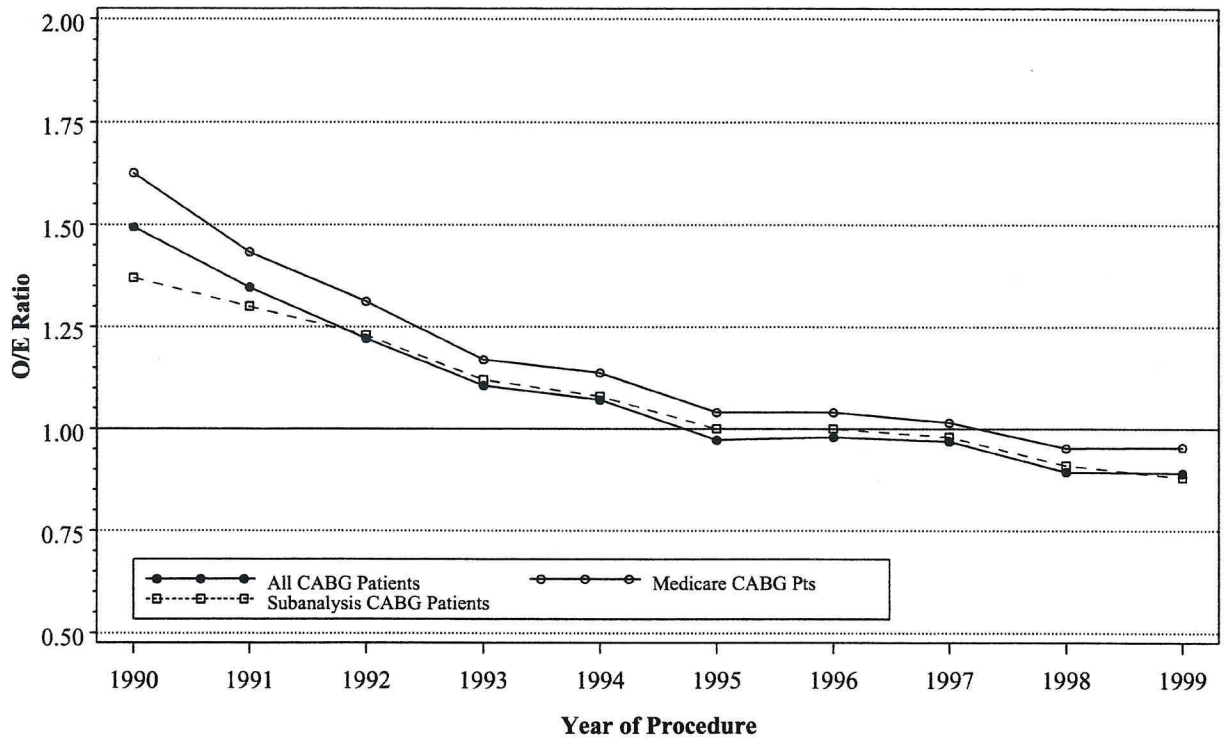

Fig 2. Observed mortality to expected mortality ratio (O/E), 1990 to 1999, for the entire coronary artery bypass grafting (CABG) population (n = 1,154,486), the Medicare-age subset (n = 629,174), and the missing data subanalysis subset of the entire coronary artery bypass grafting population (n = 766,011).

eliminated by this technique, while still leaving enough patients for trend analyses. Figure 3 demonstrates that the O/E ratio for this subanalysis was similar to the overall CABG and Medicare group analyses, and this decline in operative and risk-adjusted mortality as well as the increase in expected mortality were significant for the trend during 1990 to 1999 ($p < 0.0001$) for this missing data subanalysis as well. Thus, the seminal finding of this study, that there indeed has been an increase in expected mortality for CABG (increased surgical risk during the past decade, confirming surgeons' subjective impression that "patients today are sicker") is borne out in the overall dataset as well as both subanalyses.

The NCD has implemented a number of programs in the past several years to facilitate local data quality improvements [5], and the overall data quality in the NCD has improved substantially during the decade. Indeed, the decline in the percentage of missing data during the decade (Table 4) can be viewed as a surrogate for improved data quality in the NCB during this time frame.

Increased Risk Versus Decreased Mortality in the Elderly Population

In the patient group more than 65 years (n = 629,174), the mean age increased by 1.4 years also (71.7 versus 73.1 years) (Table 3; $p < 0.0001$). Numerous studies have documented acceptably higher mortality rates in elderly patients [1, 2]. This study reports similar mortality rates (Fig 3), and documents that the mortality for CABG in a subset of patients more than 65 years has declined significantly as well as during this past decade. Although this decline in this elderly subset is not as great as the overall population (Fig 1), it occurred during a decade where more and more elderly patients are considered acceptable candidates for elective and urgent surgical intervention. The O/E ratio has declined significantly during the decade in the Medicare population (Fig 2), and again this improvement in mortality outcome occurred in the face of an increasing, not static, baseline preoperative risk. The findings of this study support continued selected intervention in the elderly, including octogenarians and nonagenarians [1, 2].

Improved Outcomes Versus Declining Reimbursement for CABG (Fig 3)

During the decade of this analysis, the Medicare Part B reimbursement for CABG declined on average from $3,698 for a three-vein procedure in 1990 to $2,276 in 1999 for a more technically complicated standard left internal mammary artery/two-vein procedure. This represents a 38.4% decline in raw reimbursement during the decade, unadjusted for inflation (Fig 3). During this same time interval the surgical outcome for CABG improved by 41% despite the 33% increase in surgical risk. The findings from this scientific analysis should be used in establish-

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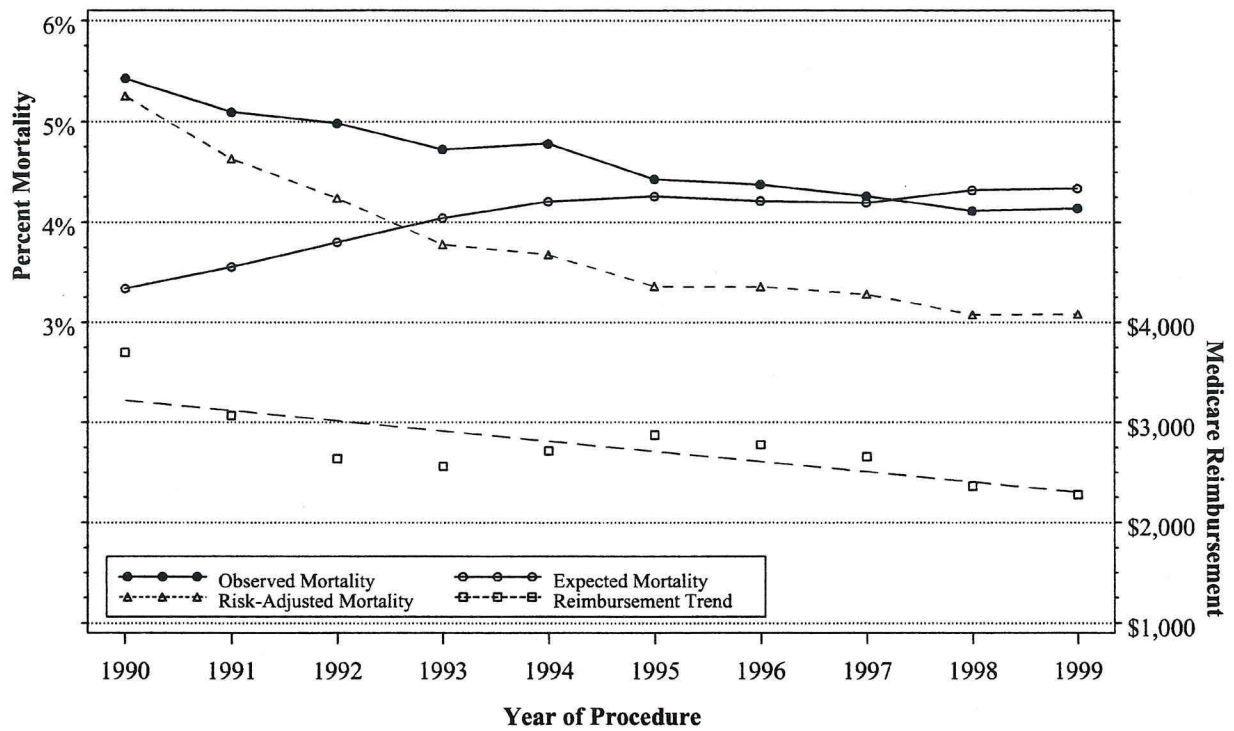

Fig 3. Composite of mortality statistics, Medicare-age subset and Medicare part B reimbursement, 1990 to 1999, Medicare-age subset (n = 629,491). Observed, expected and risk-adjusted mortality data are shown. In addition, Medicare part B reimbursement data from Health Care Financing Administration for current procedural terminology (CPT) 33512 (three veins) for 1990 to 1992 and for CPT 33518 + 33533 (left internal mammary artery + two veins) for 1993 to 1999 are shown. (HCFA is now known as CMS, Centers for Medicare and Medicaid Services.)

ing reimbursement levels to cardiothoracic surgeons for these more increasingly demanding clinical efforts. In particular, consideration should be given to the fact that these NCD participation activities are legitimate, reimbursable practice expenses that directly impact on the quality of care delivered to these patients.

Limitations

Although a substantial majority of US centers currently submit data to the STS NCD, participation is not ubiquitous among cardiac programs across the country; as such, the NCD data do not represent a truly comprehensive national experience. In addition, as the number of centers contributing to the STS has grown over time, it remains possible that some of the changes in risk factors and outcomes could be due to a change in the type or quality of centers represented in the STS NCD. A third potential limitation is that this study does not address perhaps the most important aspects of this analysis, namely why these improvements in mortality outcome occurred despite this increase in surgical risk.

In conclusion, this study documents a statistically significant increase in operative risk for patients undergoing isolated CABG during the past decade as documented in patient data from the STS National Cardiothoracic Surgical database. Importantly, despite this increase in expected mortality, the quality of care (as documented by decreased observed and risk-adjusted mortality) delivered by cardiothoracic surgeons and their colleagues to their patients was documented to have improved significantly during this time interval. Both of these time trends are highly statistically significant during the 10-year time interval. This analysis illustrates the powerful tool that the NCD represents, and clearly documents the value and "return on investment" of collecting and analyzing these outcomes data within organized medicine. Cardiothoracic surgeons should be extremely proud of the superb care delivered to their patients despite these increasingly complex and high-risk procedures.

The authors thank all STS participants who have contributed data to the STS National Database during the past decade. In addition, we extend our appreciation to the Society, the Officers, and the Members of the National Database Committee over the decade who have supported this National Database effort.

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Appendix

Mortality Data, 1990–1999

	Total Dataset		Missing Dataset	
Year	Expected	Observed	Expected	Observed
1990	2.58	3.85	2.75	3.78
1991	2.81	3.78	2.82	3.66
1992	2.97	3.63	2.90	3.58
1993	3.12	3.45	3.10	3.48
1994	3.24	3.47	3.18	3.44
1995	3.29	3.20	3.22	3.23
1996	3.25	3.18	3.18	3.19
1997	3.23	3.13	3.17	3.11
1998	3.37	3.01	3.33	3.03
1999	3.34	2.97	3.30	2.90

INVITED COMMENTARY

This manuscript has many features:

1. The Excellent: It has data from more than 1 million patients from 522 hospitals in the United States and Canada (2 Nations) from The Society of Thoracic Surgeons (STS) Database. It is, therefore, of great interest, is extremely valuable and documents that patient's risks (from cardiac disease and comorbidities) have increased from 1990 to 1999 but the observed and risk-adjusted mortality have decreased. These data are essential for monitoring the operative mortality of CABG surgery.
2. The Problems: (A) The actual mortality in each year is not listed; (B) A large amount of baseline data are missing. For example, excluding the data from a site with more than 20% data missing for any variable, results in 65% of sites being excluded in 1990, 36% in 1994 and even 15% in 1999, raising a concern about the risk-adjusted mortality. The authors' (indirect) suggestion that data are acceptable when 6% or less data are missing is reasonable and should be used in the future; (C) Data are not presented separately for patients less than 65 years of age. Data for the whole population and for those aged 65 or older are given.

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EXHIBIT 5

Global Budget Revenue Contracts Market Shift Adjustments
Draft Technical Report

Health Services Cost Review Commission
4160 Patterson Avenue Baltimore, MD 21215
(410) 764-2605

May, 2015

This document contains technical specifications for Global Budget Contract Market Share adjustments for RY 2016.

Market Shift Adjustments under Global Revenue Models

Updated-5/6/2015

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Market Shift Adjustments under Global Revenue Models

Updated-5/6/2015

This draft document, prepared in conjunction with the Payment Models Work Group, contains principles for consideration as market shift adjustments are developed and applied. It is a work in progress and may be modified as the approaches and calculations for adjustments are finalized.

1. Introduction

The Market Shift Adjustments (MSAs) mechanism is part of a much broader set of tools that links global budgets to populations and patients under the State's new All-Payer Model.

The specific purpose of MSAs is to provide a criteria for increasing or decreasing the approved regulated revenue of Maryland hospitals operating under Global Budget Revenue (GBR) rate arrangements to ensure that revenue is appropriately reallocated when shifts in patient volumes occur between hospitals as a result of efforts to achieve the Triple Aim of better care, better health, and lower costs. In fact, MSAs under global budget revenue arrangements are fundamentally different from a volume adjustment. Hospitals under a population-based payment system, such as GBR, have a fixed budget for providing services to the population in their service area. Therefore, it is imperative that MSAs reflect shifts in patient volumes independent of general volume increases in the market.

This document lays out the principles governing the development of MSA mechanisms that will be applied as part of Maryland's global budget system and provides a brief overview of the methodology.

2. Overview

MSAs should contain the following features:

- A specified population from which hospitals' market shifts will be calculated;
- A defined set of covered services of the MSA ; and
- An MSA approach that is budget neutral to the maximum extent practicable and/or results in demonstrably higher quality of care.

The MSA should complement the global budget revenue incentives to eliminate marginal services that do not add value, are unnecessary or result from better community based care. Therefore, MSAs should not be applied to these appropriate reductions in utilization.

MSAs are one of the global budget tools necessary to account for changes in utilization levels and patterns. The global budget revenue agreements contain other mechanisms intended to ensure the continued provision of needed services for Maryland patients including:

- **Population/Demographic Adjustments:** Changing demographics could result in a growth in the demand for hospital services. Currently, the annual update factor adjusts revenue to capture changes in overall population. Annual hospital level population adjustments will capture changes in total population/demographics in each hospital's service area.
- **Annual Update Provides Flexibility to Fund Innovation/New Services/Growth in Selected Quaternary Services:** Targeted funding could be provided through the Update Process. For example, the new Holy

Cross Germantown Hospital is partially funded from the general update process. Consideration is given to annual budget changes for quaternary services such as transplants, burns, and highly specialized cancer care for Johns Hopkins Hospital and University of Maryland Hospital Center under their global budget agreements.

- **Transfers to Johns Hopkins Hospital, University of Maryland Hospital Center, and Shock Trauma Center:** Adjustments will be made for changes in patient transfers to respective centers to ensure that resources are available to treat patients needing the specialized care provided in these settings.

- **Potentially Avoidable Utilization (PAU)**: PAU is excluded from the MSAs and will be analyzed separately. The exclusion of PAU avoids the possibility of rewarding a hospital that increased PAU at the expense of a hospital that appropriately reduced its PAU. A PAU focused analysis, when warranted, will allow an assessment PAU reductions that are not driven by improvements in population health, such as diversion of patients to an unregulated setting, transfer of patients due to changes in referral patterns by purchasers, or a less favorable change in service delivery (eliminating or contracting service lines that have high PAU volumes) that should not be rewarded.

The basis for distinguishing between desirable and undesirable utilization changes is the Triple Aim of the new system: to improve health care outcomes, enhance patient experiences, and control costs. MSAs, together with other global budget agreement provisions and HSCRC policies, will need to focus on efforts that support the Triple Aim.

Examples of actions that help achieve the Triple Aim are those that result from:

- Providing high quality hospital care resulting in fewer hospital-acquired conditions;
- Making efforts to improve care coordination and patient discharge planning resulting in fewer re-hospitalizations;
- Promoting the provision of care in the most appropriate setting, resulting in fewer initial hospitalizations for ambulatory care sensitive conditions and conditions that can be treated equally effectively in other settings at lower cost; and
- Providing services in lower cost settings without compromising patient care.

Possible examples of actions that undermine the Triple Aim and should be avoided include:

- Prompting patients with unprofitable service needs to seek care elsewhere or reducing the volume of non-profitable services below the amount needed by patients within the hospital's service area;
- Reducing capacity or service ability to the point of creating long waiting lists or delays;
- Under investing in new technology or modes of care proven to be efficient ways of improving patient health, safety or quality; and
- Reducing the total level of a hospital's medical staff or the quality of affiliated providers to the point of compromising patient care.

Similarly, the MSA together with other mechanisms and policies must distinguish between increases in utilization at any given hospital that should be recognized and those that should not be recognized. For

example, hospitals should receive increases to their approved regulated revenue in circumstances that result in a shift of patient volumes that are beyond the hospital's control, such as the closure of a service at a particular hospital and resulting relocation of patients receiving that service to another facility, or other discrete and readily identifiable events. As long as the financial drivers of the shift are transparent and value based, hospitals should also receive a market shift adjustment if organizations such as Health Maintenance Organizations, Accountable Care Organizations or Primary Care Medical Homes direct their members to the facility to improve efficiency, cost-effectiveness and quality.

The MSA policy should not encourage shifts in volume that are not clearly relatable to improvements in the overall value of care, for example, such as marketing or acquisition strategies that merely shift the location or ownership of resources without increasing access, improving outcomes, or reducing costs in a geographic area. In February 2014, the Commission reduced the variable cost factor for volume changes from 85% to 50% for services provided outside of global budgets revenue arrangements, yet subject to the All Payer Model. Applying this lower variable cost factor to market shift adjustments will contribute to limiting incentives to increase volume through strategies that do not improve care or value.

3. Guiding Principles

In developing its MSA approach, the HSCRC should follow certain guiding principles. These include:

1. Provide clear incentives

1.1. Promote the three part aim
1.2. Emphasize value, recognizing that this concept will take some time to develop
1.3. Promote investments in care coordination
1.4. Encourage appropriate utilization and delivery of high quality care
1.5. Avoid paying twice for the same service

2. Reinforce the maintenance of services to the community.

2.1. Encourage competition to promote responsive provision of services
2.2. Competition should be based on value
2.3. Revenue should generally follow the patient
2.4. Support strategies pursued by entities such as ACOs, PCMH, and MCOs seeking to direct patients to low cost, high quality settings

3. Changes constituting market shift should be clearly defined.

3.1. Volume increase alone is not a market shift change.
3.2. Market shift should be evaluated in combination with the overall volume trend to ensure that shift has occurred, rather than volume growth
3.3. If one hospital has higher volume and other hospitals serving the same area do not have corresponding declines in volume, a market shift should not be awarded.
3.4. Increases in the global budget of one hospital should be funded fully by the decrease in other hospitals' budgets
3.5. Market shift changes should reflect services provided by the hospital

3.6. Substantial reductions at a facility may result in a global budget reduction even if not accompanied by shift to other facilities in service area. (Investigate shift to unregulated facilities and limitations on types of procedures)
3.7. Closures of services or discrete and readily identifiable events should result in a global budget adjustment and a market shift adjustment as needed
3.8. Market shifts in Potentially Avoidable Utilization (PAU) should be evaluated separately[1]

4. Market Shift Calculations

1.1. Market Shift Algorithm

Based on the principles listed above, an algorithm has been developed to calculate market shift adjustments for a specific service area (e.g. orthopedic surgery) and defined geographic location (e.g. zip code). The algorithm compares the growth in volumes at hospitals with utilization increases to the decline in volumes at hospitals with utilization decreases. Adjustments are capped at the lesser of the growth for volume gainers or the decline for volume loses. This approach disentangles market shifts from collective changes in volume in the service area and removes incentives for driving up volume in the service area.

Table 1 provides an illustration of the calculation done for zip code 21000 and General Surgery service line. Within this zip code, the total volume increase is 654 and decline is 129. Applying the lesser of the two rule, the allowed market shift is limited to 129 ECMADs and allocated to other hospitals with volume increases proportional to this hospital's volume increase in total utilization. In the end, the net impact of market shifts in each zip code and service line combination equals zero.

Table 1: Example Calculation of the Market Shift Algorithm

Zip code 21000 General Surgery	Volume CY13	Volume CY14	Volume Growth	Hospital's Proportion of Total Increase/Decline	Market Shift
	A	B	C=B-A	D=C/Subtotal C	E=D*Allowed Market Shift
Hospital A	1,000	1,500	500	76%	99
Hospital B	500	600	100	15%	20
Hospital C	50	100	50	8%	10
Hospital D	-	4	4	1%	1
Utilization Increase	1,550	2,204	654	100%	129
Hospital E	500	400	(100)	78%	(100)
Hospital F	50	25	(25)	19%	(25)

[1] There are limited circumstances where HSCRC might want to recognize a market shift in PAUs. For example, if an HMO moved all of its patients from one facility to another, there may be an appropriate shift in revenue for some level of PAU cases. Similarly, if a PCMH changed its hospital affiliation, there may be a shift in PAU volumes from one facility to another.

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Hospital G	4	-	(4)	3%	(4)
Utilization Decline	554	425	(129)	100%	(129)
Zip Total	**2,104**	**2,629**	**525**	-	0
Allowed Market Shift			**129**		

1.2. Geographic Area Definitions

Market shift is focused on movement of patients and services between Maryland hospitals. Narrowly defined geographic regions are ideal for calculating market shift as the individual hospitals serving the region are not likely to be differentially impacted by population growth or demographically driven changes in utilization rates. Calculating market shift at the statewide level, in contrast, would result in the movement of dollars to hospitals in regions experiencing population growth at the expense of other regions. Adjustments for changes in population and demographics are already addressed by annual demographic adjustments to each hospital's global budget.

In densely populated regions of the State where there is significant completion among hospitals, market share calculations are performed at the zip code level. However, zip code level calculations introduce random variation to the measurement in small geographic areas where the population density is low and health care market is concentrated. Such zip codes are aggregated to limit the impact of small cell sizes on the calculations. In particular, the following county zip codes are aggregated at a county level:

Garrett, Allegany, Washington, Carroll, Cecil, Kent, Queen Anne's, Caroline, Talbot, Dorchester, Wicomico, Somerset, Calvert, Charles, Saint Mary's, Worcester, Harford, Frederick

In calculating market shifts all hospitals will have the same geographic definitions. For example, to calculate volume changes in Garrett County all zip codes in Garrett County will be added together for each of the hospitals which had a volume in Garrett County. The calculations of volume changes will be based on zip code level analysis for the remaining of the counties that are not aggregated such as Baltimore City.

1.3. Service Line Definitions

Narrow definitions of service lines are proposed to prevent utilization growth for one component of the service line from masking a shift in patients for another service line. For instance, a service line that captures all surgical procedures might be growing at every hospital in a region due to increasing demand for orthopedic surgery and thereby mask the shift of fifty cardiac surgical procedures from one hospital to another.

Movement of cases from inpatient to outpatient settings and utilization of observation units creates a challenge in differentiating shifts from one hospital to another, or shifts from a hospital's inpatient to outpatient services. Staff has started to address this issue by including all observation cases with 24 hours or more in inpatient counts and assigning them weights that are similar to an inpatient case. Staff is planning to continue to work on combining other outpatient cases with inpatients for future year adjustments and evaluating the impact of inpatient to outpatient services on a case by case basis.

Inpatient service lines are developed using the existing 3M methodology to group APR DRGs to specific service lines with a few modifications. The cross walk of APR DRGs to Service lines are included in APPENDIX I.

While inpatient service lines have been widely used and understood easily due to the availability of APR DRGs, outpatient service lines are more difficult to develop. Conceptually, staff uses an inpatient like logic and assigns the visits based upon the reasons for acquiring services. For example, all services provided for emergency department patients are grouped under the Emergency Department service line. APPENDIX II provides the hierarchy of outpatient service lines.

1.4. Exclusions

The following services or cases and the rationale to exclude from the market shift calculations.

1. Potentially Avoidable Utilization (PAU): As hospitals improve care and population health, trends in potentially avoidable utilization could reflect differential performance among hospitals rather than market shifts. In other words, one hospital may perform better than the others and reduce their PAU while another hospital serving a similar market may have an increase in their PAU. For the rate year 2016 adjustments, staff included only readmissions and prevention quality indicators (PQIs) developed by AHRQ that were measured in both inpatient and observation cases equaling or exceeding 24 hours and more. APPENDIX III and IV provide overviews of readmissions indicators and PQIs.
2. Categorical exclusions: These cases represent the most specialized services received at Academic Medical Centers (AMCs) and are based upon actual trends in these hospitals under their global budgets. APPENDIX V provides the definitions of categorical cases.

1.5. Timing of Adjustments

To accommodate the HSCRC case mix data submission timelines, there will be a six month lag between the measurement period and the rate adjustments. The rate year 2016 adjustments will be based on comparing the measurement period of July 2014 - December 2014 to a base year period of July 2013 - December 2013. After this initial measurement period, a full calendar year will be used to calculate market shift adjustments. Accordingly, rate year 2017 adjustment will be based on Jan - Dec 2015 compared to Jan - Dec 2014 time periods.

1.6. Case Weights and Equivalent Case Mix Adjusted Discharges

To measure utilization, HSCRC developed equivalent case mix adjusted discharges (ECMADs) as a method to quantify inpatient and outpatient hospital volume into a single measure. A hospital's ECMAD count includes case mix adjusted inpatient discharges as well as equivalent adjusted outpatient case mix discharges, which is based on case-mix adjusted outpatient visits converted to inpatient discharges by the ratio of average inpatient visit charge per discharge to average outpatient charge per visit.

Inpatient weights are developed using the Hospital Specific Relative Value (Iterative Weights) methodology. APPENDIX VI provides the detailed steps for calculating inpatient weights. Historically, HSCRC has been modifying the 3M APR DRGs to account for differences in resource use within Rehabilitation DRG (860) and psychiatric DRGs (voluntary and involuntary). Staff evaluated the impact of these modifications and found that the differences between national APR DRGs and Maryland specific DRGs were very limited. Furthermore, staff

expects t transition to ICD-10 will create inaccuracies in defining these modifications and 3M will improve the APR DRG classifications using more granular information from ICD-10 codes. Based on these considerations, HSCRC will use national 3M APR DRGs for all adjustments starting in the rate year 2016 adjustments.

Outpatient weights primary rely on EAPG grouping. After EAPGs weights are assigned to each CPT code in the patient records, a principal record type is assigned to differentiate types of visits into four main categories:

Principle EAPG Type A: Radiation, Chemo, & Major Infusion

Principal EAPG Type 2: Significant Procedures

Principal EAPG Type 3: Medical Visit

Principal EAPG Type 4: All Other (Ancillary, Incidental, Drug, Durable Medical Equipment, Unassigned EAPG Types.)

Once each record is grouped into four principal EAPG types, singleton weights are developed within each group and normalized. Singleton weights are used to assign the highest EAPG that in turn determines the assignment of the APG category for that record. Afterwards, these EAPGs are mapped to initial service lines using EAPG to Service line mapping (Appendix VII). Service lines used for Market shifts are determined using a hierarchy of services aiming to group the visits in accordance to the purpose of the patient visit. APPENDIX VIII provides technical documentation on outpatient weights.

5. Market Shift Revenue Calculations

HSCRC staff evaluated several options in calculating the cost associated with market shift changes calculated using the algorithm described above. Two viable alternatives emerged:

- the hospital specific average charge per ECMAD; or

- each hospital's service line specific average charge per ECMAD.

Service line specific cost calculations have an advantage of overcoming the variation in outpatient services within each service line. Inpatient DRG weights and prices have the advantage of decades of refinement, while outpatient weights are relatively new. Hospital specific charges per ECMAD have the advantage of overcoming some of the underlying variation in charge for equivalent case on the outpatient side as further refinements are made over time. The Maryland Hospital Association sent a letter to staff indicating that the hospital industry supports use of the hospital service line average charge per ECMAD. Staff has made a detailed review of the results using this approach compared to the alternative and we are satisfied with the results. Therefore, we are planning to use service line ECMAD average charges to develop the adjustments for each hospital. Consistent with initial policy implementation for the new All Payer Model, staff plans to use a 50% variable cost factor for market shift adjustments between regulated hospitals.

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APPENDIX

Technical Specifications for Market Shift Calculations for Rate Year 2016

1. APR DRG Version= 32
2. EAPG Version= 38
3. Readmission Logic= Readmission Reduction Program CY 2015 Logic
4. Prevention Quality Indicators Version= 4.5
5. Adjustment periods= July-Dec 2014 vs July-Dec 2013

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APPENDIX I: APR DRG Service Line Map (APR DRG version32)

APR DRG	DESCRIPTION	Product Category	Prodline
1	Liver transplant &/or intestinal transplant	Transplant Surgery	40
2	Heart &/or lung transplant	Transplant Surgery	40
3	Bone marrow transplant	Transplant Surgery	40
4	ECMO or tracheostomy w long term mechanical ventilation w extensive procedure	Ventilator Support	45
5	Tracheostomy w long term mechanical ventilation w/o extensive procedure	Ventilator Support	45
6	Pancreas transplant	Transplant Surgery	40
20	Craniotomy for trauma	Neurological Surgery	23
21	Craniotomy except for trauma	Neurological Surgery	23
22	Ventricular shunt procedures	Neurological Surgery	23
23	Spinal procedures	Spinal Surgery	37
24	Extracranial vascular procedures	Neurological Surgery	23
26	Other nervous system & related procedures	Neurological Surgery	23
40	Spinal disorders & injuries	Neurology	24
41	Nervous system malignancy	Oncology	26
42	Degenerative nervous system disorders exc mult sclerosis	Neurology	24
43	Multiple sclerosis & other demyelinating diseases	Neurology	24
44	Intracranial hemorrhage	Neurology	24
45	CVA & precerebral occlusion w infarct	Neurology	24
46	Nonspecific CVA & precerebral occlusion w/o infarct	Neurology	24
47	Transient ischemia	Neurology	24
48	Peripheral, cranial & autonomic nerve disorders	Neurology	24
49	Bacterial & tuberculous infections of nervous system	Infectious Disease	17
50	Non-bacterial infections of nervous system exc viral meningitis	Infectious Disease	17
51	Viral meningitis	Infectious Disease	17
52	Nontraumatic stupor & coma	Neurology	24
53	Seizure	Neurology	24
54	Migraine & other headaches	Neurology	24
55	Head trauma w coma >1 hr or hemorrhage	Neurology	24
56	Brain contusion/laceration & complicated skull Fx, coma < 1 hr or no coma	Neurology	24
57	Concussion, closed skull Fx nos,uncomplicated intracranial injury, coma <	Neurology	24

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APR DRG	DESCRIPTION	Product Category	Prodline
	1 hr or no coma		
58	Other disorders of nervous system	Neurology	24
70	Orbital procedures	Ophthalmologic Surg	27
73	Eye procedures except orbit	Ophthalmologic Surg	27
80	Acute major eye infections	Ophthalmology	28
82	Eye disorders except major infections	Ophthalmology	28
89	Major cranial/facial bone procedures	ENT Surgery	8
90	Major larynx & trachea procedures	ENT Surgery	8
91	Other major head & neck procedures	ENT Surgery	8
92	Facial bone procedures except major cranial/facial bone procedures	ENT Surgery	8
93	Sinus & mastoid procedures	ENT Surgery	8
95	Cleft lip & palate repair	ENT Surgery	8
97	Tonsil & adenoid procedures	ENT Surgery	8
98	Other ear, nose, mouth & throat procedures	ENT Surgery	8
110	Ear, nose, mouth, throat, cranial/facial malignancies	Oncology	26
111	Vertigo & other labyrinth disorders	Otolaryngology	32
113	Infections of upper respiratory tract	Otolaryngology	32
114	Dental & oral diseases & injuries	Dental	3
115	Other ear, nose, mouth,throat & cranial/facial diagnoses	Otolaryngology	32
120	Major respiratory & chest procedures	Thoracic Surgery	39
121	Other respiratory & chest procedures	Thoracic Surgery	39
130	Respiratory system diagnosis w ventilator support 96+ hours	Pulmonary	34
131	Cystic fibrosis - pulmonary disease	Pulmonary	34
132	BPD & oth chronic respiratory diseases arising in perinatal period	Pulmonary	34
133	Pulmonary edema & respiratory failure	Pulmonary	34
134	Pulmonary embolism	Pulmonary	34
135	Major chest & respiratory trauma	Trauma	41
136	Respiratory malignancy	Oncology	26
137	Major respiratory infections & inflammations	Pulmonary	34
138	Bronchiolitis & RSV pneumonia	Pulmonary	34
139	Other pneumonia	Pulmonary	34
140	Chronic obstructive pulmonary disease	Pulmonary	34
141	Asthma	Pulmonary	34
142	Interstitial lung disease	Pulmonary	34
143	Other respiratory diagnoses except signs, symptoms & minor diagnoses	Pulmonary	34
144	Respiratory signs, symptoms & minor diagnoses	Pulmonary	34

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APR DRG	DESCRIPTION	Product Category	Prodline
160	Major cardiothoracic repair of heart anomaly	Cardiothoracic Surgery	2
161	Cardiac defibrillator & heart assist implant	Cardiothoracic Surgery	2
162	Cardiac valve procedures w cardiac catheterization	Cardiothoracic Surgery	2
163	Cardiac valve procedures w/o cardiac catheterization	Cardiothoracic Surgery	2
165	Coronary bypass w cardiac cath or percutaneous cardiac procedure	Cardiothoracic Surgery	2
166	Coronary bypass w/o cardiac cath or percutaneous cardiac procedure	Cardiothoracic Surgery	2
167	Other cardiothoracic procedures	Cardiothoracic Surgery	2
169	Major thoracic & abdominal vascular procedures	Vascular Surgery	44
170	Permanent cardiac pacemaker implant w AMI, heart failure or shock	EP/Chronic Rhythm Mgmt	9
171	Perm cardiac pacemaker implant w/o AMI, heart failure or shock	EP/Chronic Rhythm Mgmt	9
173	Other vascular procedures	Vascular Surgery	44
174	Percutaneous cardiovascular procedures w AMI	Invasive Cardiology	19
175	Percutaneous cardiovascular procedures w/o AMI	Invasive Cardiology	19
176	Cardiac pacemaker & defibrillator device replacement	EP/Chronic Rhythm Mgmt	9
177	Cardiac pacemaker & defibrillator revision except device replacement	EP/Chronic Rhythm Mgmt	9
180	Other circulatory system procedures	Cardiothoracic Surgery	2
190	Acute myocardial infarction	Myocardial Infarction	20
191	Cardiac catheterization w circ disord exc ischemic heart disease	Invasive Cardiology	19
192	Cardiac catheterization for ischemic heart disease	Invasive Cardiology	19
193	Acute & subacute endocarditis	Cardiology	1
194	Heart failure	Cardiology	1
196	Cardiac arrest	Cardiology	1
197	Peripheral & other vascular disorders	General Medicine	11
198	Angina pectoris & coronary atherosclerosis	Cardiology	1
199	Hypertension	Cardiology	1

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APR DRG	DESCRIPTION	Product Category	Prodline
200	Cardiac structural & valvular disorders	Cardiology	1
201	Cardiac arrhythmia & conduction disorders	Cardiology	1
203	Chest pain	Cardiology	1
204	Syncope & collapse	Cardiology	1
205	Cardiomyopathy	Cardiology	1
206	Malfunction,reaction,complication of cardiac/vasc device or procedure	Cardiology	1
207	Other circulatory system diagnoses	Cardiology	1
220	Major stomach, esophageal & duodenal procedures	General Surgery	12
221	Major small & large bowel procedures	General Surgery	12
222	Other stomach, esophageal & duodenal procedures	General Surgery	12
223	Other small & large bowel procedures	General Surgery	12
224	Peritoneal adhesiolysis	General Surgery	12
225	Appendectomy	General Surgery	12
226	Anal procedures	General Surgery	12
227	Hernia procedures except inguinal, femoral & umbilical	General Surgery	12
228	Inguinal, femoral & umbilical hernia procedures	General Surgery	12
229	Other digestive system & abdominal procedures	General Surgery	12
240	Digestive malignancy	Oncology	26
241	Peptic ulcer & gastritis	Gastroenterology	10
242	Major esophageal disorders	Gastroenterology	10
243	Other esophageal disorders	Gastroenterology	10
244	Diverticulitis & diverticulosis	Gastroenterology	10
245	Inflammatory bowel disease	Gastroenterology	10
246	Gastrointestinal vascular insufficiency	Gastroenterology	10
247	Intestinal obstruction	Gastroenterology	10
248	Major gastrointestinal & peritoneal infections	Gastroenterology	10
249	Non-bacterial gastroenteritis, nausea & vomiting	Gastroenterology	10
251	Abdominal pain	Gastroenterology	10
252	Malfunction, reaction & complication of GI device or procedure	Gastroenterology	10
253	Other & unspecified gastrointestinal hemorrhage	Gastroenterology	10
254	Other digestive system diagnoses	Gastroenterology	10
260	Major pancreas, liver & shunt procedures	General Surgery	12
261	Major biliary tract procedures	General Surgery	12
262	Cholecystectomy except laparoscopic	General Surgery	12
263	Laparoscopic cholecystectomy	General Surgery	12
264	Other hepatobiliary, pancreas & abdominal procedures	General Surgery	12
279	Hepatic coma & other major acute liver disorders	Gastroenterology	10

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APR DRG	DESCRIPTION	Product Category	Prodline
280	Alcoholic liver disease	Gastroenterology	10
281	Malignancy of hepatobiliary system & pancreas	Oncology	26
282	Disorders of pancreas except malignancy	Gastroenterology	10
283	Other disorders of the liver	Gastroenterology	10
284	Disorders of gallbladder & biliary tract	Gastroenterology	10
301	Hip joint replacement	Orthopedic Surgery	29
302	Knee joint replacement	Orthopedic Surgery	29
303	Dorsal & lumbar fusion proc for curvature of back	Orthopedic Surgery	29
304	Dorsal & lumbar fusion proc except for curvature of back	Orthopedic Surgery	29
305	Amputation of lower limb except toes	Orthopedic Surgery	29
308	Hip & femur procedures for trauma except joint replacement	Orthopedic Surgery	29
309	Hip & femur procedures for non-trauma except joint replacement	Orthopedic Surgery	29
310	Intervertebral disc excision & decompression	Orthopedic Surgery	29
312	Skin graft, except hand, for musculoskeletal & connective tissue diagnoses	Orthopedic Surgery	29
313	Knee & lower leg procedures except foot	Orthopedic Surgery	29
314	Foot & toe procedures	Orthopedic Surgery	29
315	Shoulder, upper arm & forearm procedures	Orthopedic Surgery	29
316	Hand & wrist procedures	Orthopedic Surgery	29
317	Tendon, muscle & other soft tissue procedures	Orthopedic Surgery	29
320	Other musculoskeletal system & connective tissue procedures	Orthopedic Surgery	29
321	Cervical spinal fusion & other back/neck proc exc disc excis/decomp	Spinal Surgery	37
340	Fracture of femur	Orthopedics	30
341	Fracture of pelvis or dislocation of hip	Orthopedics	30
342	Fractures & dislocations except femur, pelvis & back	Orthopedics	30
343	Musculoskeletal malignancy & pathol fracture d/t muscskel malig	Oncology	26
344	Osteomyelitis, septic arthritis & other musculoskeletal infections	Infectious Disease	17
346	Connective tissue disorders	Rheumatology	36
347	Other back & neck disorders, fractures & injuries	Orthopedics	30
349	Malfunction, reaction, complic of orthopedic device or procedure	Orthopedics	30
351	Other musculoskeletal system & connective tissue diagnoses	Rheumatology	36
361	Skin graft for skin & subcutaneous tissue diagnoses	General Surgery	12
362	Mastectomy procedures	General Surgery	12
363	Breast procedures except mastectomy	General Surgery	12
364	Other skin, subcutaneous tissue & related procedures	General Surgery	12
380	Skin ulcers	Dermatology	4
381	Major skin disorders	Dermatology	4

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APR DRG	DESCRIPTION	Product Category	Prodline
382	Malignant breast disorders	Oncology	26
383	Cellulitis & other bacterial skin infections	Infectious Disease	17
384	Contusion, open wound & other trauma to skin & subcutaneous tissue	Dermatology	4
385	Other skin, subcutaneous tissue & breast disorders	Dermatology	4
401	Pituitary & adrenal procedures	Endocrinology Surgery	7
403	Procedures for obesity	Endocrinology Surgery	7
404	Thyroid, parathyroid & thyroglossal procedures	Endocrinology Surgery	7
405	Other procedures for endocrine, nutritional & metabolic disorders	Endocrinology Surgery	7
420	Diabetes	Diabetes	5
421	Malnutrition, failure to thrive & other nutritional disorders	Endocrinology	6
422	Hypovolemia & related electrolyte disorders	Endocrinology	6
423	Inborn errors of metabolism	Endocrinology	6
424	Other endocrine disorders	Endocrinology	6
425	Electrolyte disorders except hypovolemia related	Endocrinology	6
440	Kidney transplant	Transplant Surgery	40
441	Major bladder procedures	Urological Surgery	42
442	Kidney & urinary tract procedures for malignancy	Oncology	26
443	Kidney & urinary tract procedures for nonmalignancy	Urological Surgery	42
444	Renal dialysis access device procedure only	Urological Surgery	42
445	Other bladder procedures	Urological Surgery	42
446	Urethral & transurethral procedures	Urological Surgery	42
447	Other kidney, urinary tract & related procedures	Urological Surgery	42
460	Renal failure	Nephrology	22
461	Kidney & urinary tract malignancy	Oncology	26
462	Nephritis & nephrosis	Nephrology	22
463	Kidney & urinary tract infections	Nephrology	22
465	Urinary stones & acquired upper urinary tract obstruction	Urology	43
466	Malfunction, reaction, complic of genitourinary device or proc	Nephrology	22
468	Other kidney & urinary tract diagnoses, signs & symptoms	Nephrology	22
480	Major male pelvic procedures	Urological Surgery	42
481	Penis procedures	Urological Surgery	42
482	Transurethral prostatectomy	Urological Surgery	42
483	Testes & scrotal procedures	Urological Surgery	42

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APR DRG	DESCRIPTION	Product Category	Prodline
484	Other male reproductive system & related procedures	General Surgery	12
500	Malignancy, male reproductive system	Oncology	26
501	Male reproductive system diagnoses except malignancy	Urology	43
510	Pelvic evisceration, radical hysterectomy & other radical GYN procs	Gynecological Surg	13
511	Uterine & adnexa procedures for ovarian & adnexal malignancy	Oncology	26
512	Uterine & adnexa procedures for non-ovarian & non-adnexal malig	Oncology	26
513	Uterine & adnexa procedures for non-malignancy except leiomyoma	Gynecological Surg	13
514	Female reproductive system reconstructive procedures	Gynecological Surg	13
517	Dilation & curettage for non-obstetric diagnoses	Gynecological Surg	13
518	Other female reproductive system & related procedures	Gynecological Surg	13
519	Uterine & adnexa procedures for leiomyoma	Gynecological Surg	13
530	Female reproductive system malignancy	Oncology	26
531	Female reproductive system infections	Gynecology	14
532	Menstrual & other female reproductive system disorders	Gynecology	14
540	Cesarean delivery	Obstetrics/Delivery	25
541	Vaginal delivery w sterilization &/or D&C	Obstetrics/Delivery	25
542	Vaginal delivery w complicating procedures exc sterilization &/or D&C	Obstetrics/Delivery	25
544	D&C, aspiration curettage or hysterotomy for obstetric diagnoses	Other Obstetrics	31
545	Ectopic pregnancy procedure	Gynecological Surg	13
546	Other O.R. proc for obstetric diagnoses except delivery diagnoses	Other Obstetrics	31
560	Vaginal delivery	Obstetrics/Delivery	25
561	Postpartum & post abortion diagnoses w/o procedure	Other Obstetrics	31
563	Threatened abortion	Other Obstetrics	31
564	Abortion w/o D&C, aspiration curettage or hysterotomy	Other Obstetrics	31
565	False labor	Other Obstetrics	31
566	Other antepartum diagnoses	Other Obstetrics	31
580	Neonate, transferred <5 days old, not born here	Neonatology	21
581	Neonate, transferred < 5 days old, born here	Neonatology	21
583	Neonate w ECMO	Neonatology	21
588	Neonate bwt <1500g w major procedure	Neonatology	21
589	Neonate bwt <500g	Neonatology	21
591	Neonate birthwt 500-749g w/o major procedure	Neonatology	21
593	Neonate birthwt 750-999g w/o major procedure	Neonatology	21
602	Neonate bwt 1000-1249g w resp dist synd/oth maj resp or maj anom	Neonatology	21
603	Neonate birthwt 1000-1249g w or w/o other significant condition	Neonatology	21
607	Neonate bwt 1250-1499g w resp dist synd/oth maj resp or maj anom	Neonatology	21
608	Neonate bwt 1250-1499g w or w/o other significant condition	Neonatology	21

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APR DRG	DESCRIPTION	Product Category	Prodline
609	Neonate bwt 1500-2499g w major procedure	Neonatology	21
611	Neonate birthwt 1500-1999g w major anomaly	Neonatology	21
612	Neonate bwt 1500-1999g w resp dist synd/oth maj resp cond	Neonatology	21
613	Neonate birthwt 1500-1999g w congenital/perinatal infection	Neonatology	21
614	Neonate bwt 1500-1999g w or w/o other significant condition	Neonatology	21
621	Neonate bwt 2000-2499g w major anomaly	Neonatology	21
622	Neonate bwt 2000-2499g w resp dist synd/oth maj resp cond	Neonatology	21
623	Neonate bwt 2000-2499g w congenital/perinatal infection	Neonatology	21
625	Neonate bwt 2000-2499g w other significant condition	Neonatology	21
626	Neonate bwt 2000-2499g, normal newborn or neonate w other problem	Neonatology	21
630	Neonate birthwt >2499g w major cardiovascular procedure	Neonatology	21
631	Neonate birthwt >2499g w other major procedure	Neonatology	21
633	Neonate birthwt >2499g w major anomaly	Neonatology	21
634	Neonate, birthwt >2499g w resp dist synd/oth maj resp cond	Neonatology	21
636	Neonate birthwt >2499g w congenital/perinatal infection	Neonatology	21
639	Neonate birthwt >2499g w other significant condition	Neonatology	21
640	Neonate birthwt >2499g, normal newborn or neonate w other problem	Normal Newborn	48
650	Splenectomy	General Surgery	12
651	Other procedures of blood & blood-forming organs	General Surgery	12
660	Major hematologic/immunologic diag exc sickle cell crisis & coagul	Hematology	15
661	Coagulation & platelet disorders	Hematology	15
662	Sickle cell anemia crisis	Hematology	15
663	Other anemia & disorders of blood & blood-forming organs	Hematology	15
680	Major O.R. procedures for lymphatic/hematopoietic/other neoplasms	General Surgery	12
681	Other O.R. procedures for lymphatic/hematopoietic/other neoplasms	General Surgery	12
690	Acute leukemia	Oncology	26
691	Lymphoma, myeloma & non-acute leukemia	Oncology	26
692	Radiotherapy	Oncology	26
693	Chemotherapy	Oncology	26
694	Lymphatic & other malignancies & neoplasms of uncertain behavior	Oncology	26
710	Infectious & parasitic diseases including HIV w O.R. procedure	General Surgery	12
711	Post-op, post-trauma, other device infections w O.R. procedure	General Surgery	12
720	Septicemia & disseminated infections	Infectious Disease	17
721	Post-operative, post-traumatic, other device infections	General Surgery	12
722	Fever	Infectious Disease	17
723	Viral illness	Infectious Disease	17
724	Other infectious & parasitic diseases	Infectious Disease	17

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APR DRG	DESCRIPTION	Product Category	Prodline
740	Mental illness diagnosis w O.R. procedure	General Surgery	12
750	Schizophrenia	Psychiatry	33
751	Major depressive disorders & other/unspecified psychoses	Psychiatry	33
752	Disorders of personality & impulse control	Psychiatry	33
753	Bipolar disorders	Psychiatry	33
754	Depression except major depressive disorder	Psychiatry	33
755	Adjustment disorders & neuroses except depressive diagnoses	Psychiatry	33
756	Acute anxiety & delirium states	Psychiatry	33
757	Organic mental health disturbances	Psychiatry	33
758	Childhood behavioral disorders	Psychiatry	33
759	Eating disorders	Psychiatry	33
760	Other mental health disorders	Psychiatry	33
770	Drug & alcohol abuse or dependence, left against medical advice	Substance Abuse	38
772	Alcohol & drug dependence w rehab or rehab/detox therapy	Substance Abuse	38
773	Opioid abuse & dependence	Substance Abuse	38
774	Cocaine abuse & dependence	Substance Abuse	38
775	Alcohol abuse & dependence	Substance Abuse	38
776	Other drug abuse & dependence	Substance Abuse	38
791	O.R. procedure for other complications of treatment	Injuries/complic. of prior care	18
811	Allergic reactions	General Medicine	11
812	Poisoning of medicinal agents	General Medicine	11
813	Other complications of treatment	Injuries/complic. of prior care	18
815	Other injury, poisoning & toxic effect diagnoses	General Medicine	11
816	Toxic effects of non-medicinal substances	General Medicine	11
841	Extensive 3rd degree burns w skin graft	General Medicine	11
842	Full thickness burns w skin graft	General Medicine	11
843	Extensive 3rd degree or full thickness burns w/o skin graft	General Medicine	11
844	Partial thickness burns w or w/o skin graft	General Medicine	11
850	Procedure w diag of rehab, aftercare or oth contact w health service	General Surgery	12
860	Rehabilitation	Rehabilitation	35
861	Signs, symptoms & other factors influencing health status	General Medicine	11
862	Other aftercare & convalescence	General Medicine	11
863	Neonatal aftercare	General Medicine	11
890	HIV w multiple major HIV related conditions	HIV	16
892	HIV w major HIV related condition	HIV	16

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APR DRG	DESCRIPTION	Product Category	Prodline
893	HIV w multiple significant HIV related conditions	HIV	16
894	HIV w one signif HIV cond or w/o signif related cond	HIV	16
910	Craniotomy for multiple significant trauma	Trauma	41
911	Extensive abdominal/thoracic procedures for mult significant trauma	Trauma	41
912	Musculoskeletal & other procedures for multiple significant trauma	Trauma	41
930	Multiple significant trauma w/o O.R. procedure	Trauma	41
950	Extensive procedure unrelated to principal diagnosis	General Surgery	12
951	Moderately extensive procedure unrelated to principal diagnosis	General Surgery	12
952	Nonextensive procedure unrelated to principal diagnosis	General Surgery	12
955	Invalid	Invalid	46
956	Ungroupable	Ungroupable	47

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APPENDIX II Outpatient Service Line Assignment Hierarchy

1. **Radiation Therapy/Infusion/Chemo/Oncology Radiation** Therapy/Infusion/Chemo/Oncology cases where operating (rctchg40)<drug charge (rctchg67), Operating Room (rctchg40)<Radiation (rctchg 45 & rctchg46);Included EAPGS: (1, 110, 111,117, 340,341,342,343,344,345,346,347,348,349,431, 432,433, 434,441,443,460,461,462,463,464,465,476,477,478,482,483,484, 802, and 803)

2. **Emergency Department:** Emergency Department cases where emergency (rctchg28), free standing center (rctchg34), or Trauma Resuscitation rate center charges(rctchg90) > 0

3. **Drug:** Drug cases where EAPGs are assigned to drug service line

4. **Major Surgery**: Major Surgery cases where EAPGs are assigned to major surgery service line

5. **Cardiovascular:** Cardiovascular cases where EAPGs are assigned to cardiovascular service line

6. **Minor Surgery:** Cases where EAPGs are assigned to minor surgery service line

7. **Psychiatry**: Cases where EAPGs are assigned psychiatry service line

8. **Rehab & Therapy**: Cases where EAPGs are assigned rehab & therapy service line

9. **Clinic**: Cases where clinic (rctchg29), clinic services primary (rctchg30), oncology clinic (rctchg35), operating room clinic (rctchg79), or UM shock trauma clinic rate center charges (rctchg37) > 010.

10. **Unassigned**: If high weight eapg =0

11. **Other**: Cases where EAPGs are assigned various services including: Other; Lab, Pathology, CT/MRI/PET, Radiology

APPENDIX III: 30-day Readmission Definition Overview

The methodology for the readmission indicator is based on definitions in Maryland Readmission Reduction Incentive Program. Readmissions are based on 30-day all-payer all hospital (both intra and inter hospital) readmission rates. The readmission logic is run with both inpatient and observation stays with 24 hour or greater length of stay.

The following exclusions are applied in the CY 2015 Program logic:

- Planned readmissions are excluded from the numerator based upon CMS Planned Readmission Algorithm V. 3. The HSCRC has also added all vaginal and C-section deliveries as planned using the APR-DRGs rather than principal diagnosis (APR-DRGs 540, 541, 542, 560). Planned admissions are counted in the denominator because they could have an unplanned readmission.

- All newborn APR-DRG discharges are NOT eligible for a readmission.

- Hospitalizations within 30 days of a hospital discharge where a patient dies is counted as a readmission, however the readmission is removed from the denominator because there cannot be a subsequent readmission.

- Admissions that result in transfers, defined as cases where the discharge date of the admission is on the same day as the admission date of the subsequent admission, are removed from the denominator counts. Thus only one admission is counted in the denominator and that is the admission to the transfer hospital, and it is this discharge date that is used to calculate the 30-day readmission window.

    - In addition the following data cleaning edits are applied:
        - Cases with null or missing Chesapeake Regional Information System unique patient identifiers (CRISP EIDs)
        - Duplicates
        - Negative interval days

HSCRC staff is revising case mix data edits to prevent submission of duplicates and negative intervals which are very rare. In addition CRISP EID matching benchmarks are closely monitored. The percent of inpatient discharges with CRISP EID is currently at 99 percent.

APPENDIX IV: Prevention Quality Indicators Overview

The Prevention Quality Indicators (PQIs) are a set of measures that can be used with hospital inpatient discharge data to identify quality of care for "ambulatory care sensitive conditions." These are conditions for which good outpatients care can potentially prevent the need for hospitalization or for which early intervention can prevent complications or more severe disease. The PQIs are population based and adjusted for factors such as age, severity of illness.

Discharges, for patient's ages 18 years and older, that meet the inclusion and exclusion rules for the numerator in any of the following PQIs:

- PQI #1 Diabetes Short-Term Complications
- PQI #3 Diabetes Long-Term Complications
- PQI #5 Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults
- PQI #7 Hypertension
- PQI #8 Heart Failure
- PQI #10 Dehydration
- PQI #11 Bacterial Pneumonia
- PQI #12 Urinary Tract Infection
- PQI #13 Angina Without Procedure
- PQI #14 Uncontrolled Diabetes
- PQI #15 Asthma in Younger Adults Admission Rate
- PQI #16 Lower-Extremity Amputation among Patients with Diabetes

Discharges that meet the inclusion and exclusion rules for the numerator in more than one of the above PQIs are counted only once in the composite numerator.

Additional information can be accessed at:

http://www.qualityindicators.ahrq.gov/modules/pqi_resources.aspx

APPENDIX V: Categorical Cases Exclusions

1. Categorical Case Exclusions
   - 1.1. Solid Organ Transplants APR DRGS = 001, 002, 003, 006 or 440 (any procedure = 5280, 5282 or 5283 or any procedure = 5280, 5282, 5283, 4100, 4101, 4102, 4103, 4104, 4105, 4106, 4107, 4108 or 3751 Heart Transplantation 4109 or 336 or 3350 , 3351, 3352, 5569, 5561, 5281, 5051, or 5059)
   - 1.2. Melodysplastic - Any Diagnosis = 2387 for Johns Hopkins Oncology Center
   - 1.3. JHU Pediatric Burn Cases (Age < 18) - 3rd Degree Burns
   - 1.4. Johns Hopkins and University Oncology Center
     - 1.4.1. Transplant Cases (Reserve Flag = 1)
     - 1.4.2. Research Cases (Reserve Flag = 2)
     - 1.4.3. Hematological Cases (Reserve Flag = 3)
     - 1.4.4. Transfer in Cases (Reserve Flag = 4)

APPENDIX VI: Steps for Calculating APR DRG Weights - TBD

APPENDIX VII: EAPG Service Line Map (EAPG version 38)

APG	APG DESCRIPTION	SERVICE
1	PHOTOCHEMOTHERAPY	Other
2	SUPERFICIAL NEEDLE BIOPSY AND ASPIRATION	Other
3	LEVEL I SKIN INCISION AND DRAINAGE	Minor Surgery
4	LEVEL II SKIN INCISION AND DRAINAGE	Major Surgery
5	NAIL PROCEDURES	Minor Surgery
6	LEVEL I SKIN DEBRIDEMENT AND DESTRUCTION	Minor Surgery
7	LEVEL II SKIN DEBRIDEMENT AND DESTRUCTION	Major Surgery
8	LEVEL III SKIN DEBRIDEMENT AND DESTRUCTION	Major Surgery
9	LEVEL I EXCISION AND BIOPSY OF SKIN AND SOFT TISSUE	Minor Surgery
10	LEVEL II EXCISION AND BIOPSY OF SKIN AND SOFT TISSUE	Major Surgery
11	LEVEL III EXCISION AND BIOPSY OF SKIN AND SOFT TISSUE	Major Surgery
12	LEVEL I SKIN REPAIR	Minor Surgery
13	LEVEL II SKIN REPAIR	Major Surgery
14	LEVEL III SKIN REPAIR	Major Surgery
15	LEVEL IV SKIN REPAIR	Major Surgery
20	LEVEL I BREAST PROCEDURES	Minor Surgery
21	LEVEL II BREAST PROCEDURES	Major Surgery
22	LEVEL III BREAST PROCEDURES	Major Surgery
30	LEVEL I MUSCULOSKELETAL PROCEDURES EXCLUDING HAND AND FOOT	Minor Surgery
31	LEVEL II MUSCULOSKELETAL PROCEDURES EXCLUDING HAND AND FOOT	Major Surgery
32	LEVEL III MUSCULOSKELETAL PROCEDURES EXCLUDING HAND AND FOOT	Major Surgery
33	LEVEL I HAND PROCEDURES	Minor Surgery
34	LEVEL II HAND PROCEDURES	Major Surgery
35	LEVEL I FOOT PROCEDURES	Major Surgery
36	LEVEL II FOOT PROCEDURES	Major Surgery
37	LEVEL I ARTHROSCOPY	Major Surgery
38	LEVEL II ARTHROSCOPY	Major Surgery
39	REPLACEMENT OF CAST	Other
40	SPLINT, STRAPPING AND CAST REMOVAL	Other
41	CLOSED TREATMENT FX & DISLOCATION OF FINGER, TOE & TRUNK	Major Surgery
42	CLOSED TREATMENT FX & DISLOCATION EXC FINGER, TOE & TRUNK	Major Surgery
43	OPEN OR PERCUTANEOUS TREATMENT OF FRACTURES	Major Surgery
44	BONE OR JOINT MANIPULATION UNDER ANESTHESIA	Major Surgery
45	BUNION PROCEDURES	Major Surgery
46	LEVEL I ARTHROPLASTY	Major Surgery
47	LEVEL II ARTHROPLASTY	Major Surgery
48	HAND AND FOOT TENOTOMY	Major Surgery

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APG	APG DESCRIPTION	SERVICE
49	ARTHROCENTESIS AND LIGAMENT OR TENDON INJECTION	Minor Surgery
60	PULMONARY TESTS	Other
61	NEEDLE AND CATHETER BIOPSY, ASPIRATION, LAVAGE AND INTUBATION	Other
62	LEVEL I ENDOSCOPY OF THE UPPER AIRWAY	Minor Surgery
63	LEVEL II ENDOSCOPY OF THE UPPER AIRWAY	Major Surgery
64	ENDOSCOPY OF THE LOWER AIRWAY	Other
65	RESPIRATORY THERAPY	Other
66	PULMONARY REHABILITATION	Rehabilitation
67	VENTILATION ASSISTANCE AND MANAGEMENT	Other
80	EXERCISE TOLERANCE TESTS	Cardiovascular
81	ECHOCARDIOGRAPHY	Cardiovascular
82	CARDIAC ELECTROPHYSIOLOGIC TESTS AND MONITORING	Cardiovascular
83	PLACEMENT OF TRANSVENOUS CATHETERS	Cardiovascular
84	DIAGNOSTIC CARDIAC CATHETERIZATION	Cardiovascular
85	ANGIOPLASTY AND TRANSCATHETER PROCEDURES	Cardiovascular
86	PACEMAKER INSERTION AND REPLACEMENT	Cardiovascular
87	REMOVAL AND REVISION OF PACEMAKER AND VASCULAR DEVICE	Cardiovascular
88	LEVEL I CARDIOTHORACIC PROCEDURES W OR W/O VASCULAR DEVICE	Cardiovascular
89	LEVEL II CARDIOTHORACIC PROCEDURES W OR W/O VASCULAR DEVICE	Cardiovascular
90	SECONDARY VARICOSE VEINS AND VASCULAR INJECTION	Cardiovascular
91	VASCULAR LIGATION AND RECONSTRUCTION	Cardiovascular
92	RESUSCITATION	Cardiovascular
93	CARDIOVERSION	Cardiovascular
94	CARDIAC REHABILITATION	Cardiovascular
95	THROMBOLYSIS	Cardiovascular
96	ATRIAL AND VENTRICULAR RECORDING AND PACING	Cardiovascular
97	AICD IMPLANT	Cardiovascular
110	PHARMACOTHERAPY BY EXTENDED INFUSION	Radiation, Infusion, Chemotherapy
111	PHARMACOTHERAPY EXCEPT BY EXTENDED INFUSION	Radiation, Infusion, Chemotherapy
112	PHLEBOTOMY	Other
113	LEVEL I BLOOD AND BLOOD PRODUCT EXCHANGE	Other
114	LEVEL II BLOOD AND BLOOD PRODUCT EXCHANGE	Other
115	DEEP LYMPH STRUCTURE AND THYROID PROCEDURES	Minor Surgery
116	ALLERGY TESTS	Other
117	HOME INFUSION	Radiation, Infusion, chemotherapy

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APG	APG DESCRIPTION	SERVICE
118	NUTRITION THERAPY	Other
130	ALIMENTARY TESTS AND SIMPLE TUBE PLACEMENT	Major Surgery
131	ESOPHAGEAL DILATION WITHOUT ENDOSCOPY	Other
132	ANOSCOPY WITH BIOPSY AND DIAGNOSTIC PROCTOSIGMOIDOSCOPY	Other
133	PROCTOSIGMOIDOSCOPY WITH EXCISION OR BIOPSY	Other
134	DIAGNOSTIC UPPER GI ENDOSCOPY OR INTUBATION	Other
135	THERAPEUTIC UPPER GI ENDOSCOPY OR INTUBATION	Other
136	DIAGNOSTIC LOWER GASTROINTESTINAL ENDOSCOPY	Other
137	THERAPEUTIC COLONOSCOPY	Other
138	ERCP AND MISCELLANEOUS GI ENDOSCOPY PROCEDURES	Minor Surgery
139	LEVEL I HERNIA REPAIR	Major Surgery
140	LEVEL II HERNIA REPAIR	Major Surgery
141	LEVEL I ANAL AND RECTAL PROCEDURES	Minor Surgery
142	LEVEL II ANAL AND RECTAL PROCEDURES	Major Surgery
143	LEVEL I GASTROINTESTINAL PROCEDURES	Minor Surgery
144	LEVEL II GASTROINTESTINAL PROCEDURES	Major Surgery
145	LEVEL I LAPAROSCOPY	Minor Surgery
146	LEVEL II LAPAROSCOPY	Major Surgery
147	LEVEL III LAPAROSCOPY	Major Surgery
148	LEVEL IV LAPAROSCOPY	Major Surgery
149	SCREENING COLORECTAL SERVICES	Other
160	EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY	Other
161	URINARY STUDIES AND PROCEDURES	Other
162	URINARY DILATATION	Minor Surgery
163	LEVEL I BLADDER AND KIDNEY PROCEDURES	Minor Surgery
164	LEVEL II BLADDER AND KIDNEY PROCEDURES	Major Surgery
165	LEVEL III BLADDER AND KIDNEY PROCEDURES	Major Surgery
166	LEVEL I URETHRA AND PROSTATE PROCEDURES	Minor Surgery
167	LEVEL II URETHRA AND PROSTATE PROCEDURES	Major Surgery
168	HEMODIALYSIS	Other
169	PERITONEAL DIALYSIS	Other
180	TESTICULAR AND EPIDIDYMAL PROCEDURES	Major Surgery
181	CIRCUMCISION	Minor Surgery
182	INSERTION OF PENILE PROSTHESIS	Major Surgery
183	OTHER PENILE PROCEDURES	Major Surgery
184	DESTRUCTION OR RESECTION OF PROSTATE	Major Surgery
185	PROSTATE NEEDLE AND PUNCH BIOPSY	Other
190	ARTIFICIAL FERTILIZATION	Major Surgery

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APG	APG DESCRIPTION	SERVICE
191	LEVEL I FETAL PROCEDURES	Minor Surgery
192	LEVEL II FETAL PROCEDURES	Major Surgery
193	TREATMENT OF INCOMPLETE ABORTION	Major Surgery
194	THERAPEUTIC ABORTION	Major Surgery
195	VAGINAL DELIVERY	Major Surgery
196	LEVEL I FEMALE REPRODUCTIVE PROCEDURES	Minor Surgery
197	LEVEL II FEMALE REPRODUCTIVE PROCEDURES	Major Surgery
198	LEVEL III FEMALE REPRODUCTIVE PROCEDURES	Major Surgery
199	DILATION AND CURETTAGE	Minor Surgery
200	HYSTEROSCOPY	Major Surgery
201	COLPOSCOPY	Other
210	EXTENDED EEG STUDIES	Other
211	ELECTROENCEPHALOGRAM	Other
212	ELECTROCONVULSIVE THERAPY	Other
213	NERVE AND MUSCLE TESTS	Other
214	NERVOUS SYSTEM INJECTIONS, STIMULATIONS OR CRANIAL TAP	Radiology
215	LEVEL I REVISION OR REMOVAL OF NEUROLOGICAL DEVICE	Minor Surgery
216	LEVEL II REVISION OR REMOVAL OF NEUROLOGICAL DEVICE	Major Surgery
217	LEVEL I NERVE PROCEDURES	Major Surgery
218	LEVEL II NERVE PROCEDURES	Major Surgery
219	SPINAL TAP	Major Surgery
220	INJECTION OF ANESTHETIC AND NEUROLYTIC AGENTS	Major Surgery
221	LAMINOTOMY AND LAMINECTOMY	Major Surgery
222	SLEEP STUDIES	Other
223	LEVEL III NERVE PROCEDURES	Major Surgery
224	LEVEL IV NERVE PROCEDURES	Major Surgery
230	MINOR OPHTHALMOLOGICAL TESTS AND PROCEDURES	Minor Surgery
231	FITTING OF CONTACT LENSES	Other
232	LASER EYE PROCEDURES	Major Surgery
233	CATARACT PROCEDURES	Major Surgery
234	LEVEL I ANTERIOR SEGMENT EYE PROCEDURES	Major Surgery
235	LEVEL II ANTERIOR SEGMENT EYE PROCEDURES	Major Surgery
236	LEVEL III ANTERIOR SEGMENT EYE PROCEDURES	Major Surgery
237	LEVEL I POSTERIOR SEGMENT EYE PROCEDURES	Major Surgery
238	LEVEL II POSTERIOR SEGMENT EYE PROCEDURES	Major Surgery
239	STRABISMUS AND MUSCLE EYE PROCEDURES	Major Surgery
240	LEVEL I REPAIR AND PLASTIC PROCEDURES OF EYE	Major Surgery
241	LEVEL II REPAIR AND PLASTIC PROCEDURES OF EYE	Major Surgery

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APG	APG DESCRIPTION	SERVICE
250	COCHLEAR DEVICE IMPLANTATION	Major Surgery
251	OTORHINOLARYNGOLOGIC FUNCTION TESTS	Other
252	LEVEL I FACIAL AND ENT PROCEDURES	Minor Surgery
253	LEVEL II FACIAL AND ENT PROCEDURES	Major Surgery
254	LEVEL III FACIAL AND ENT PROCEDURES	Major Surgery
255	LEVEL IV FACIAL AND ENT PROCEDURES	Major Surgery
256	TONSIL AND ADENOID PROCEDURES	Minor Surgery
257	AUDIOMETRY	Other
270	OCCUPATIONAL THERAPY	Rehabilitation
271	PHYSICAL THERAPY	Physical Therapy
272	SPEECH THERAPY AND EVALUATION	Rehabilitation
273	MANIPULATION THERAPY	Rehabilitation
274	OCCUPATIONAL/PHYSICAL THERAPY, GROUP	Rehabilitation
275	SPEECH THERAPY & EVALUATION, GROUP	Rehabilitation
280	VASCULAR RADIOLOGY EXCEPT VENOGRAPHY OF EXTREMITY	Radiology
281	MAGNETIC RESONANCE ANGIOGRAPHY - HEAD AND/OR NECK	Radiology
282	MAGNETIC RESONANCE ANGIOGRAPHY - CHEST	Radiology
283	MAGNETIC RESONANCE ANGIOGRAPHY - OTHER SITES	Radiology
284	MYELOGRAPHY	Radiology
285	MISCELLANEOUS RADIOLOGICAL PROCEDURES WITH CONTRAST	Radiology
286	MAMMOGRAPHY	Radiology
287	DIGESTIVE RADIOLOGY	Radiology
288	DIAGNOSTIC ULTRASOUND EXCEPT OBSTETRICAL AND VASCULAR OF LOWER EXTREMITIES	Radiology
289	VASCULAR DIAGNOSTIC ULTRASOUND OF LOWER EXTREMITIES	Radiology
290	PET SCANS	CT/MRI/PET
291	BONE DENSITOMETRY	Radiology
292	MRI- ABDOMEN	CT/MRI/PET
293	MRI- JOINTS	CT/MRI/PET
294	MRI- BACK	CT/MRI/PET
295	MRI- CHEST	CT/MRI/PET
296	MRI- OTHER	CT/MRI/PET
297	MRI- BRAIN	CT/MRI/PET
298	CAT SCAN BACK	CT/MRI/PET
299	CAT SCAN - BRAIN	CT/MRI/PET
300	CAT SCAN - ABDOMEN	CT/MRI/PET
301	CAT SCAN - OTHER	CT/MRI/PET
302	ANGIOGRAPHY, OTHER	Radiology

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APG	APG DESCRIPTION	SERVICE
303	ANGIOGRAPHY, CEREBRAL	Radiology
310	DEVELOPMENTAL & NEUROPSYCHOLOGICAL TESTING	Other
311	FULL DAY PARTIAL HOSPITALIZATION FOR SUBSTANCE ABUSE	Psychiatric
312	FULL DAY PARTIAL HOSPITALIZATION FOR MENTAL ILLNESS	Psychiatric
313	HALF DAY PARTIAL HOSPITALIZATION FOR SUBSTANCE ABUSE	Psychiatric
314	HALF DAY PARTIAL HOSPITALIZATION FOR MENTAL ILLNESS	Psychiatric
315	COUNSELLING OR INDIVIDUAL BRIEF PSYCHOTHERAPY	Psychiatric
316	INDIVIDUAL COMPREHENSIVE PSYCHOTHERAPY	Psychiatric
317	FAMILY PSYCHOTHERAPY	Psychiatric
318	GROUP PSYCHOTHERAPY	Psychiatric
319	ACTIVITY THERAPY	Psychiatric
320	CASE MANAGEMENT & TREATMENT PLAN DEVELOPMENT - MENTAL HEALTH OR SUBSTANCE ABUSE	Psychiatric
321	CRISIS INTERVENTION	Psychiatric
322	MEDICATION ADMINISTRATION & OBSERVATION	Psychiatric
323	MENTAL HYGIENE ASSESSMENT	Psychiatric
324	MENTAL HEALTH SCREENING & BRIEF ASSESSMENT	Psychiatric
327	INTENSIVE OUTPATIENT PSYCHIATRIC TREATMENT	Psychiatric
328	DAY REHABILITATION, HALF DAY	Rehabilitation
329	DAY REHABILITATION, FULL DAY	Rehabilitation
330	LEVEL I DIAGNOSTIC NUCLEAR MEDICINE	Other
331	LEVEL II DIAGNOSTIC NUCLEAR MEDICINE	Other
332	LEVEL III DIAGNOSTIC NUCLEAR MEDICINE	Other
340	THERAPEUTIC NUCLEAR MEDICINE	Other
341	RADIATION THERAPY AND HYPERTHERMIA	Radiation, Infusion, chemotherapy
342	LEVEL I AFTERLOADING BRACHYTHERAPY	Radiation, Infusion, chemotherapy
343	RADIATION TREATMENT DELIVERY	Radiation, Infusion, chemotherapy
344	INSTILLATION OF RADIOELEMENT SOLUTIONS	Radiation, Infusion, chemotherapy
345	HYPERTHERMIC THERAPIES	Radiation, Infusion, chemotherapy
346	RADIOSURGERY	Radiation, Infusion, Chemotheraphy
347	HIGH ENERGY NEUTRON RADIATION TREATMENT DELIVERY	Radiation, Infusion, Chemotheraphy

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APG	APG DESCRIPTION	SERVICE
348	PROTON TREATMENT DELIVERY	Radiation, Infusion, Chemotheraphy
349	LEVEL II AFTERLOADING BRACHYTHERAPY	Radiation, Infusion, Chemotheraphy
350	LEVEL I ADJUNCTIVE GENERAL DENTAL SERVICES	Other
351	LEVEL II ADJUNCTIVE GENERAL DENTAL SERVICES	Other
352	PERIODONTICS	Other
353	LEVEL I PROSTHODONTICS, FIXED	Other
354	LEVEL II PROSTHODONTICS, FIXED	Other
355	LEVEL III PROSTHODONTICS, FIXED	Other
356	LEVEL I PROSTHODONTICS, REMOVABLE	Other
357	LEVEL II PROSTHODONTICS, REMOVABLE	Other
358	LEVEL III PROSTHODONTICS, REMOVABLE	Other
359	LEVEL I MAXILLOFACIAL PROSTHETICS	Other
360	LEVEL II MAXILLOFACIAL PROSTHETICS	Other
361	LEVEL I DENTAL RESTORATIONS	Other
362	LEVEL II DENTAL RESTORATIONS	Other
363	LEVEL III DENTAL RESTORATION	Other
364	LEVEL I ENDODONTICS	Other
365	LEVEL II ENDODONTICS	Other
366	LEVEL III ENDODONTICS	Other
367	LEVEL I ORAL AND MAXILLOFACIAL SURGERY	Minor Surgery
368	LEVEL II ORAL AND MAXILLOFACIAL SURGERY	Major Surgery
369	LEVEL III ORAL AND MAXILLOFACIAL SURGERY	Major Surgery
370	LEVEL IV ORAL AND MAXILLOFACIAL SURGERY	Major Surgery
371	ORTHODONTICS	Other
372	SEALANT	Other
373	LEVEL I DENTAL FILM	Other
374	LEVEL II DENTAL FILM	Other
375	DENTAL ANESTHESIA	Other
376	DIAGNOSTIC DENTAL PROCEDURES	Minor Surgery
377	PREVENTIVE DENTAL PROCEDURES	Preventive
380	ANESTHESIA	Other
390	LEVEL I PATHOLOGY	Pathology
391	LEVEL II PATHOLOGY	Pathology
392	PAP SMEARS	Pathology
393	BLOOD AND TISSUE TYPING	Lab
394	LEVEL I IMMUNOLOGY TESTS	Lab

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APG	APG DESCRIPTION	SERVICE
395	LEVEL II IMMUNOLOGY TESTS	Lab
396	LEVEL I MICROBIOLOGY TESTS	Lab
397	LEVEL II MICROBIOLOGY TESTS	Lab
398	LEVEL I ENDOCRINOLOGY TESTS	Lab
399	LEVEL II ENDOCRINOLOGY TESTS	Lab
400	LEVEL I CHEMISTRY TESTS	Lab
401	LEVEL II CHEMISTRY TESTS	Lab
402	BASIC CHEMISTRY TESTS	Lab
403	ORGAN OR DISEASE ORIENTED PANELS	Lab
404	TOXICOLOGY TESTS	Lab
405	THERAPEUTIC DRUG MONITORING	Lab
406	LEVEL I CLOTTING TESTS	Lab
407	LEVEL II CLOTTING TESTS	Lab
408	LEVEL I HEMATOLOGY TESTS	Lab
409	LEVEL II HEMATOLOGY TESTS	Lab
410	URINALYSIS	Lab
411	BLOOD AND URINE DIPSTICK TESTS	Lab
412	SIMPLE PULMONARY FUNCTION TESTS	Other
413	CARDIOGRAM	Other
414	LEVEL I IMMUNIZATION	Other
415	LEVEL II IMMUNIZATION	Other
416	LEVEL III IMMUNIZATION	Other
417	MINOR REPRODUCTIVE PROCEDURES	Minor Surgery
418	MINOR CARDIAC AND VASCULAR TESTS	Other
419	MINOR OPHTHALMOLOGICAL INJECTION, SCRAPING AND TESTS	Other
420	PACEMAKER AND OTHER ELECTRONIC ANALYSIS	Other
421	TUBE CHANGE	Other
422	PROVISION OF VISION AIDS	Other
423	INTRODUCTION OF NEEDLE AND CATHETER	Other
424	DRESSINGS AND OTHER MINOR PROCEDURES	Minor Surgery
425	OTHER MISCELLANEOUS ANCILLARY PROCEDURES	Minor Surgery
426	PSYCHOTROPIC MEDICATION MANAGEMENT	Other
427	BIOFEEDBACK AND OTHER TRAINING	Other
428	PATIENT EDUCATION, INDIVIDUAL	Other
429	PATIENT EDUCATION, GROUP	Other
430	CLASS I CHEMOTHERAPY DRUGS	Radiation, Infusion, Chemotheraphy

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APG	APG DESCRIPTION	SERVICE
431	CLASS II CHEMOTHERAPY DRUGS	Radiation, Infusion, Chemotheraphy
432	CLASS III CHEMOTHERAPY DRUGS	Radiation, Infusion, Chemotheraphy
433	CLASS IV CHEMOTHERAPY DRUGS	Radiation, Infusion, Chemotheraphy
434	CLASS V CHEMOTHERAPY DRUGS	Radiation, Infusion, Chemotheraphy
435	CLASS I PHARMACOTHERAPY	Drugs
436	CLASS II PHARMACOTHERAPY	Drugs
437	CLASS III PHARMACOTHERAPY	Drugs
438	CLASS IV PHARMACOTHERAPY	Drugs
439	CLASS V PHARMACOTHERAPY	Drugs
440	CLASS VI PHARMACOTHERAPY	Drugs
441	CLASS VI CHEMOTHERAPY DRUGS	Radiation, Infusion, Chemotheraphy
443	CLASS VII CHEMOTHERAPY DRUGS	Radiation, Infusion, Chemotheraphy
444	CLASS VII PHARMACOTHERAPY	Drugs
448	EXPANDED HOURS ACCESS	Other
449	ADDITIONAL UNDIFFERENTIATED MEDICAL VISITS/SERVICES	Other
450	OBSERVATION	Observation
451	SMOKING CESSATION TREATMENT	Other
452	DIABETES SUPPLIES	Other
453	MOTORIZED WHEELCHAIR	Other
454	TPN FORMULAE	Other
455	IMPLANTED TISSUE OF ANY TYPE	Other
456	MOTORIZED WHEELCHAIR ACCESSORIES	Other
457	VENIPUNCTURE	Other
458	ALLERGY THERAPY	Other
459	VACCINE ADMINISTRATION	Other
460	CLASS VIII COMBINED CHEMOTHERAPY AND PHARMACOTHERAPY	Radiation, Infusion, Chemotheraphy
461	CLASS IX COMBINED CHEMOTHERAPY AND PHARMACOTHERAPY	Radiation, Infusion, Chemotheraphy
462	CLASS X COMBINED CHEMOTHERAPY AND PHARMACOTHERAPY	Radiation, Infusion, Chemotheraphy
463	CLASS XI COMBINED CHEMOTHERAPY AND PHARMACOTHERAPY	Radiation, Infusion, Chemotheraphy

Market Shift Adjustments under Global Revenue Models

Updated-5/6/2015

APG	APG DESCRIPTION	SERVICE
464	CLASS XII COMBINED CHEMOTHERAPY AND PHARMACOTHERAPY	Radiation, Infusion, Chemotheraphy
465	CLASS XIII COMBINED CHEMOTHERAPY AND PHARMACOTHERAPY	Radiation, Infusion, Chemotheraphy
470	OBSTETRICAL ULTRASOUND	Radiology
471	PLAIN FILM	Radiology
472	ULTRASOUND GUIDANCE	Radiology
473	CT GUIDANCE	CT/MRI/PET
474	RADIOLOGICAL GUIDANCE FOR THERAPEUTIC OR DIAGNOSTIC PROCEDURES	Radiology
475	MRI GUIDANCE	CT/MRI/PET
476	LEVEL I THERAPEUTIC RADIATION TREATMENT PREPARATION	Radiology
477	LEVEL II THERAPEUTIC RADIATION TREATMENT PREPARATION	Radiology
478	MEDICAL RADIATION PHYSICS	Radiology
479	TREATMENT DEVICE DESIGN AND CONSTRUCTION	Radiology
480	TELETHERAPY/BRACHYTHERAPY CALCULATION	Radiology
481	THERAPEUTIC RADIOLOGY SIMULATION FIELD SETTING	Radiology
482	RADIOELEMENT APPLICATION	Radiation, Infusion, Chemotheraphy
483	RADIATION THERAPY MANAGEMENT	Radiation, Infusion, Chemotheraphy
484	THERAPEUTIC RADIOLOGY TREATMENT PLANNING	Radiology
485	CORNEAL TISSUE PROCESSING	Other
490	INCIDENTAL TO MEDICAL, SIGNIFICANT PROCEDURE OR THERAPY VISIT	Other
491	MEDICAL VISIT INDICATOR	Other
492	ENCOUNTER/REFERRAL FOR OBSERVATION INDICATOR	Other
495	MINOR CHEMOTHERAPY DRUGS	Radiation, Infusion, Chemotheraphy
496	MINOR PHARMACOTHERAPY	Drugs
500	ENCOUNTER/REFERRAL FOR OBSERVATION - OBSTETRICAL	Other
501	ENCOUNTER/REFERRAL FOR OBSERVATION - OTHER DIAGNOSES	Other
502	ENCOUNTER/REFERRAL FOR OBSERVATION - BEHAVIORAL HEALTH	Other
510	MAJOR SIGNS, SYMPTOMS AND FINDINGS	Other
520	SPINAL DISORDERS & INJURIES	Other
521	NERVOUS SYSTEM MALIGNANCY	Radiation, Infusion, Chemotheraphy
522	DEGENERATIVE NERVOUS SYSTEM DISORDERS EXC MULT SCLEROSIS	Other
523	MULTIPLE SCLEROSIS & OTHER DEMYELINATING DISEASES	Other
524	LEVEL I CNS DISORDERS	Other

Market Shift Adjustments under Global Revenue Models

Updated-5/6/2015

APG	APG DESCRIPTION	SERVICE
525	LEVEL II CNS DISORDERS	Other
526	TRANSIENT ISCHEMIA	Other
527	PERIPHERAL NERVE DISORDERS	Other
528	NONTRAUMATIC STUPOR & COMA	Other
529	SEIZURE	Other
530	HEADACHES OTHER THAN MIGRAINE	Other
531	MIGRAINE	Other
532	HEAD TRAUMA	Other
533	AFTEREFFECTS OF CEREBROVASCULAR ACCIDENT	Other
534	NONSPECIFIC CVA & PRECEREBRAL OCCLUSION W/O INFARC	Other
535	CVA & PRECEREBRAL OCCLUSION W INFARCT	Other
536	CEREBRAL PALSY	Other
550	ACUTE MAJOR EYE INFECTIONS	Other
551	CATARACTS	Other
552	GLAUCOMA	Other
553	LEVEL I OTHER OPHTHALMIC DIAGNOSES	Other
554	LEVEL II OTHER OPHTHALMIC DIAGNOSES	Other
555	CONJUNCTIVITIS	Other
560	EAR, NOSE, MOUTH, THROAT, CRANIAL/FACIAL MALIGNANCIES	Other
561	VERTIGINOUS DISORDERS EXCEPT FOR BENIGN VERTIGO	Other
562	INFECTIONS OF UPPER RESPIRATORY TRACT & OTITIS MEDIA	Other
563	DENTAL & ORAL DISEASES & INJURIES	Other
564	LEVEL I OTHER EAR, NOSE, MOUTH,THROAT & CRANIAL/FACIAL DIAGNOSES	Other
565	LEVEL II OTHER EAR, NOSE, MOUTH,THROAT & CRANIAL/FACIAL DIAGNOSES	Other
570	CYSTIC FIBROSIS - PULMONARY DISEASE	Other
571	RESPIRATORY MALIGNANCY	Other
572	BRONCHIOLITIS & RSV PNEUMONIA	Other
573	COMMUNITY ACQUIRED PNUEMONIA	Other
574	CHRONIC OBSTRUCTIVE PULMONARY DISEASE	Other
575	ASTHMA	Other
576	LEVEL I OTHER RESPIRATORY DIAGNOSES	Other
577	LEVEL II OTHER RESPIRATORY DIAGNOSES	Other
578	PNEUMONIA EXCEPT FOR COMMUNITY ACQUIRED PNEUMONIA	Other
579	STATUS ASTHMATICUS	Other
591	ACUTE MYOCARDIAL INFARCTION	Other
592	LEVEL I CARDIOVASCULAR DIAGNOSES	Other
593	LEVEL II CARDIOVASCULAR DIAGNOSES	Other

Market Shift Adjustments under Global Revenue Models

Updated-5/6/2015

APG	APG DESCRIPTION	SERVICE
594	HEART FAILURE	Other
595	CARDIAC ARREST	Other
596	PERIPHERAL & OTHER VASCULAR DISORDERS	Other
597	PHLEBITIS	Other
598	ANGINA PECTORIS & CORONARY ATHEROSCLEROSIS	Other
599	HYPERTENSION	Other
600	CARDIAC STRUCTURAL & VALVULAR DISORDERS	Other
601	LEVEL I CARDIAC ARRHYTHMIA & CONDUCTION DISORDERS	Other
602	ATRIAL FIBRILLATION	Other
603	LEVEL II CARDIAC ARRHYTHMIA & CONDUCTION DISORDERS	Other
604	CHEST PAIN	Other
605	SYNCOPE & COLLAPSE	Other
620	DIGESTIVE MALIGNANCY	Radiation, Infusion, Chemotheraphy
621	PEPTIC ULCER & GASTRITIS	Other
623	ESOPHAGITIS	Other
624	LEVEL I GASTROINTESTINAL DIAGNOSES	Other
625	LEVEL II GASTROINTESTINAL DIAGNOSES	Other
626	INFLAMMATORY BOWEL DISEASE	Other
627	NON-BACTERIAL GASTROENTERITIS, NAUSEA & VOMITING	Other
628	ABDOMINAL PAIN	Other
629	MALFUNCTION, REACTION & COMPLICATION OF GI DEVICE OR PROCEDURE	Other
630	CONSTIPATION	Other
631	HERNIA	Other
632	IRRITABLE BOWEL SYNDROME	Other
633	ALCOHOLIC LIVER DISEASE	Other
634	MALIGNANCY OF HEPATOBILIARY SYSTEM & PANCREAS	Radiation, Infusion, Chemotheraphy
635	DISORDERS OF PANCREAS EXCEPT MALIGNANCY	Other
636	HEPATITIS WITHOUT COMA	Other
637	DISORDERS OF GALLBLADDER & BILIARY TRACT	Other
638	CHOLECYSTITIS	Other
639	LEVEL I HEPATOBILIARY DIAGNOSES	Other
640	LEVEL II HEPATOBILIARY DIAGNOSES	Other
650	FRACTURE OF FEMUR	Other
651	FRACTURE OF PELVIS OR DISLOCATION OF HIP	Other
652	FRACTURES & DISLOCATIONS EXCEPT FEMUR, PELVIS & BACK	Other
653	MUSCULOSKELETAL MALIGNANCY & PATHOLOGICAL FRACTURES	Other

Market Shift Adjustments under Global Revenue Models

Updated-5/6/2015

APG	APG DESCRIPTION	SERVICE
654	OSTEOMYELITIS, SEPTIC ARTHRITIS & OTHER MUSCULOSKELETAL INFECTIONS	Other
655	CONNECTIVE TISSUE DISORDERS	Other
656	BACK & NECK DISORDERS EXCEPT LUMBAR DISC DISEASE	Other
657	LUMBAR DISC DISEASE	Other
658	LUMBAR DISC DISEASE WITH SCIATICA	Other
659	MALFUNCTION, REACTION, COMPLIC OF ORTHOPEDIC DEVICE OR PROCEDURE	Other
660	LEVEL I OTHER MUSCULOSKELETAL SYSTEM & CONNECTIVE TISSUE DIAGNOSES	Other
661	LEVEL II OTHER MUSCULOSKELETAL SYSTEM & CONNECTIVE TISSUE DIAGNOSES	Other
662	OSTEOPOROSIS	Other
663	PAIN	Other
670	SKIN ULCERS	Other
671	MAJOR SKIN DISORDERS	Other
672	MALIGNANT BREAST DISORDERS	Radiation, Infusion, Chemotheraphy
673	CELLULITIS & OTHER BACTERIAL SKIN INFECTIONS	Other
674	CONTUSION, OPEN WOUND & OTHER TRAUMA TO SKIN & SUBCUTANEOUS TISSUE	Other
675	OTHER SKIN, SUBCUTANEOUS TISSUE & BREAST DISORDERS	Other
676	DECUBITUS ULCER	Other
690	MALNUTRITION, FAILURE TO THRIVE & OTHER NUTRITIONAL DISORDERS	Other
691	INBORN ERRORS OF METABOLISM	Other
692	LEVEL I ENDOCRINE DISORDERS	Other
693	LEVEL II ENDOCRINE DISORDERS	Other
694	ELECTROLYTE DISORDERS	Other
695	OBESITY	Other
710	DIABETES WITH OPHTHALMIC MANIFESTATIONS	Other
711	DIABETES WITH OTHER MANIFESTATIONS & COMPLICATIONS	Other
712	DIABETES WITH NEUROLOGIC MANIFESTATIONS	Other
713	DIABETES WITHOUT COMPLICATIONS	Other
714	DIABETES WITH RENAL MANIFESTATIONS	Other
720	RENAL FAILURE	Other
721	KIDNEY & URINARY TRACT MALIGNANCY	Radiation, Infusion, Chemotheraphy
722	NEPHRITIS & NEPHROSIS	Other
723	KIDNEY AND CHRONIC URINARY TRACT INFECTIONS	Other

Market Shift Adjustments under Global Revenue Models

Updated-5/6/2015

APG	APG DESCRIPTION	SERVICE
724	URINARY STONES & ACQUIRED UPPER URINARY TRACT OBSTRUCTION	Other
725	MALFUNCTION, REACTION, COMPLIC OF GENITOURINARY DEVICE OR PROC	Other
726	OTHER KIDNEY & URINARY TRACT DIAGNOSES, SIGNS & SYMPTOMS	Other
727	ACUTE LOWER URINARY TRACT INFECTIONS	Other
740	MALIGNANCY, MALE REPRODUCTIVE SYSTEM	Radiation, Infusion, Chemotheraphy
741	MALE REPRODUCTIVE SYSTEM DIAGNOSES EXCEPT MALIGNANCY	Other
742	NEOPLASMS OF THE MALE REPRODUCTIVE SYSTEM	Other
743	PROSTATITIS	Other
744	MALE REPRODUCTIVE INFECTIONS	Other
750	FEMALE REPRODUCTIVE SYSTEM MALIGNANCY	Other
751	FEMALE REPRODUCTIVE SYSTEM INFECTIONS	Other
752	LEVEL I MENSTRUAL AND OTHER FEMALE DIAGNOSES	Other
753	LEVEL II MENSTRUAL AND OTHER FEMALE DIAGNOSES	Other
760	VAGINAL DELIVERY	Other
761	POSTPARTUM & POST ABORTION DIAGNOSES W/O PROCEDURE	Other
762	THREATENED ABORTION	Other
763	ABORTION W/O D&C, ASPIRATION CURETTAGE OR HYSTEROTOMY	Other
764	FALSE LABOR	Other
765	OTHER ANTEPARTUM DIAGNOSES	Other
766	ROUTINE PRENATAL CARE	Other
770	NORMAL NEONATE	Other
771	LEVEL I NEONATAL DIAGNOSES	Other
772	LEVEL II NEONATAL DIAGNOSES	Other
780	OTHER HEMATOLOGICAL DISORDERS	Other
781	COAGULATION & PLATELET DISORDERS	Other
782	CONGENITAL FACTOR DEFICIENCIES	Other
783	SICKLE CELL ANEMIA CRISIS	Other
784	SICKLE CELL ANEMIA	Other
785	ANEMIA EXCEPT FOR IRON DEFICIENCY ANEMIA AND SICKLE CELL ANEMIA	Other
786	IRON DEFICIENCY ANEMIA	Other
800	ACUTE LEUKEMIA	Other
801	LYMPHOMA, MYELOMA & NON-ACUTE LEUKEMIA	Other
802	RADIOTHERAPY	Other
803	CHEMOTHERAPY	Other
804	LYMPHATIC & OTHER MALIGNANCIES & NEOPLASMS OF UNCERTAIN BEHAVIOR	Other
805	SEPTICEMIA & DISSEMINATED INFECTIONS	Other

Market Shift Adjustments under Global Revenue Models

Updated-5/6/2015

APG	APG DESCRIPTION	SERVICE
806	POST-OPERATIVE, POST-TRAUMATIC, OTHER DEVICE INFECTIONS	Other
807	FEVER	Other
808	VIRAL ILLNESS	Other
809	OTHER INFECTIOUS & PARASITIC DISEASES	Other
810	H. PYLORI INFECTION	Other
820	SCHIZOPHRENIA	Psychiatric
821	MAJOR DEPRESSIVE DISORDERS & OTHER/UNSPECIFIED PSYCHOSES	Psychiatric
822	DISORDERS OF PERSONALITY & IMPULSE CONTROL	Psychiatric
823	BIPOLAR DISORDERS	Psychiatric
824	DEPRESSION EXCEPT MAJOR DEPRESSIVE DISORDER	Psychiatric
825	ADJUSTMENT DISORDERS & NEUROSES EXCEPT DEPRESSIVE DIAGNOSES	Psychiatric
826	ACUTE ANXIETY & DELIRIUM STATES	Psychiatric
827	ORGANIC MENTAL HEALTH DISTURBANCES	Psychiatric
828	MENTAL RETARDATION	Psychiatric
829	CHILDHOOD BEHAVIORAL DISORDERS	Psychiatric
830	EATING DISORDERS	Psychiatric
831	OTHER MENTAL HEALTH DISORDERS	Psychiatric
840	OPIOID ABUSE & DEPENDENCE	Other
841	COCAINE ABUSE & DEPENDENCE	Other
842	ALCOHOL ABUSE & DEPENDENCE	Other
843	OTHER DRUG ABUSE & DEPENDENCE	Other
850	ALLERGIC REACTIONS	Other
851	POISONING OF MEDICINAL AGENTS	Other
852	OTHER COMPLICATIONS OF TREATMENT	Other
853	OTHER INJURY, POISONING & TOXIC EFFECT DIAGNOSES	Other
854	TOXIC EFFECTS OF NON-MEDICINAL SUBSTANCES	Other
860	EXTENSIVE 3RD DEGREE OR FULL THICKNESS BURNS W/O SKIN GRAFT	Other
861	PARTIAL THICKNESS BURNS W OR W/O SKIN GRAFT	Other
870	REHABILITATION	Rehabilitation
871	SIGNS, SYMPTOMS & OTHER FACTORS INFLUENCING HEALTH STATUS	Other
872	OTHER AFTERCARE & CONVALESCENCE	Other
873	NEONATAL AFTERCARE	Other
874	JOINT REPLACEMENT	Other
875	CONTRACEPTIVE MANAGEMENT	Other
876	ADULT PREVENTIVE MEDICINE	Preventive
877	CHILD PREVENTIVE MEDICINE	Preventive
878	GYNECOLOGIC PREVENTIVE MEDICINE	Preventive
879	PREVENTIVE OR SCREENING ENCOUNTER	Preventive

Market Shift Adjustments under Global Revenue Models

Updated-5/6/2015

APG	APG DESCRIPTION	SERVICE
880	HIV INFECTION	Other
881	AIDS	Other
993	INPATIENT ONLY PROCEDURES	Major Surgery
994	USER CUSTOMIZABLE INPATIENT PROCEDURES	Other
999	UNASSIGNED	Unassigned
1001	DURABLE MEDICAL EQUIPMENT - LEVEL 1	Other
1002	DURABLE MEDICAL EQUIPMENT - LEVEL 2	Other
1003	DURABLE MEDICAL EQUIPMENT - LEVEL 3	Other
1004	DURABLE MEDICAL EQUIPMENT - LEVEL 4	Other
1005	DURABLE MEDICAL EQUIPMENT - LEVEL 5	Other
1006	DURABLE MEDICAL EQUIPMENT - LEVEL 6	Other
1007	DURABLE MEDICAL EQUIPMENT - LEVEL 7	Other
1008	DURABLE MEDICAL EQUIPMENT - LEVEL 8	Other
1009	DURABLE MEDICAL EQUIPMENT - LEVEL 9	Other
1010	DURABLE MEDICAL EQUIPMENT - LEVEL 10	Other
1011	DURABLE MEDICAL EQUIPMENT - LEVEL 11	Other
1012	DURABLE MEDICAL EQUIPMENT - LEVEL 12	Other
1013	DURABLE MEDICAL EQUIPMENT - LEVEL 13	Other
1014	DURABLE MEDICAL EQUIPMENT - LEVEL 14	Other
1015	DURABLE MEDICAL EQUIPMENT - LEVEL 15	Other
1016	DURABLE MEDICAL EQUIPMENT - LEVEL 16	Other
1017	DURABLE MEDICAL EQUIPMENT - LEVEL 17	Other
1018	DURABLE MEDICAL EQUIPMENT - LEVEL 18	Other
1019	DURABLE MEDICAL EQUIPMENT - LEVEL 19	Other
1020	DURABLE MEDICAL EQUIPMENT - LEVEL 20	Other
1090	USER DEFINED 340B DRUGS	Drugs

APPENDIX VIII: Steps in Calculating Outpatient Weights - TBD

EXHIBIT 6

Craig P. Tanio, M.D.
CHAIR

STATE OF MARYLAND

Ben Steffen
EXECUTIVE DIRECTOR

MARYLAND HEALTH CARE COMMISSION

4160 PATTERSON AVENUE – BALTIMORE, MARYLAND 21215
TELEPHONE: 410-764-3460 FAX: 410-358-1236

January 14, 2015

Kathleen McCollum
Chief Operating Officer and
Senior Vice President, Clinical Integration
Baltimore Washington Medical Center
301 Hospital Drive
Glen Burnie, Maryland 21061

Re: Baltimore Washington Medical Center Fit Out of Shell Space for Three Operating Rooms

Dear Ms. McCollum:

I write regarding Baltimore Washington Medical Center's ("BWMC") request for a determination of coverage with respect to the proposed fit out of shell space to create three additional operating rooms ("ORs") made via email on November 18, 2014 and the subsequent November 24, 2014 filing, via regular mail, of the request accompanied by a larger scale drawing of the BWMC surgical department.

You have stated that this project is estimated to cost $5,157,915; that the these additional ORs will be offset by the removal from service of three existing operating rooms; and that the rooms being taken out of service will be used for storage. Further, in response to Paul Parker's observation in correspondence of December 4, 2014 that the drawings submitted showed 17 ORs, you have stated that the room labeled as "OR 9" in those drawings is actually a dedicated cystoscopy room.

Based on the information provided MHCC staff finds that this project will not require a Certificate of Need, as the capital expenditure falls below the expenditure threshold and OR capacity is not being increased.

TOLL FREE
1-877-245-1762

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MARYLAND RELAY SERVICE
1-800-735-2258

Should you have questions, please don't hesitate to contact Kevin McDonald, Chief, CON Division, at 410-764-5982.

Sincerely,

Ben Steffen,
Executive Director

cc: Donna Kinzer, Health Services Cost Review Commission
Patricia Nay, M.D., Office of Health Care Quality
Jinlene Chan, M.D., Anne Arundel County Health Department

UNIVERSITY of MARYLAND
BALTIMORE WASHINGTON
MEDICAL CENTER

301 Hospital Drive
Glen Burnie, Maryland 21061
mybwmc.org

CHS 6480

November 18, 2014

RECEIVED
MARYLAND HEALTH
CARE COMMISSION

Mr. Ben Steffen
Executive Director
Maryland Health Care Commission
4160 Patterson Avenue
Baltimore, Maryland 21215

Re: University of Maryland Baltimore Washington Medical Center; Request for Determination of Non-Coverage for a $5,157,915 Capital Expenditure to Fit Out Shell Space for Three Replacement Operating Rooms.

Dear Mr. Steffen:

I write on behalf of the University of Maryland Baltimore Washington Medical Center (UM BWMC) to request a determination that UM BWMC may spend $5,157,915 to fit out previously approved shell space in order to replace three mixed-use general operating rooms without obtaining a Certificate of Need (CON). The reasons for this request are related below.

On December 17, 2009, the Commission authorized a new construction/renovation project at UM BWMC which added three mixed-use, general purpose operating rooms to the hospital, created shell space for up to three operating rooms in the future, and expanded and renovated surgical support space. The space was built on top of the hospital's Emergency Department. While no condition was attached to the fit-out of the shell space, UM BWMC is seeking a determination of non-coverage because the request concerns mixed-use general operating room capacity.

The fit-out of the shelled space with three operating rooms will not add operating room capacity. UM BWMC will remove from service three of its oldest and smallest operating rooms once the project is complete. These rooms are currently 407 sq. ft., 382 sq. feet, and 406 sq. ft. respectively. UM BWMC currently has 16 mixed use general OR's. This project would retain the current number of OR's, replacing the small rooms with larger modern OR's to meet the demands of our current surgical program and the associated mix of cases.

Md. Ann. Code Section 19-120(k) provides that a CON must be obtained before a hospital makes a capital expenditure in excess of $10,000,000.00. As provided in Section 19-120(k)(i)(1), the $10 million CON threshold is subject to "adjustment for inflation as provided in the regulations of the Commission." Pursuant to this authority, the Commission has increased the CON threshold to $11,750,000.00. The capital expenditures associated with fitting out the operating room shell space ($5,157,915) is well below the current capital expenditure threshold ($11,750,000.00).

For the reasons related above, UM BWMC respectfully requests that the Commission issue a determination that UM BWMC may implement this project without obtaining a CON.

If you have questions about this request, please contact me at your convenience.

Sincerely,

Kathleen McCollum
Chief Operating Officer and
Senior Vice President, Clinical Integration

cc: Paul Parker
Karen Olscamp
Suellen Wideman, Esq.
Tom Dame, Esq.
Andy Solberg

Attachments:

1. Architectural Floor Plans
2. Project Budget

PART II: PROJECT BUDGET

(INSTRUCTION: All estimates for 1.a.-d., 2.a.-h., and 3 are current costs as of the date of application submission and should not include the costs for all intended construction and renovations to be undertaken. DO NOT CHANGE THIS FORM OR ITS LINE ITEMS. IF ADDITIONAL DETAIL OR CLARIFICATION IS NEEDED, ATTACH ADDITIONAL SHEET.)

A. Use of Funds

1. Capital Costs

a.	New Construction	
(1)	Building	
(2)	Fixed Equipment (not included in construction)	
(3)	Land Purchase	
(4)	Site Preparation	
(5)	Architect/Engineering Fees	
(6)	Permits (Building, Utilities, Etc.)	
SUBTOTAL		
b.	Renovations	
(1)	Building	$ 952,957.00
(2)	Fixed Equipment (not included in construction)	
(3)	Architect/Engineering Fees	$ 249,903.00
(4)	Permits (Building, Utilities, Etc.)	
SUBTOTAL		$ 1,202,860.00
C.	Other Capital Costs	
(1)	Major Movable Equipment	$ 3,300,000.00
(2)	Minor Movable Equipment	
(3)	Contingencies	$ 373,896.00
(4)	Other (I.T., Admin, Signage, Escalation costs)	$ 281,159.00
TOTAL CURRENT CAPITAL COSTS (a-c)		$ 5,157,915.00
d.	Non Current Capital Costs	
(1)	Interest (Gross)	
(2)	Inflation (state all assumptions, including time period and rate)	
TOTAL PROPOSED CAPITAL COSTS (a-d)		$ 5,157,915.00

2. Financing Cost and Other Cash Requirements

a.	Loan Placment Fees	_____
b.	Bond Discount	_____
c.	Legal Fees (CON related)	_____
d.	Legal Fees (other)	_____
e.	Printing	_____
f.	Consultant Fees	_____
	CON Application Assistance	_____
	Other (Specify)	_____
g.	Liquidation of Existing Debt	_____
h.	Debt Service Reserve Fund	_____
i.	Principal Amortization	_____
	Reserve Fund	_____
j.	Other (Specify)	_____

TOTAL (a - j) _____

3. Working Capital Startup Costs _____

TOTAL USES OF FUND (1 - 3) $ 5,157,915.00

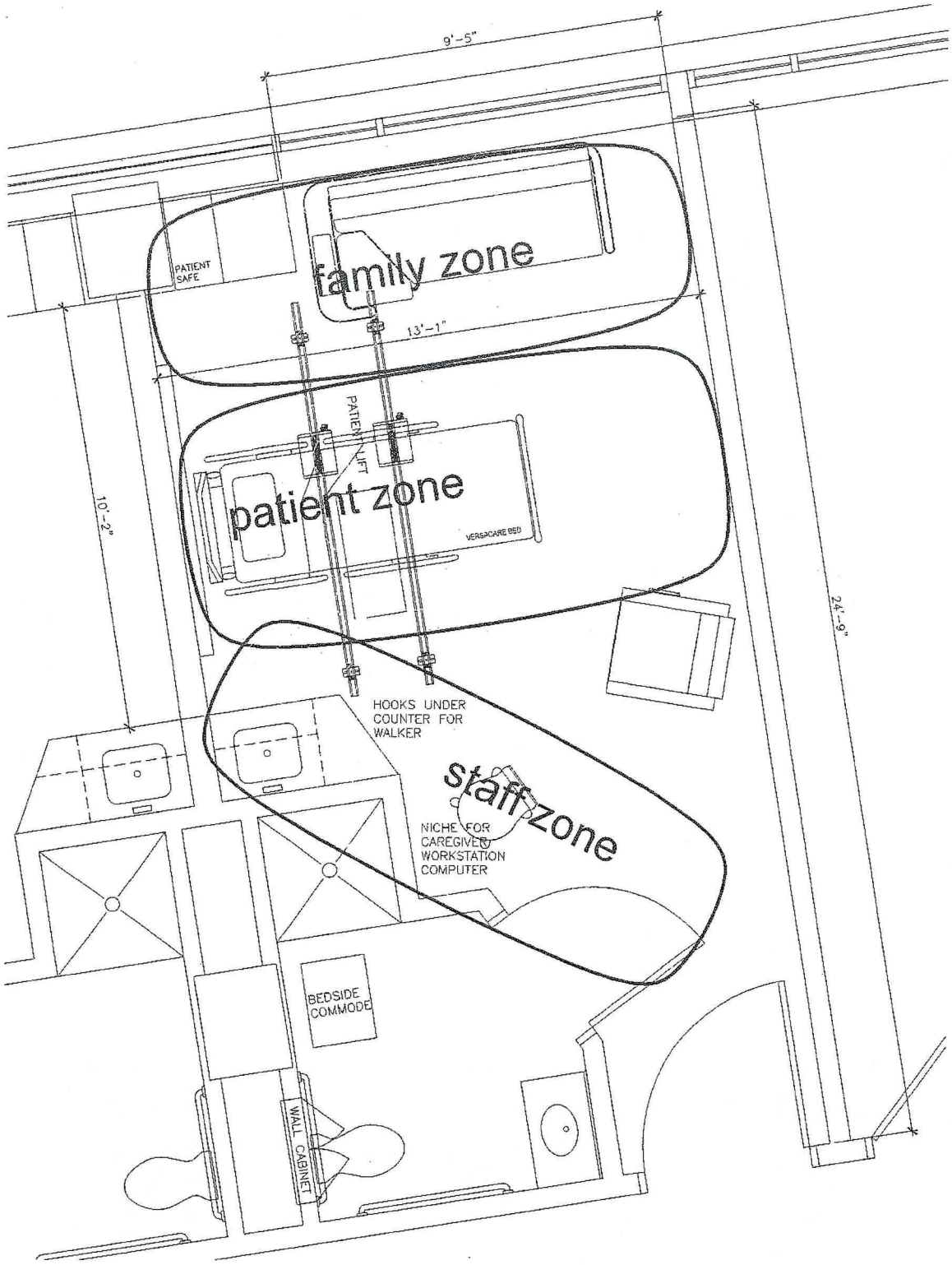
B. Sources of Funds for Project:

1.	Cash	$ 5,157,915.00
2.	Pledges: Gross_____, less allowance for uncollectibles _____ = Net	_____
3.	Gifts, bequests	_____
4.	Interest income (gross)	_____
5.	Authorize Bonds	_____
6.	Mortgage	_____
7.	Working capital loans	_____
8.	Grants or Appropriations	_____
	(a) Federal	_____
	(b) State	_____
	(c) Local	_____
9.	Other (Specify)	_____

TOTAL SOURCES OF FUNDS (1 - 9) $ 5,157,915.00

Lease Costs:

a. Land	$_____	x _____	= $ _____
b. Building	$_____	x _____	= $ _____
c. Major Movable Equipment	$_____	x _____	= $ _____
d. Minor Movable Equipment	$_____	x _____	= $ _____
e. Other (Specify)	$_____	x _____	= $ _____



PATIENT ROOM - TYPICAL

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OCTOBER 13, 2014

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301 Hospital Drive
Glen Burnie, Maryland 21061
mybwmc.org

CHS-6505

December 5, 2014

Mr. Paul Parker
Director, Health Care Facilities Planning and Development
Maryland Health Care Commission
4160 Patterson Avenue
Baltimore, Maryland 21215

Re: Baltimore Washington Medical Center Fit Out of Shell Space for Three Operating Rooms

Dear Mr. Parker:

In response to your letter of December 4, 2014, I am submitting clarification about the number of mixed use general OR's. On the diagram you received, there is a room labeled as "OR 9". This is actually a dedicated cystoscopy room and consistent with our 2014 report to the MHCC.

The existing operating room space which will be taken out of service will be used as much needed storage rooms.

Thank you for consideration.

Sincerely,

Kathleen McCollum
Chief Operating Officer and
Senior Vice President, Clinical Integration

cc: Kevin McDonald
Christine Parent
Karen Olscamp
Suellen Wideman, Esq.
Tom Dame, Esq.
Andy Solberg

UNIVERSITY of MARYLAND
BALTIMORE WASHINGTON
MEDICAL CENTER

301 Hospital Drive
Glen Burnie, Maryland 21061
mybwmc.org

December 30, 2014

Mr. Paul Parker
Director, Health Facilities Planning and Development
Maryland Health Care Commission
4160 Patterson Avenue
Baltimore, Maryland 21215

Re: University of Maryland Baltimore Washington Medical Center (UM BWMC) Fit Out of Shell Space for 30-Bed General Medical/Surgical Unit

Dear Mr. Parker:

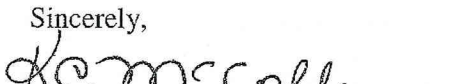
In response to your letter of December 9, 2014 regarding the above project, please find UM BWMC's responses below:

1) **Please describe the reconfiguration proposed for the 4 South unit that will alter it from a 25-room unit to a 22-room unit.** There is no reconfiguration of the unit. In order to remove the required number of beds from the 4 South unit, UM BWMC is planning to convert three existing patient rooms to non-patient care use, eliminating six semi-private beds. This leaves 22 physical rooms to be used as bed capacity, with one bed in each of those 22 rooms for a total of 22 private rooms on the 4 South unit.

2) **Does the estimated cost of this project include expenses for physically altering semi-private patient rooms so they can be set up as private rooms? Please provide an itemization of the specific construction/renovation work and equipment expenditures in the estimated project expenditure.** The project budget includes $49,500 to physically alter the rooms. An estimate of $1,650 per bed for the removal 30 bed-spaces was used, to account for plumbing, painting and patching, and third-party recertification if required. That estimate was included in the line item for major equipment, but probably should have been included in renovations. A line item budget is attached, as well as a revised project budget. UM BWMC has not yet identified every individual piece of equipment that would be required on the new unit. Rather, the line item for equipment is an allowance. These are conservative estimates, as some of the current equipment on the current 4 South unit can be relocated (including beds, computers, etc.).

Please let me know if you have any further questions or would like any additional information.

Sincerely,



Kathleen McCollum
Chief Operating Officer and
Senior Vice President, Clinical Integration

cc: Kevin McDonald
Christine Parent

RECEIVED
JAN 02 2015
MARYLAND HEALTH
CARE COMMISSION

Attached Exhibits:
1. Detailed Line Item Budget
2. Revised project budget

BWMC – 7TH FLOOR WEST

BWMC – 7TH FLOOR WEST – CONSTRUCTION BUDGET	COST	
27,600 S.F. Patient Floor @ $189/S.F.	$	5,216,400
4,000 S.F. Concourse/Elevator Lobby/Seating Area @ $100/S.F.	$	400,000
Escalation – 4%	$	224,656
TOTAL CONSTRUCTION COSTS	**$**	**5,841,056**

BWMC – 7TH FLOOR WEST – OWNER COSTS	COST	
Medical Equipment – 30%	$	876,159
I.T. Costs - $25/S.F.	$	382,500
Furniture/Art Work - $10/S.F.	$	306,000
Signage/Wayfinding/Graphics - $1.50/S.F.	$	45,900
Tests/Inspections/Admin Costs – 2%	$	116,821
Architect & Engineer Fee – 8%	$	706,168
Owner's Contingency – 10%	$	953,326
Capping off headwalls	$	49,500
TOTAL OWNER COSTS	**$**	**3,436,374**

PROJECT TOTAL BUDGET	**$**	**9,277,430**

PART II: PROJECT BUDGET

(INSTRUCTION: All estimates for 1.a.-d., 2.a.-h., and 3 are current costs as of the date of application submission and should not include the costs for all intended construction and renovations to be undertaken. DO NOT CHANGE THIS FORM OR ITS LINE ITEMS. IF ADDITIONAL DETAIL OR CLARIFICATION IS NEEDED, ATTACH ADDITIONAL SHEET.)

A. Use of Funds

1. Capital Costs

a.	New Construction	
(1)	Building	
(2)	Fixed Equipment (not included in construction)	
(3)	Land Purchase	
(4)	Site Preparation	
(5)	Architect/Engineering Fees	
(6)	Permits (Building, Utilities, Etc.)	
SUBTOTAL		
b.	Renovations	
(1)	Building	$ 5,890,556.00
(2)	Fixed Equipment (not included in construction)	
(3)	Architect/Engineering Fees	$ 706,168.00
(4)	Permits (Building, Utilities, Etc.)	
SUBTOTAL		$ 6,596,724.00
C.	Other Capital Costs	
(1)	Major Movable Equipment	$ 1,727,380.00
(2)	Minor Movable Equipment	
(3)	Contingencies	$ 953,326.00
(4)	Other (Specify)	
TOTAL CURRENT CAPITAL COSTS (a-c)		$ 9,277,430.00
d.	Non Current Capital Costs	
(1)	Interest (Gross)	
(2)	Inflaction (state all assumptions, including time period and rate)	
TOTAL PROPOSED CAPITAL COSTS (a-d)		$ 9,277,430.00

2. Financing Cost and Other Cash Requirements

a.	Loan Placment Fees	

b.	Bond Discount	_____
c.	Legal Fees (CON related)	_____
d.	Legal Fees (other)	_____
e.	Printing	_____
f.	Consultant Fees	_____
	CON Application Assistance	_____
	Other (Specify)	_____
g.	Liquidation of Existing Debt	_____
h.	Debt Service Reserve Fund	_____
i.	Principal Amortization	_____
	Reserve Fund	_____
j.	Other (Specify)	_____

TOTAL (a - j)

3. Working Capital Startup Costs _____

TOTAL USES OF FUND (1 - 3) $ 9,277,430.00

B. Sources of Funds for Project:

1.	Cash	$ 9,277,430.00
2.	Pledges: Gross_____, less allowance for uncollectibles _____ = Net	_____
3.	Gifts, bequests	_____
4.	Interest income (gross)	_____
5.	Authorize Bonds	_____
6.	Mortgage	_____
7.	Working capital loans	_____
8.	Grants or Appropriations	_____
	(a) Federal	_____
	(b) State	_____
	(c) Local	_____
9.	Other (Specify)	_____

TOTAL SOURCES OF FUNDS (1 - 9) $ 9,277,430.00

Lease Costs:

a. Land	$_____ x _____ = $ _____
b. Building	$_____ x _____ = $ _____
c. Major Movalbe Equipment	$_____ x _____ = $ _____
d. Minor Movalble Equipment	$_____ x _____ = $ _____
e. Other (Specify)	$_____ x _____ = $ _____

EXHIBIT 7

Final Recommendations on Uncompensated Care Policy for 2016

Health Services Cost Review Commission
4160 Patterson Avenue Baltimore, MD 21215
(410) 764-2605

April 15, 2015

This document contains the final Staff recommendations the Uncompensated Care policy for 2016.

Finals Recommendations on Uncompensated Care Policy for 2016

INTRODUCTION

Overview

Since it first began setting rates, the HSCRC has recognized the cost of uncompensated care (charity care and bad debt) within Maryland's unique hospital rate setting system. As a result, patients who cannot pay for care are still able to access hospital services, and hospitals are credited for a reasonable level of uncompensated care provided to those patients.

Under the current HSCRC policy, uncompensated care is funded by a statewide pooling system in which regulated Maryland hospitals draw funds from the pool if they experience a greater-than-average level of uncompensated care and pay into the pool if they experience a less-than-average level of uncompensated care. This ensures that the cost of uncompensated care is shared equally across all of the hospitals within the system.

The HSCRC must determine the total amount of uncompensated care that will be placed in hospital rates for FY 2016 and the amount of funding that will be made available for the uncompensated care pool. Additionally, HSCRC must review the methodology for distributing these funds among hospitals.

Traditionally the HSCRC prospectively calculates the rate of uncompensated care at each regulated Maryland hospital by combining historical uncompensated care rates with predictions from a regression model. For fiscal 2015, the HSCRC adjusted this methodology to incorporate a prospective yet conservative adjustment for the expected impact of the Affordable Care Act's (ACA) Medicaid expansion on uncompensated care. The results of the historic trend and regression model were adjusted down from 7.23% to 6.14% to capture the expected impact of the State extending the full Medicaid benefits to people previously enrolled in the Primary Adult Care (PAC) program. PAC offered limited health care coverage including the cost of primary care, family planning, prescriptions, mental health care and addiction services, and outpatient hospital emergency room services. However, PAC did not reimburse hospitals for inpatient or outpatient care beyond the emergency room.

ACA implementation will influence the FY 2016 update as the variables underlying regression model include Medicaid coverage and the actual Medicaid expansion enrollment far exceeded the participants in the PAC program.

This report discusses the factors influencing uncompensated care rates in Maryland and makes recommendations to adjust the total funds available in the uncompensated care pool, to again use the results of last year's regression model for allocation of those funds in lieu of updating the regression analysis, and to update last's year prospective ACA adjustment to capture the full impact of the Medicaid expansion on uncompensated care.

The changes recommended are necessary to recognize an appropriate level of uncompensated care at hospitals in the State and to share the cost of that care equally across all regulated Maryland hospitals.

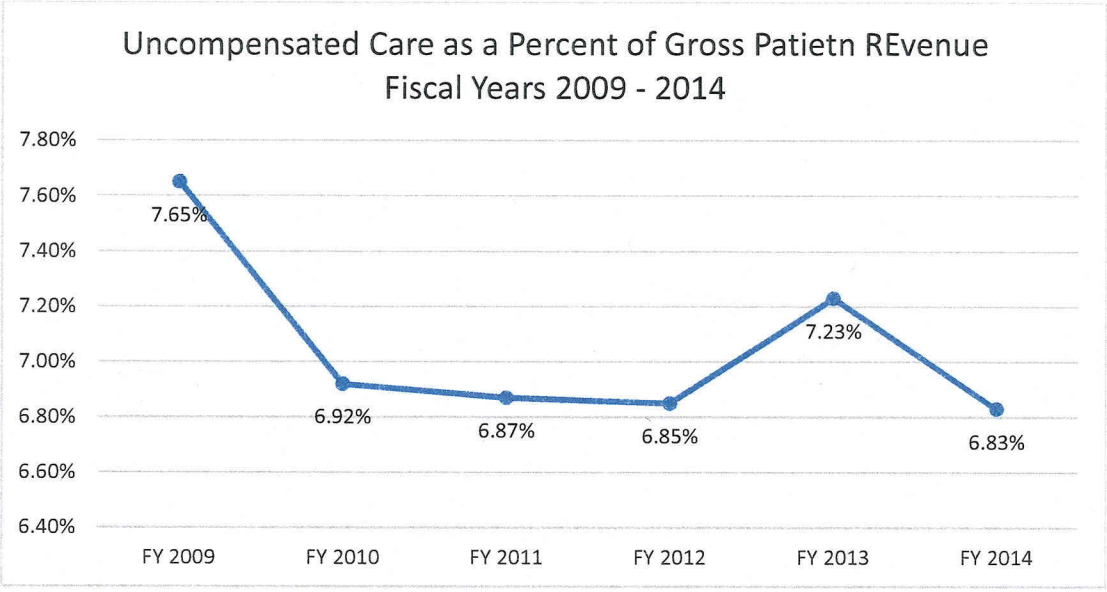
STAKEHOLDER INPUT

The conclusions in this report were reviewed with the Payment Models Workgroup and the Maryland Hospital Association's Financial Technical Issues workgroup. Several comments from the workgroups are incorporated in this staff report. Multiple iterations of hospital specific trends in self-pay and charity care were shared with each Maryland hospital. The overall analytic approach and figures for some hospitals were adjusted based on hospital feedback and additional analysis.

BACKGROUND

Recent Trends in Uncompensated Care

The chart below shows the actual total uncompensated care rate for all regulated Maryland hospitals between FY 2009 and FY 2014. Uncompensated care levels dropped between FY 2009 and FY 2012, before climbing slightly in FY 2013. Implementation of the ACA in mid-FY 2014 resulted in a decline in an overall uncompensated care for the year.



Current Uncompensated Care Policy

The Commission adopted the current uncompensated care policies between 2007 and 2014. The policies create a statewide pool built into the rate structure of Maryland hospitals. Hospitals either pay into or withdraw from the pool depending on each hospital's prospectively calculated rate of uncompensated care. Each year, the total amount of funds available in the pool is determined by the total per cent of gross patient revenue due to uncompensated care experienced in regulated Maryland hospitals during the previous year. For example, if in 2014 the actual total cost of uncompensated care were 6 percent, then in 2014 the pool would prospectively be set at 6 percent of the 2014 gross patient revenue.

For FY 2015, the prospective uncompensated care percentage for each hospital was computed by taking the average actual percent of uncompensated care experienced by the hospital over the past two years and combining that "actual" value with a predicted value of uncompensated care determined by a regression model. The annual uncompensated care percentage for each hospital was weighted equally between the two-year average and the predicted regression value as shown in the formula below.

$$\frac{Average\ UCC\ Rate\ for\ Past\ 2\ Years + Regression\ Value}{2} = Annual\ UCC\ Percentage$$

Once the annual uncompensated care percentage s were calculated for each hospital, they were adju sted so th at the pooling system will rem ain revenue neutral. Appendix I illustrates this calculation.

The regression m odel used to determ ine the FY 2015 predicted uncom pensated care percentage for each hospital relied upon five explanatory variables:

- The proportion of a hospital's total charges from inpatient Medicaid admissions through the emergency room
- The proportion of a hospital's total ch arges from inpatient comm ercial insurance cases
- The proportion of a hospital's total charges from inpatient self-pay and charity cases
- The proportion of hospital's total charges from outpatient self-pay and charity emergency department charges
- The proportion of a hospital's total charges from inpatient self-pay and charity admission through the em ergency room from the 80 th percentile of Medicaid undocumented immigrant enrollment zip codes

This model was applied to data f rom the two- year historical period used to generate the average actual uncompensated care percen tage described above. Three hospitals, Levindale Hospital, th e University of Maryland Rehabilitation & Orthopedic Ins titute (formerly Kernan Hospital), and the Shock Trauma Center were excluded from the regression calculation. U nder the current m odel, the HSCRC set the annual uncompensated care percen tages for these hospitals at their actual average uncompensated care percentage for the previous three years.

Enrollment under the Affordable Care Act (ACA)

A prim ary goal of the ACA was to expand coverage to uninsured or underinsured individuals. Counting both i ndividuals who have obtained Me dicaid coverage and those who have selected a private health plan through Maryland' s insurance exchange, more than 370,000 Marylanders enroll ed in coverage through F ebruary 2015. This includes coverage of about 254,000 Mary landers through new Medicai d eligibility categories (including people previously covered unde r PAC) and about 120,000 through private health plans.

HSCRC st aff i s focusi ng i ts effort s on t he new categories of Medi caid enro llees who account for about 70% of people covered through ACA related expansions. A wealth of information on this populations ' u tilization of hospita l se rvices bef ore and af ter ACA

implementation is available due to the collaborative efforts of Medicaid and the Chesapeake Regional Information System for our Patients (CRISP).

ANALYSIS

Determining Appropriate Level of Uncompensated Care Funding in Rates

The HSCRC must determine the percentage of uncompensated care to recognize in hospitals' rates to enable funding of the uncompensated care pool.

Normally staff would begin by updating the regression model and examining the actual UCC rate for the last two or three years. Updating the regression model or the historical uncompensated care experience to include FY 2014 data is not recommended. Only six months of experience with the ACA expansion is captured in the FY 2014 data. This short a period is inadequate for assessing the impact of the Medicaid expansion on uncompensated care. Staff, instead, recommend continuing to use the historical experience from FY 12 and FY 13 and the results of last year's regression model.

The only recommended change to the FY 2015 uncompensated care analysis is to update the prospective adjustment for the impact of Medicaid expansion for an analysis of the actual calendar 2014 impact of the Medicaid coverage expansion. The prospective adjustment made for FY 2015 was limited to an estimate of the impact of the PAC population gaining full Medicaid coverage. The adjustment for FY 2016 captures the actual calendar 2014 impact on uncompensated care from extending Medicaid coverage to the entire expansion population covered by Medicaid (PAC and non-PAC).

Changes in Self-Pay and Charity Charges

HSCRC staff has focused on quantifying the impact of the ACA's Medicaid expansion on uncompensated care. To evaluate the impact, staff initially compared the charges identified in the Commission's case mix data with a primary expected payer of self-pay or charity before and after the ACA expansion. Self-pay and charity were the focus of the analysis as they are the best indicators of charges incurred by the uninsured population. This assumption is supported by an analysis of write-off data that shows about 80% of self-pay/charity charges are written off at most hospitals.

The staff analysis compared total charges with a primary expected payer of self-pay/charity for the first six months of calendar 2013 (pre-Medicaid expansion) and calendar 2014 (post- Medicaid expansion). Only six months of data for each year were used as Medicaid enrollment files were required to verify the accuracy of some of the

data (see discussion below). Because Medicaid allows retroactive eligibility, incomplete enrollment data was available at the time of the analysis for the 2nd half of calendar 2014.

Hospitals advised that the trends from 2013 to 2014 were distorted by a lack of uniformity in the classification of charges identified as Medicaid pending (charges associated with cases where the patient was not already enrolled in Medicaid but may qualify for coverage). Until July 2014 when the Commission staff established a uniform policy, some hospitals reported Medicaid pending cases as self-pay while others reported these cases as Medicaid. To resolve this data issue, staff collaborated with Medicaid and CRISP. CRISP's master patient index was used to identify all the hospital charges associated with people with Medicaid coverage for the time of service. Commission staff used the results of the CRISP analysis to reassign charges between Medicaid and self-pay/charity:

- Charges identified in the case mix data as self-pay or charity but associated with a patient enrolled in Medicaid were re-assigned to the Medicaid category.

- Charges identified in the case mix data as Medicaid but associated with a patient who was not identified as CRISP as enrolled in Medicaid were re-assigned to the self-pay category.

The results of the revised analysis are provided in the table below. Combined self-pay/charity charges dropped by $150 million from the first half of calendar 2013 to the first half of calendar 2014. Annualizing the six-month trend produces a $299 million decline in self-pay/charity charges. This amount is $133 million more than the prospective adjustment of the Medicaid expansion to the PAC population incorporated into the HSCRC's FY 2015 uncompensated care policy.

Analysis of Self-Pay/Charity Charges First Half of 2013 to First Half of 2014
($ in Millons)

	CY 2013	CY 2014	$ Change	% Change
Self-Pay/Charity Charges in Case Mix Data	$357	$183		
Remove Self-pay/Charity in CRISP Medicaid	-75	-27		
Add MA as Payer Not in CRISP	165	140		
	$446	**$296**	**-$150**	-34%
Annualized Change			**-$299**	

The annualized $299 million change was then adjusted for:

- Increases in Out-of -State Medica id charges th at were rep orted with in-Sta te Medicaid charges at certain hospitals. The analysis treated out-of-State Medicaid as self-pay/charity. As a result, cale ndar 2014 self-pay/charity charges at border hospitals with sign ificant growth in out-of -State Med icaid ch arges were overstated.

- An overstatem ent of calendar 2014 self-pay /charity charges at one hospital that appears to have incorrectly classified expected payers in the case mix data.

- Price changes at fiv e hospitals that experi enced significant swi ngs in prices from calendar 2013 to calendar 2014.

The net impact of the adjustments is to reduce self-pay/charity charges b y $10 million in calendar 2014. As shown in the table below, the revised annualized change in self-pay charity charges from calendar 2013 to calend ar 2014 is $310 million. Staff recomm ends using the C Y 2014 decline in self-pay/charity charges, converted to a percentage to reduce the provision for UCC in hospitals' rates for FY 2016.

Adjustments to Analysis of Self-Pay /Charity Charges

$ in Millions

	CY 2013 1st 6 Months	CY 2014 1st 6 Months	$ Change
Self-Pay Charity Charges for First Half of Year	$446	$296	-$150
Out-of-State Medicaid	-14	-16	-2
Correct Data issue at one hospital		-4	-4
Price Leveling		1	1
Revised Totals	$432	$278	-$155
Annualized Change			-$310

The estimate for the reduction in UCC without any offsets for collections is 1.98 percent. It should b e noted that Medicaid receives a differential of 6 pe rcent; therefore, approximately 94 percent of the reduction of the uncom pensated care will be recognized in hospital rates due to a corresponding increase that will occur in the m ark up relative to the increase in the differential that will re sult from the hig her p roportion of Medicaid revenues. This mark-up change is a separate provision in the rate update process.

Based on these recommendations, the UCC in hospitals' rates would be set at 5.25 percent as shown below. This percent is nearly identical to the FY 2015 year-to-date figure of 5.23% reported by hospitals through February 2015.

	FY 15 UCC	FY 16 UCC
FY 15 Policy Before ACA Adjustment	7.23%	7.23%
ACA Impact*	-1.09%	-1.98%
Net	**6.14%**	**5.25%**

*FY 2015 Adjustment limited to PAC population.

Continuing Suspension of Charity Care Multiplier

HSCRC staff recommends continuing the suspension of the charity care multiplier indefinitely. The data have not improved and, furthermore, the expansion of coverage under the ACA will likely reduce charity care. This policy can be reevaluated in two to three years after the expansion and implementation of ACA have been completed.

Evaluation of Continuing Sources of Uncompensated Care

Last year the Commission directed staff to begin collecting data on write-offs to guide future development of uncompensated care regression models and uncompensated care policies. Hospitals have submitted information on write-offs and recoveries that occurred during calendar 2014. The data submitted cover claims for services incurred in calendar 2014 and prior years. The data, which are still being scrubbed, are summarized in the table below.

Write-off and Recovery Data Submitted During CY 2014

$ in Millions

	Write-Off Amount	Payer Share of Write-offs	Total Billed Amount	Write-off as % of Bill
Self-Pay/Charity/Medicaid	$586	58%	$1,229	48%*
Commercial	265	26%	1,630	16%
Medicare	116	11%	1,264	9%
Workers' Comp	14	1%	53	26%
Other	31	3%	84	37%
Total	**$1,012**		**$4,260**	

	Recovery	Recovery as % of Writeoff
Self-Pay/Charity/Medicaid	$104	18%
Commercial	128	48%
Medicare	44	38%
Workers' Comp	7	50%
Other	11	35%
Total	**$294**	29%

	Write-off Net of Recovery	Payer Share of Net	Total Billed Amount	Write-off as % of Bill
Self-Pay/Charity/Medicaid	$482	67%	$1,229	39%*
Commercial	$137	19%	1,630	8%
Medicare	$72	10%	1,264	6%
Workers' Comp	$7	1%	53	13%
Other	$20	3%	84	24%
Total	**$718**		**$4,260**	

*Most hospitals report write-offs as share of Medicaid, self-pay, charity bills at 75% to 80%. The state average is pulled down by a couple of outliers who report a substantial volume of charges and write-offs of about 20%. Staff are working with those hospitals to determine if there is a data reporting issue.

The majority (58%) of the write-offs were for charges with a primary expected payer of self-pay, charity, or Medicaid. Since Medicaid does not require enrollee cost sharing,

Medicaid write-offs are most likely cases where the person ultimately failed to qualify for Medicaid and lacked insurance.

About 26% of the write-offs are associated with a commercial payer with the average write-off representing 16% of total charges. With only one year of data available, it is too soon to determine the extent to which increasing deductibles are contributing to increases in uncompensated care. Continued collection of the data is recommended to enable analysis of multi-year trends and guide future development of uncompensated care regression models and policies.

Impact of Denials on All-Payer Model

In response to direction from the Commission during development of the FY 2015 uncompensated care policy, hospitals have begun submitting data on outpatient denials. Due to the uneven quality of initial submissions, insufficient data are available at this point to perform a meaningful analysis. Staff are working with hospitals to improve the uniformity of the data submissions and expect to release an initial analysis in September.

HSCRC staff recommend continued collection of this data to support development of trends analysis and a better understanding of the impact denials have on individual hospital revenues.

Future Uncompensated Care Policy

HSCRC staff notes that the changes to the uncompensated care policy laid out in this report should only be applied for FY 2016. Development of the FY 2017 uncompensated policy will occur in a less dynamic insurance market place and a more data rich environment. Almost two years of post-ACA implementation data including audited financial statements for FY 2015 will be available to update the regression model. With two years of data on write-offs also available, staff may be able to incorporate new variables into the regression model that better capture the continuing sources of uncompensated care.

RECOMMENDATIONS

Based on the preceding analysis, the HSCRC staff recommends that:

1. The uncompensated care provision in rates be reduced from 6.14% to 5.25%, effective July 1, 2015;

2. The combined results of the regression model and two years of historical data underpinning the FY 2015 uncompensated care policy be re-used for FY 2016:
    a. No update to the regression results.
    b. Combine the regression results with the same two years of actual data (FY 2012 and FY 2013) incorporated into the FY 2015 policy.
    c. Subtract the ACA driven decline in self-pay/charity charges from CY 2013 to CY 2014 from the modeled uncompensated care result for each hospital to derive its final percentage for determining its contribution or withdrawal from the uncompensated care pool. Appendix II shows the result of this calculation.
3. The Charity Care Adjustment be suspended indefinitely and not be reinstituted in FY 2016 rates;
4. Data continued to be collected on write-offs to guide future development of uncompensated care regression models and uncompensated care policies;
5. Data continued to be collected on outpatient denials, in addition to data already collected on inpatient denials, to understand the continuing trends in denials under the new All-Payer model; and
6. A new uncompensated care policy be developed for FY 2017 that reflects the patterns in uncompensated care experience, which are observed in FY 2015 and projected for FY 2016.

Appendix I: Calculation to Achieve a Revenue Neutral Policy

The HSCRC calculated the annual UCC percentage for each hospital by combining the average actual UCC percentage for each hospital for the past two years with a predicted UCC percentage from the regression model. The HSCRC then adjusted the annual UCC percentage for each hospital so that the total statewide UCC percentage was equal to the actual total statewide UCC percentage for 2013. This was done to achieve a revenue neutral system of pooling across all hospitals. This adjustment was done before any policy adjustments were made, such as the PAC reduction.

Revenue neutral adjustment factor:

$$= \frac{Total\ actual\ 2013\ UCC\ \% - Total\ calculated\ UCC\%\ for\ 2015}{Total\ actual\ \ 2013\ UCC\%} + 1$$

Adjusted UCC percentage for each hospital:

$$= revenue\ neutral\ adjustment\ factor * 2015\ UCC\%\ calculated\ for\ hospital\ 1$$

Appendix II: Proposed Uncompensated Care Levels by Hospital for FY 2016

	A	B	C	D	E
			C = A - B		E = A -D
	FY 2015 Policy Results Without PAC	FY 15 PAC Adjustment	FY 2015 Policy	FY 2016 ACA Expansion Adjustment	FY 2016 Policy
Meritus Medical Center	7.83%	1.66%	6.17%	3.08%	4.76%
Univ. of Maryland Medical Center	6.50%	1.85%	4.65%	3.69%	2.81%
Prince Georges Hospital	16.07%	1.09%	14.98%	1.09%	14.98%
Holy Cross Hospital of Silver Spring	8.84%	0.31%	8.53%	1.46%	7.39%
Frederick Memorial Hospital	6.33%	0.90%	5.43%	2.32%	4.02%
Harford Memorial Hospital	10.75%	1.51%	9.24%	2.00%	8.75%
Mercy Medical Center, Inc.	6.74%	1.34%	5.40%	1.02%	5.72%
Johns Hopkins Hospital	4.31%	0.78%	3.53%	1.21%	3.10%
UM Dorchester	8.25%	2.67%	5.58%	4.16%	4.09%
St. Agnes Hospital	8.13%	1.45%	6.69%	2.81%	5.33%
Sinai Hospital	5.83%	1.10%	4.73%	1.33%	4.50%
Bon Secours Hospital	17.59%	5.80%	11.79%	7.12%	10.47%
Franklin Square Hospital	7.74%	0.95%	6.80%	2.82%	4.92%
Washington Adventist Hospital	13.36%	0.59%	12.78%	1.16%	12.20%
Garrett County Memorial Hospital	10.10%	0.75%	9.36%	3.24%	6.86%
Montgomery General Hospital	7.02%	0.78%	6.25%	1.55%	5.47%
Peninsula Regional Medical Center	6.71%	1.30%	5.41%	1.84%	4.87%
Suburban Hospital Association,Inc	5.33%	0.28%	5.05%	1.25%	4.08%
Anne Arundel General Hospital	4.82%	0.54%	4.29%	1.45%	3.38%
Union Memorial Hospital	7.49%	1.45%	6.03%	2.39%	5.10%
Western Maryland	6.49%	1.06%	5.43%	2.88%	3.61%
St. Marys Hospital	7.41%	1.09%	6.32%	3.09%	4.32%
Johns Hopkins Bayview Med. Center	8.71%	1.73%	6.98%	3.22%	5.49%
UM Chestertown	9.01%	0.77%	8.24%	2.50%	6.51%
Union Hospital of Cecil County	8.25%	1.82%	6.43%	2.61%	5.64%
Carroll County General Hospital	5.23%	0.69%	4.53%	1.23%	3.99%
Harbor Hospital Center	9.12%	1.47%	7.65%	2.55%	6.57%
UM Charles Regional	8.15%	0.80%	7.35%	2.36%	5.79%
UM Easton	6.40%	0.83%	5.56%	1.58%	4.82%
UM Midtown	12.65%	3.52%	9.14%	4.14%	8.51%
Calvert Memorial Hospital	6.55%	1.05%	5.51%	2.17%	4.39%
Northwest Hospital Center, Inc.	8.47%	0.93%	7.54%	2.75%	5.73%
UM Baltimore Washington	8.82%	1.02%	7.80%	2.01%	6.81%
Greater Baltimore Medical Center	3.79%	0.38%	3.42%	0.41%	3.39%
McCready Foundation, Inc.	9.57%	2.76%	6.81%	3.54%	6.04%
Howard County General Hospital	6.33%	0.61%	5.72%	2.18%	4.15%
Upper Chesepeake Medical Center	5.71%	0.59%	5.12%	0.61%	5.10%
Doctors Community Hospital	9.10%	0.61%	8.49%	2.09%	7.01%
Laurel Regional Hospital	13.24%	0.94%	12.30%	1.74%	11.51%
Good Samaritan Hospital	7.33%	0.90%	6.43%	1.93%	5.40%
Shady Grove Adventist Hospital	7.24%	0.53%	6.71%	1.06%	6.17%
Fort Washington Medical Center	13.09%	0.86%	12.23%	1.34%	11.76%
Atlantic General Hospital	7.86%	1.42%	6.43%	1.26%	6.60%
Southern Maryland Hospital	7.54%	0.94%	6.60%	2.65%	4.89%
UM St. Joseph's	4.63%	0.72%	3.90%	0.68%	3.95%
UM Rehab and Ortho	5.80%	1.13%	4.67%	1.61%	4.19%
Univ. of Maryland (MIEMSS)	21.36%	0.25%	21.11%	-0.73%	22.09%
Levindale	1.83%	0.00%	1.83%	0.00%	1.83%
Statewide	**7.23%**	**1.09%**	**6.14%**	**1.98%**	**5.25%**

*University of Maryland and MIEMSS will have a combined rate of 5.35%