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Paper 2: A Proposal for Calculating Population-Based Volume Allowances for Hospitals on Global Budgets

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1. Introduction

1.1 - The purpose of this Paper is to propose a Volume Allowance methodology to be used to adjust the approved budgets of hospitals operating under Global Budget Rate (GBR) payment arrangements.

1.2 - The per capita limitations imposed by the Maryland Demonstration reflect the reasonable position that Maryland hospitals should not be held accountable for the additional volumes attributable to the growth in State residents or in the number of Medicare beneficiaries. Accordingly, our proposed methodology has been formulated based on the key assumption that in population-based payment systems, Volume Allowances for each hospital should be derived from demographic changes in the particular hospital's service area.[1]

1.3 - The proposed Demonstration will include two types of hospital payment arrangements: 1) A modified Charge per Case (CPC) option with stringent volume limitations; and 2) A Global Budget option (including both Total Patient Revenue or "TPR" hospitals and GBR hospitals) that establishes fixed budgets for services to a given population. The Demonstration requires that at least 80% of Maryland hospital revenue be shifted to either TPR or GBR payment arrangements by its fifth year.

1.4 – In this Paper, we propose two different Methods for calculating the Volume Allowances for GBR hospitals. Method 1 applies to hospitals in all Counties other than Baltimore City and Method 2 applies to Baltimore City hospitals only.[2] The proposed Methods will accomplish the following goals:

a) Align the hospital rate setting system with the objectives of population-based payment;
b) Allow for an equitable allocation of hospital revenue between hospitals opting for the Modified CPC and the Global Model systems; and

[1] Demographic changes include both changes in the population and age profile of patients residing in a given Global Budget hospital's identified Patient Service Area.

[2] Throughout this paper we will refer to Baltimore City as a County to simplify the presentation.

c) Support the HSCRC in ensuring that the Demonstration complies with the per-capita limitations imposed on hospital revenue growth.

1.5 – The Volume Allowance methodology proposed in this Paper relates solely to changes in the demographics of a given hospital's Service Area. In Paper 3, we will propose a separate adjustment related to a hospital's level of Potentially Avoidable Volumes (PAVs) as a means of providing hospitals incentives to reduce these PAVs.

2. The Statewide Volume Allowance Limit

2.1 - In keeping with the key assumption that Volume Allowances in population-based payment systems should be derived from the underlying demographic changes, we begin by establishing an aggregate Volume Allowance for the State that is based on the projected demographic change in Maryland. This is accomplished by calculating the projected change in the number of Weighted Residents, using the age cohorts and related weights of the TPR system, to classify Maryland residents and to weight their hospital expenditures in the derivation of Weighted Residents in each year.[3]

a) Using HSCRC data and estimates of population growth for the state, we have determined that the projected annual increase in Weighted Residents is approximately 1.4% for CY 2014 and in CY 2015. Roughly one half of this annual increase is attributable to population growth and the other half is attributable to the redistribution of residents by age cohort.[4] In each year of the Demonstration, the aggregate volume allowance in the State will be equal to the product of:

   - The variable cost factor (VCF) of 50%, and
   - The percentage increase in the projected number of Weighted Residents from the preceding year to the particular year of the Demonstration

b) In CY 2014 and CY 2015, the aggregate volume allowance would equal approximately .7%, which is the product of the 50% VCF and the projected annual increase in the State's Weighted Residents (1.4%). In this Paper, the Volume Allowances for both the GBR and the Modified CPC hospitals are constructed to be consistent with this Statewide aggregate Volume Allowance.

3. Two Proposed Methods for Determining the Volume Allowance for GBR Hospitals Based on a Generalized Definition of TPR Hospitals' Patient Service Area (PSA)

3.1 – Having identified an appropriate population-based methodology for establishing a State Wide Aggregate Volume Allowance, we now turn to the discussion of two proposed methods for

[3] In Paper 3, which deals with the topic of Potentially Avoidable Volumes, we suggest modifications to this approach that identify and adjust for PAVs in calculating the Weighted Residents of a hospital's VPSA.
[4] An example of the calculation of projected change in the number of Maryland Weighted Residents is shown in Appendix 1 at the end of this Paper.

determining population-based volume allowances for GBR hospitals in a way that is consistent with the formulation of the Statewide Aggregate Volume Allowance. The HSCRC's current TPR Arrangement operates as a population-based payment system covering the residents of the PSA of the particular hospital (see Footnote 5 for a general description of a PSA). Under the HSCRC's policy framework for TPR hospitals, the allowances provided to each TPR hospital for increases in its volume of service are derived from the demographics of the hospital's PSA.[5]

3.2 – It is not possible to create a Global Model for most non-TPR hospitals in the same way they are created for TPR hospitals because these hospitals do not have well-defined PSAs.[6] Therefore, a central problem in crafting the Global Models is how to credit the target budgets of the GBR hospitals with annual allowances that adequately account for demographically-induced increases in their volumes of service.

3.3 – As noted above, the HSCRC must shift increasing amounts of hospital revenue to Global Models over time. Accordingly, in order to facilitate this shift, the Volume Allowances for GBR hospitals should be at least equal to, and generally more favorable than, the volume adjustments of the Modified CPC system.

3.4 – As noted above, this Paper proposes two volume allowance methodologies for Global Model hospitals. Method 1 applies to all counties (except Baltimore City) based on a generalized definition of the PSAs of hospitals under the TPR. The generalized Patient Service Areas associated with this proposed Method 1, which are termed "Virtual Patient Service Areas" (VPSAs), are defined in terms of populations within each of Maryland's 23 Counties.

a) A VPSA is defined on a collective basis for all of the hospitals in each County by doing the following:

   The Commission would first determine the Maryland hospital services provided to the residents of each County and would break down these services into three categories:

   i) The hospital services provided by hospitals in the County

   ii) The hospital services provided by the hospitals in a County other than the particular County that account for a "substantial proportion" of the hospital services of the residents of the particular County, and

[5] Generally, the PSAs of the TPR hospitals can be easily defined because these hospitals are typically relatively isolated facilities serving discrete patient populations. TPR hospital PSAs are generally defined as the set of zip codes from which the hospital receives the vast majority of its patients (such as 75% of its patient population in a particular calendar year).

[6] TPR hospital budgets were established based on the historical aggregate revenues of the particular TPR hospital in some chosen base year, trended forward to the first and subsequent performance years by an assumed annual inflation update and an adjustment for that hospital's projected change in its PSA demographics (i.e., changes in both the population and the age profile of PSA residents).

iii) The hospital volumes of services not included in categories (i) or (ii)

These patients-flow statistics in (i) and (ii) are then used to identify a VPSA for any given hospital on a Global Model and to develop a corresponding basis for a demographic adjustment for that Global Model hospital. An example of the establishment of a VPSA for the two hospitals in Harford County is provided in Appendix 2 of this Paper

b) Thus, the VPSA of a hospital includes a fraction of the population of the particular County plus a fraction of the population of every other County whose residents receive a "substantial proportion" of hospital services from the particular County's hospitals.[7] Sixteen of the Counties include a single hospital and, for 13 of these Counties, the VPSA includes only residents of the particular County.

c) Under the Method 1 approach, an aggregate volume allowance for all of the hospitals in each County is derived based on the demographic changes in the resident population of its defined VPSA. The volume allowance of the particular County (and would apply to all hospitals in a particular county on a collective basis) is calculated in a manner similar to the TPR Volume Allowances in each year of the Demonstration as the product of:

- The projected percentage change in the Weighted Residents of a VPSA in a given year; and
- The variable cost factor (VCF) of 50% (we note our belief that the VCF of 25% that is used in the TPR arrangement should be increased to 50% in order to make the Global Budget Volume Allowances at least comparable to and generally more attractive than those of the Modified CPC system).[8]

3.5 - For the 13 Counties with VPSAs comprised solely of residents in the County, the Volume Allowances per Method 1 would be equal to the Volume Allowances provided by the TPR Demographic Adjustments (assuming that the TPR VCF would be increased from 25% to 50%). In this way, the proposed Method 1 for calculating volume allowances generalizes the policy framework that is applied to TPR hospitals.[9]

3.6 – When applied to Counties (other than Baltimore City) that have more than one hospital, Method 1 would apply the aggregate derived percentage amount of the County volume allowance to each hospital in the County. For Counties such as Harford, Baltimore, Anne Arundel,

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[7] For purposes of this analysis, a "substantial proportion" is defined to mean 10% or more of the hospital services provided to a County's residents by the hospitals of the particular County for which the VPSA is being defined.

[8] As will be discussed in Paper 4 that deals with the topic of establishing the Annual Update Allowance, Global Model that have a 50% VCF for demographically- induced volume adjustments will generally present hospitals with a more attractive option than the Modified CPC system because these hospitals receive this adjustment automatically, whether or not they realize the volume increase.

[9] Allowances derived in this way are equal to the Volume Allowances provided by the TPR Demographic Adjustments except that the 25% VCF multiplier of the TPR arrangement is replaced by the 50% VCF of the volume adjustment methodology of the Modified CPC arrangement.

Montgomery and Prince Georges, the Method 1 and Method 2 generate almost identical results (i.e., showing differences in the volume adjustments between the two methods at the level of the fourth decimal point). Thus, it appears that one does not obtain any additional meaningful information by performing the analysis at the hospital level. Also defining the VPSAs at the County level can provide more incentives for hospitals in a particular County to cooperate as they attempt to meet the needs of their identified population and the goals of the overall Demonstration.

4. The Special Case of Baltimore City Hospitals

4.1 - For Baltimore City, the situation is very different than in the other counties, including those with more than one hospital, because the VPSA of Baltimore City includes significant subpopulations drawn from every Maryland County with the exception of Allegheny County in Western Maryland. The distribution of the utilization that is drawn from these other counties varies widely across the hospitals in Baltimore City. In particular, a disproportionately large share of this utilization is concentrated in the major teaching and specialty hospitals. Therefore, it is appropriate to distribute the Baltimore City Volume Allowance on a non-uniform basis that reflects the concentration of referrals from the other counties to the major teaching and specialty hospitals. We propose an alternative, non-uniform distribution of the overall volume adjustment approach for Baltimore City that reflects the referrals to each hospital. We will refer to this volume adjustment approach as "Method 2."

4.2 - Baltimore City hospitals account for a "substantial proportion" (i.e. more than 10%) of the hospital services provided to the residents of every Maryland County other than Allegheny County in Western Maryland. As a result, the Baltimore City VPSA includes a fraction of the population of each such County and the calculation of the percentage change in Baltimore City's Weighted Residents therefore combines the percentage changes in the Weighted Residents of each such County.

4.3 - For instance, only 18.4% of the services provided by the University of Maryland Medical System (UMMS) to Maryland residents in UMMS's VPSA are provided to residents of Baltimore City. The other 81.6% of its services are provided to residents of the State who live outside Baltimore City. This means that over 80% of the VPSA population of UMMS resides outside of Baltimore City in other Maryland Counties. Therefore, the UMMS increase in the Weighted Residents of its VPSA is determined primarily by the demographic changes in Maryland outside of Baltimore City.

4.4 - Because the statewide referrals to Baltimore City are concentrated in a relatively small number of teaching hospitals (i.e., UMMS, the Maryland Trauma Center, JHH, etc.), we propose to allocate the aggregate Baltimore City volume allowance to the Baltimore City hospitals based on the pattern of statewide referrals to each hospital. In this arrangement, the major Baltimore teaching hospitals would receive Volume Allowances that would be larger than those of the community hospitals to reflect the regional character of their referral base.[10].

[10] Appendix 3 illustrates the patient referral patterns from counties outside of Baltimore City to hospitals in the City by showing the referral pattern for the University of Maryland Medical System.

5. Demographic Changes, Volume Allowances/Volume Governor of the Modified CPC Hospitals

5.1 - Based on the methodologies described above, it is possible to calculate a "volume allowance" for all hospitals, including those on the Modified CPC arrangement, based on the demographics of the hospital's VPSA.

5.2 - The sum of the Volume Allowances of all Maryland hospitals should equal the aggregate volume allowance for the State, which we have projected as .7% of the hospitals' aggregate revenue in CY 2014 and CY 2015. Under the proposed methodology for establishing a Volume Governor, the Volume Governor of the Modified CPC hospitals should equal the sum of the projected changes in the Weighted Residents of the VPSAs of the Modified CPC hospitals. This means that the maximum payment to the Modified CPC hospitals for volume increases would equal 50% of this amount or the sum of the Volume Allowances they would have received if they had all opted for the Global Model. However, the Modified CPC system is generally less attractive than the Global Budget option under this proposed approach, because if the CPC hospitals do not realize the volume increases predicted by the Demographic Adjustment they will only receive 50 cents on the dollar for these lower volumes. In addition, if these hospitals exceed the volumes predicted by the demographic adjustment they will be subject to offsets applied by the Volume Governor mechanism. Conversely, under this proposed approach, the Global Budget hospitals will receive increases to their rates equal to the amount predicted by the Demographic Adjustment, independent of whether they realize these volume increases or not.

6. Summary of Proposed Volume Allowance Methods and Our Recommendations

6.1 – In summary, we are proposing two Methods for calculating the Volume Allowances for GBR hospitals:

a) Method 1 (which would apply to all Counties except Baltimore City). Under Method 1, the VPSA of each County would be a subset of the County's population plus a fraction of the population of any other County receiving a substantial share of hospital services from the hospitals in the particular County, and the Volume Allowance for each of the hospitals would be a uniform equal percentage calculated on a Countywide-basis. This approach derives the Volume Allowance based on the collective experience of all hospitals in a particular County. It also adequately accounts for outside referrals to hospitals in the County.

b) Method 2 applies to Baltimore City hospitals. In Baltimore City, out-of-area referrals are concentrated in selected hospitals (i.e., the major teaching and certain specialty hospitals). The concentration of out-of-area referrals in selected hospitals suggests that the Volume Allowances for Baltimore City hospitals should be calculated on a hospital-specific basis rather than on a Countywide basis.

6.2 - We recommend the use of Method 1 for hospitals outside Baltimore City that have adopted Global Models. The Demographic Adjustment would be calculated on a Countywide basis and all of the hospitals in each County would receive the same County-specific Demographic Adjustment.

6.3 - The hospitals in Baltimore City that opt for a Global Model would receive the hospital-specific adjustment derived in Method 2 by allocating the VPSA of Baltimore City to the individual hospitals and by deriving a Demographic Adjustment tied to each hospital's allocated VPSA.

6.4 - The hospitals that remain on the Modified CPC system would have a Volume Governor equal to the average Demographic Adjustment that they would have received if each of these hospitals had elected to operate under a Global Model. This means that, after the application of the Volume Governor, the total of the Volume Allowances for the hospitals operating under the Modified CPC system, plus the total of the Demographic Adjustments of the hospitals operating under Global Models, will equal 50% of the statewide increase in Weighted Residents. These limitations are in keeping with the basic principles of population-based payment and will incentivize hospitals to adopt the Global Model approach by giving such hospitals more attractive and stable Volume Allowances. As noted, the Global Budget option will be relatively more attractive because these hospitals will be allowed projected volume increases associated with demographic changes in their PSAs or VPSAs regardless of whether they realize these volume increases or not.

6.5 - The HSCRC staff has proposed modifying the weights of the sex/age cohorts of the TPR arrangements (the weights used in the preceding calculations) by removing from the derivation of the weights for all, or a portion of, the charges for Potentially Avoidable Volumes (PAVs). We anticipate that these modifications will reduce the Demographic Adjustments we are proposing. This topic is discussed in more detail in Paper 3 of our submission relating to proposed approaches for addressing Potentially Avoidable Volumes.

6.6 - The calculation of the Demographic Adjustments of the TPR hospitals should, to the maximum extent practicable, equal those of other hospitals on Global Models. Our Method 1 achieves this result provided that the VCF that is applied to each TPR hospital's change in Weighted Residents is increased from 25% to 50%.

Appendix 1 – Illustrative Example of a Calculation of the Change in Weighted Residents for the State of Maryland

A	B	C	D	(A x C)	(A x D)
		Maryland Population Unweighted		Maryland Population Weighted	
MD Whts Weights (1)	Age Cohorts	2000	2010	2000	2010
0.34	0-14	1,136,846	1,139,168	386,528	387,317
0.71	15-54	3,089,957	3,338,815	2,193,869	2,370,559
1.60	55-64	470,376	649,961	752,602	1,039,938
2.55	65-74	321,285	363,803	819,277	927,698
3.22	75-84	211,120	226,955	679,806	730,795
4.25	85+	66,902	84,479	284,334	359,036
Totals		5,296,486	5,803,181	5,116,415	5,815,342
% change			9.57%		13.66%
Average Annual Increase			0.92%		1.29% (2)

(1) Weights reflect the relative hospital resource use (not adjusted for the level of Potentially Preventable Volumes) of of the population by age cohort.

(2) Note: this example is used for illustrative purposes only. Maryland State population forecasts for 2010 to 2020 project a 1.4% iincrease in the Weighted Residents for CY 2014 and CY 2015.

Appendix 2 –<u>The Determination of a VPSA for Harford County – A County with Two Hospitals</u>

In the example of Harford County, there are two hospitals, Upper Chesapeake and Harford Memorial. These hospitals provide a "substantial proportion" of the hospital services of the residents of Cecil County. Using the allocation methodology described in this Paper, based on the data shown in Schedule 1, Harford County would be allocated 16.7% of the 102,349 residents of Cecil County, or 17,092 residents.

Using its annual Case Mix data, the HSCRC could have determined that 16.7% of the patients in Cecil County utilize the services of the hospitals in Harford County. This outflow of patients from Cecil County to Harford County hospitals constitutes a "substantial proportion" of patient services (i.e. in excess of 10%). We summarize the populations of residents that are the source of the demand for services of Harford County hospitals on Schedule 1 and refer to the aggregation of these populations as the Virtual Patient Service Area (VPSA) of Harford County.

Schedule 1
Harford County
Resident Population in the VPSA

County	% Service	Population in VPSA	% Total
Harford	43.4%	105,219	86.0
Cecil	16.7%	17,092	14.0
Total		**122,311**	**100.0**

Unlike the patient service areas (PSAs) of the TPR hospitals, the VPSA that is created in this example is not a specific group of residents in Harford and Cecil County. The demographic changes of the VPSA would be expected to affect the demand for services at the Harford County hospitals just as the demographic changes of the PSA of each TPR hospital would be expected to effect the demand for services at the particular TPR hospital.

Using this VPSA, it is possible to predict the impact of Demographic Changes (i.e. population increases or decreases plus changes in the age of the population) on the Harford County hospitals in terms of the level of population-driven demand for hospital services) by combining the Demographic Changes of Harford and Cecil Counties based on the population distribution of the Harford County VPSA. For example, to account for the impact of just the annual projected population increases of Harford County (.55%) and of Cecil County (.48%) on the demand for services of the Harford County hospitals, one would combine the population increases using the population distribution of the Harford County VPSA as set forth below:

.86 (.55%) + .14 (.48%) = .54%

This calculation suggests that population growth in Harford and Cecil County will increase the demand for the services of the Harford County hospitals by .54%.

Schedule 2 sets forth a more complete Demographic calculation that projects the effects of both the population change and the aging of the population in Harford County (1.64%) and Cecil County (1.58%) on the demand for the services of Harford County hospitals. Schedule 2 projects this effect at 1.63% per year.

Schedule 2
Harford County Hospitals
Projecting the Effects of Demographic Changes
On the Demand for Hospital Services

VPSA Counties	VPSA Population	% Total	Demographic Change	Increases in Hospital Demand
Harford	105,219	86.0	1.64%	1.41%
Cecil	17,092	14.0	1.50%	.22%
Total	**122,311**	**100.0**		**1.63%**

Schedule 3 sets forth the projected impact of demographic changes on the level of hospital services in each County based on the VPSA methodology before application of the VCF.

Schedule 3
Maryland Counties
Projected Increase in Weighted Residents

Allegheny	.54%
Anne Arundel	1.87%
Baltimore City	1.39%
Baltimore	1.18%
Calvert	1.82%
Carroll	1.35%
Cecil	1.58%
Charles	2.40%
Dorchester	0.91%
Frederick	2.02%
Garrett	0.93%
Harford	1.63%
Howard	2.61%
Kent	0.98%
Montgomery	1.96%
Prince Georges	1.79%
Somerset	0.37%
St. Mary's	2.40%
Talbot	1.14%
Washington	1.13%
Wicomico	0.97%
Worchester	1.02%
Total	**1.59%**

Appendix 3 – Baltimore City Patient Referral Data Example for the University of Maryland Medical System (UMMS)

As noted in Section 4 of this Paper, only 18.4% of the services provided by UMMS to Maryland residents in UMMS's VPSA are provided to residents of Baltimore City. This means that, with this definition of UMMS's VPSA, over 80% of the VPSA population of the hospital is located outside of Baltimore City in the Maryland Counties. Therefore, the UMMS increase in the Weighted Residents of its VPSA is determined primarily by the demographic changes in Maryland outside of Baltimore City. No part of the Allegheny County population is included in the UMMS VPSA because the Baltimore City hospitals do not provide a "substantial proportion" of the hospital services received by Allegheny County residents.

For example, UMMS accounts for 10.45% of the CMADs of hospital service provided by Maryland hospitals to Anne Arundel County residents. Anne Arundel County has a population of 535,205, so the VPSA of UMMS will include 55,825 Anne Arundel residents. The table below sets forth the VPSA of UMMS by County in column 2.

The UMMS Hospital
Calculation of the Increase in Weighted Residents
Method 2

County	VPSA Population	Prop of VPSA to Total	Inc in Weighted Residents	Combined Effect
ANNE ARUNDEL	55825	0.129	1.862%	0.002401407
BALT CITY	79531	0.184	0.651%	0.001195248
BALTIMORE	55867	0.129	1.127%	0.001454079
CALVERT	5354	0.012	1.823%	0.000225489
CAROLINE	5823	0.013	0.782%	0.000105226
CARROLL	13954	0.032	1.350%	0.000435122
CECIL	11028	0.025	1.581%	0.000402720
CHARLES	13252	0.031	2.401%	0.000735028
DORCHESTER	4612	0.011	0.913%	0.000097315
FREDERICK	17058	0.039	2.022%	0.000796719
GARRETT	1056	0.002	0.929%	0.000022651
HARFORD	28356	0.065	1.636%	0.001071868
HOWARD	25133	0.058	2.606%	0.001513065
KENT	4515	0.010	0.980%	0.000102156
MONTGOMERY	33919	0.078	2.006%	0.001571597
PRINCE GEORGES	35674	0.082	1.748%	0.001440162
QUEEN ANNES	5118	0.012	1.968%	0.000232653
SOMERSET	1129	0.003	0.370%	0.000009655
ST MARYS	4229	0.010	2.400%	0.000234451
TALBOT	7055	0.016	1.247%	0.000203193
WASHINGTON	13126	0.030	1.133%	0.000343600
WICOMICO	6341	0.015	1.077%	0.000157781
WORCESTER	3334	0.008	1.024%	0.000078868
Grand Total	431289	1.000		0.014830054

Columns 3-5 calculate the proportion of each County's VPSA population, summarize the changes in the Weighted Residents of each County, and combine these changes as a weighted average using the proportions in column 2 as the weights. This weighted average, 1.48%, represents the change in the Weighted Residents in UMMS's VPSA. The population-based volume allowance associated with this 1.48% would be 0.74% (i.e., 1.48% multiplied by the VCF of 50%).