

Calculation of HCAHPS Scores: From Raw Data to Publicly Reported Results

Overview of Presentation

- **Process Submitted HCAHPS Data**
- **Calculate HCAHPS Scores w/Example**
 - HCAHPS Composite Measure Calculation
 - Patient-Mix Variables
 - Final HCAHPS scores

Process Submitted HCAHPS Data

- Remove surveys determined to be **ineligible** for HCAHPS
- Exclude surveys that do not meet HCAHPS criteria for survey **completeness**
- HCAHPS scores are calculated from eligible and completed surveys

HCAHPS “Boxes”

- **“Top-Box”**: most positive response category
 - “Always” for 5 HCAHPS Composites, “Yes” for Discharge Information, “9” or “10” for Hospital Rating, and “Definitely” for Recommend the Hospital
- **“Middle-Box”**: “in-between” response category
 - “Usually” for 5 HCAHPS Composites, does not exist for Discharge Information, “7” or “8” for Hospital Rating, and “Probably Yes” for Recommend the Hospital
- **“Bottom-Box”**: least positive response category
 - “Sometimes” or “Never” for 5 HCAHPS Composites, “No” for Discharge Information, “0” through “6” for Hospital Rating, and “Definitely No” or “Probably No” for Recommend the Hospital

HCAHPS Composite Example

- **Nurse Communication, “Top-Box”**
 - **“Always”** is the most positive response category for all 3 questions that comprise Nurse Communication
 - Q1: Nurse courtesy and respect
 - Q2: Nurse listen
 - Q3: Nurse explain

HCAHPS Composite Example *(cont'd)*

1. During this hospital stay, how often did nurses treat you with courtesy and respect?

- 1 Never
- 2 Sometimes
- 3 Usually
- 4 Always

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HCAHPS Composite Example *(cont'd)*

- Hospital A has 7 completed surveys

Survey ID	Q1 Response	Nurse1 Top-Box	Q2 Response	Nurse2 Top-Box	Q3 Response	Nurse3 Top-Box
1	Always	1	Always	1	Always	1
2	Sometimes	0	Never	0	Sometimes	0
3	Always	1	Always	1	Always	1
4	Usually	0	Always	1	Always	1
5	Always	1	Always	1	Always	1
6	Always	1	Usually	0	Always	1
7	Always	1	Always	1	Always	1

HCAHPS Composite Example *(cont'd)*

Calculate mean for each of Nurse1 Top-Box, Nurse2 Top-Box, and Nurse3 Top-Box:

$$\text{Nurse1 Top-Box mean} = (1+0+1+0+1+1+1) / 7 = 5/7$$

$$\text{Nurse2 Top-Box mean} = (1+0+1+1+1+0+1) / 7 = 5/7$$

$$\text{Nurse3 Top-Box mean} = (1+0+1+1+1+1+1) / 7 = 6/7$$

HCAHPS Composite Example *(cont'd)*

Nurse Communication composite score for Hospital A

Calculate the Nurse Communication composite mean (Y) as follows:

$$Y = (\text{Nurse1 Top-Box mean} + \text{Nurse2 Top-Box mean} + \text{Nurse3 Top-Box mean}) / 3 = (5/7 + 5/7 + 6/7) / 3 = \mathbf{0.762}$$

Patient-Mix Variables: Education

24. What is the highest grade or level of school that you have completed?

- 1 8th grade or less
- 2 Some high school, but did not graduate
- 3 High school graduate or GED
- 4 Some college or 2-year degree
- 5 4-year college graduate
- 6 More than 4-year college degree

Patient-Mix Variables: Education (cont'd)

Question 24 for Hospital A

- **Education:**

- Derived from HCAHPS survey (values range from 1 to 6)
- Calculate the Education mean for Hospital A:

$$\begin{aligned} H_{\text{EDUC}} &= (4+1+\dots+3) / 7 \\ &= 22/7 = \mathbf{3.14} \end{aligned}$$

Survey ID	Education
1	4
2	1
3	6
4	5
5	1
6	2
7	3

Patient-Mix Variables: Overall Health

23. In general, how would you rate your overall health?

- 1 Excellent
- 2 Very Good
- 3 Good
- 4 Fair
- 5 Poor

Patient-Mix Variables: Overall Health (cont'd)

Question 23 for Hospital A

- **Self-Rated Health:**

- Derived from HCAHPS survey (values range from 1 to 5)
- Calculate the Self-Rated Health mean for Hospital A:

$$\begin{aligned} H_{\text{HLTH}} &= (5+5+\dots+4) / 7 \\ &= 24/7 = \mathbf{3.43} \end{aligned}$$

Survey ID	Self-Rated Health
1	5
2	5
3	2
4	3
5	4
6	1
7	4

Patient-Mix Variables: Non-English Language

27. What language do you mainly speak at home?

- ¹ English
 - ² Spanish
 - ³ Some other language (please print)
-

Patient-Mix Variables: Non-English Language *(cont'd)*

Question 27 for Hospital A

- **Non-English Language**

- If Q27 answer value is “Spanish” or “Some other language” then let indicator variable *Non-English* = 1, otherwise *Non-English* = 0
- Calculate the Non-English mean for Hospital A:

$$\begin{aligned} H_{\text{NENG}} &= (0+1+\dots+0) / 7 \\ &= 2/7 = \mathbf{0.29} \end{aligned}$$

Survey ID	Question 27	Non-English
1	English	0
2	Spanish	1
3	Some other	1
4	English	0
5	English	0
6	English	0
7	English	0

Patient-Mix Variables: Age Range Age Ranges for Hospital A

- Create 7 indicator (0 or 1) age variables for each of the 8 age range groups (Age 85+ is the reference category):

Survey ID	Age 18-24	Age 25-34	Age 35-44	Age 45-54	Age 55-64	Age 65-74	Age 75-84
1	0	0	0	0	0	1	0
2	0	0	0	0	1	0	0
3	0	1	0	0	0	0	0
4	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0
6	0	0	1	0	0	0	0
7	0	0	0	0	0	1	0

Patient-Mix Variables: Age Range (cont'd)

For Hospital A, calculate mean of each of the 7 age range variables

$$H_{18-24} = (0+0+0+0+1+0+0) / 7 = 1/7 = \mathbf{0.14}$$

$$H_{25-34} = (0+0+1+0+0+0+0) / 7 = 1/7 = \mathbf{0.14}$$

$$H_{35-44} = (0+0+0+0+0+1+0) / 7 = 1/7 = \mathbf{0.14}$$

$$H_{45-54} = (0+0+0+0+0+0+0) / 7 = 0/7 = \mathbf{0.00}$$

$$H_{55-64} = (0+1+0+0+0+0+0) / 7 = 1/7 = \mathbf{0.14}$$

$$H_{65-74} = (1+0+0+0+0+0+1) / 7 = 2/7 = \mathbf{0.29}$$

$$H_{75-84} = (0+0+0+0+0+0+0) / 7 = 0/7 = \mathbf{0.00}$$

Patient-Mix Variables: Service Line

Hospital A's Service Line

- Create an indicator (0 or 1) variable for Maternity and Surgical (Medical is reference category):

Survey ID	Service Line	Maternity	Surgical
1	Surgical	0	1
2	Medical	0	0
3	Maternity	1	0
4	Medical	0	0
5	Maternity	1	0
6	Medical	0	0
7	Medical	0	0

Patient-Mix Variables: Service Line *(cont'd)*

Calculate Hospital A's mean for Maternity and Surgical variables

$$H_{\text{MAT}} = (0+0+1+0+1+0+0) / 7 = 2/7 = \mathbf{0.29}$$

$$H_{\text{SURG}} = (1+0+0+0+0+0+0) / 7 = 1/7 = \mathbf{0.14}$$

Patient-Mix Variables: Service Line x Age

- **Service Line x Age Interaction Variables**
 - Create single variable called **Age** that takes on values 1 through 8, to indicate a patient's age range

Age Range:	18-24	25-34	35-44	45-54	55-64	65-74	75-84	85+
Age:	1	2	3	4	5	6	7	8

Patient-Mix Variables: Service Line x Age (*cont'd*)

Use variables **Surgical**, **Maternity**, and **Age** to create the following interaction variables:

- **Surgical*Age** = (Surgical) x (Age)
- **Maternity*Age** = (Maternity) x (Age)

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Patient-Mix Variables: Service Line x Age (*cont'd*)

Service Line x Age Interaction for Hospital A

Survey ID	Age	Maternity	Surgical	Maternity* Age	Surgical* Age
1	6	0	1	$0*6 = 0$	$1*6 = 6$
2	5	0	0	$0*5 = 0$	$0*5 = 0$
3	2	1	0	$1*2 = 2$	$0*2 = 0$
4	8	0	0	$0*8 = 0$	$0*8 = 0$
5	1	1	0	$1*1 = 1$	$0*8 = 0$
6	3	0	0	$0*3 = 0$	$0*3 = 0$
7	6	0	0	$0*6 = 0$	$0*6 = 0$

Patient-Mix Variables: Service Line x Age (*cont'd*)

For Hospital A, calculate the mean for **Maternity x Age** and **Surgical x Age** variables:

$$H_{\text{MAT*AGE}} = (0+0+2+0+1+0+0) / 7 = 3/7 = \mathbf{0.43}$$

$$H_{\text{SURG*AGE}} = (6+0+0+0+0+0+0) / 7 = 6/7 = \mathbf{0.86}$$

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Patient-Mix Variables: Response Percentile

- A survey's **Lag Time** is required to create the PMA variable **Response Percentile**
- All completed surveys for a given month and hospital are ranked by **Lag Time**
 - **Lag Time** = # of days between patient's discharge date and the date that data collection activities ended for the patient

$$\text{Response Percentile} = \frac{\text{Lag Time Rank}}{\text{Monthly Sample Size}}$$

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Patient-Mix Variables: Response Percentile (*cont'd*)

Response Percentile for Hospital A

Response Percentile = Lag Time Rank / Monthly Sample Size

Survey ID	Month	Lag Time (in days)	Lag Time Rank (by month)	Monthly Sample Size	Response Percentile
1	January	21	1	9	1/9
2	January	34	2	9	2/9
3	February	8	1	11	1/11
4	February	12	2	11	2/11
5	March	29	2	8	2/8
6	March	6	1	8	1/8
7	March	30	3	8	3/8

Patient-Mix Variables: Response Percentile (*cont'd*)

Calculate Hospital A's mean Response Percentile for the quarter

$$\begin{aligned} H_{\text{RPCT}} &= [(1/9)+(2/9)+(1/11)+(2/11)+(2/8) \\ &\quad +(1/8)+(3/8)] / 7 \\ &= \mathbf{0.19} \end{aligned}$$

3 Components needed for Hospital PMA

- **Hospital means** for each patient-mix variable (just calculated)
- **National means** for each patient mix variable found on www.hcahpsonline.org
- Patient-level **Adjustments** for each patient-mix variable found on www.hcahpsonline.org

PMA Means for Hospital A

$$H_{\text{EDUC}} = 3.14$$

$$H_{18-24} = 0.14$$

$$H_{\text{MAT}} = 0.29$$

$$H_{25-34} = 0.14$$

$$H_{\text{SURG}} = 0.14$$

$$H_{\text{HLTH}} = 3.43$$

$$H_{35-44} = 0.14$$

$$H_{45-54} = 0.00$$

$$H_{\text{MAT*AGE}} = 0.43$$

$$H_{\text{NENG}} = 0.29$$

$$H_{55-64} = 0.14$$

$$H_{\text{SURG*AGE}} = 0.86$$

$$H_{65-74} = 0.29$$

$$H_{\text{RPCT}} = 0.19$$

$$H_{75-84} = 0.00$$

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National Means for Patient-Mix Variables: Table 3 from www.hcahpsonline.org

Patient-Mix Adjustment (PMA)	National Mean
Education (per level) (1=8th grade or less and 6=More than 4-year college degree)	3.646
Self-Rated Health (per level) (1=Excellent and 5=Poor)	2.815
ER Admission ¹	0.442
Response Percentile (per 1% of response percentile)	16.3%
Non-English Primary Language	0.059
AGE	
Age 18-24	0.045
Age 25-34	0.106
Age 35-44	0.075
Age 45-54	0.116
Age 55-64	0.176
Age 65-74	0.214
Age 75-84	0.189
Age 85+ (REFERENCE)	0.081
SERVICE LINE	
Maternity	0.150
Surgical	0.341
Medical (REFERENCE)	0.509
INTERACTIONS	
Surgical Line * Age ²	1.808
Maternity Line * Age ²	0.377

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National Means for Patient-Mix Variables (from Table 3) *(cont'd)*

$$M_{\text{EDUC}} = 3.65$$

$$M_{18-24} = 0.05$$

$$M_{\text{MAT}} = 0.15$$

$$M_{25-34} = 0.11$$

$$M_{\text{SURG}} = 0.34$$

$$M_{\text{HLTH}} = 2.82$$

$$M_{35-44} = 0.08$$

$$M_{45-54} = 0.12$$

$$M_{\text{MAT*AGE}} = 0.38$$

$$M_{\text{NENG}} = 0.06$$

$$M_{55-64} = 0.18$$

$$M_{\text{SURG*AGE}} = 1.81$$

$$M_{65-74} = 0.21$$

$$M_{\text{RPCT}} = 0.16$$

$$M_{75-84} = 0.19$$

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Patient-Level Adjustments for Patient-Mix Variables: Table 1 from www.hcahpsonline.org

Patient-Mix Adjustment (PMA)	Comm. with Nurses	Comm. with Doctors	Responsiveness of Hosp. Staff	Pain Management	Comm. About Medicines	Cleanliness of Hosp. Env.	Quietness of Hosp. Env.	Discharge Information	Overall Hospital Rating	Recommend the Hospital
Education (per level) (1=8th grade or less and 6=More than 4-year college degree)	2.12%	1.81%	2.69%	2.60%	3.22%	2.10%	3.87%	0.89%	3.35%	1.28%
Self-Rated Health (per level) (1=Excellent and 5=Poor)	5.28%	4.96%	6.44%	6.72%	5.25%	4.13%	4.24%	1.32%	6.41%	5.52%
ER Admission ¹	0.85%	3.29%	1.57%	1.42%	1.89%	0.20%	1.35%	2.33%	1.28%	1.27%
Response Percentile (per 1% of response percentile)	0.20%	0.17%	0.23%	0.16%	0.17%	0.07%	0.03%	0.01%	0.18%	0.17%
Non-English Primary Language	-0.04%	-0.48%	-0.12%	-1.87%	-1.79%	0.72%	-5.80%	-2.04%	-7.49%	-6.11%
AGE										
Age 18-24	4.18%	3.95%	3.70%	5.93%	-9.27%	3.92%	-7.24%	-1.70%	17.87%	16.00%
...
Age 75-84	-3.04%	-2.81%	-4.19%	-3.66%	-5.02%	1.78%	0.00%	-1.53%	-1.70%	-0.34%
Age 85+ (REFERENCE)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
SERVICE LINE										
Maternity	-6.27%	11.81%	-13.98%	-11.35%	-11.04%	3.81%	-10.86%	-7.83%	-11.58%	-12.93%
Surgical	1.64%	-9.18%	1.85%	-1.59%	-1.47%	0.06%	-0.21%	-5.82%	-4.20%	-3.66%
Medical (REFERENCE)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
INTERACTIONS										
Surgical Line * Age ²	-0.07%	0.98%	-0.31%	-0.38%	0.27%	-0.12%	0.05%	-0.06%	0.50%	0.42%
Maternity Line * Age ²	1.06%	1.52%	1.91%	1.62%	1.94%	-0.17%	1.25%	1.37%	1.84%	2.10%

Patient-Level Adjustments for Patient-Mix Variables (from Table 1) *(cont'd)*

For Nurse Communication:

$A_{\text{EDUC}} = 2.12\%$	$A_{18-24} = 4.18\%$	$A_{\text{MAT}} = -6.27\%$
	$A_{25-34} = 1.21\%$	$A_{\text{SURG}} = 1.64\%$
$A_{\text{HLTH}} = 5.28\%$	$A_{35-44} = -1.08\%$	
	$A_{45-54} = -3.24\%$	$A_{\text{MAT*AGE}} = 1.06\%$
$A_{\text{NENG}} = -0.04\%$	$A_{55-64} = -5.14\%$	$A_{\text{SURG*AGE}} = -0.07\%$
	$A_{65-74} = -5.06\%$	
$A_{\text{RPCT}} = 0.20\%$	$A_{75-84} = -3.04\%$	

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Using PMA Equation

PMA Equation:

$$\begin{aligned} \text{PMA} = & A_{\text{EDUC}} * (H_{\text{EDUC}} - M_{\text{EDUC}}) + A_{\text{HLTH}} * (H_{\text{HLTH}} - M_{\text{HLTH}}) + A_{\text{NENG}} * (H_{\text{NENG}} - M_{\text{NENG}}) \\ & + A_{\text{RPCT}} * (H_{\text{RPCT}} - M_{\text{RPCT}}) + A_{1824} * (H_{1824} - M_{1824}) + A_{2534} * (H_{2534} - M_{2534}) \\ & + A_{3544} * (H_{3544} - M_{3544}) + A_{4554} * (H_{4554} - M_{4554}) + A_{5564} * (H_{5564} - M_{5564}) \\ & + A_{6574} * (H_{6574} - M_{6574}) + A_{7584} * (H_{7584} - M_{7584}) + A_{\text{MAT}} * (H_{\text{MAT}} - M_{\text{MAT}}) \\ & + A_{\text{SURG}} * (H_{\text{SURG}} - M_{\text{SURG}}) + A_{\text{MAT*AGE}} * (H_{\text{MAT*AGE}} - M_{\text{MAT*AGE}}) \\ & + A_{\text{SURG*AGE}} * (H_{\text{SURG*AGE}} - M_{\text{SURG*AGE}}) \end{aligned}$$

Net Adjustment for Hospital A:

$$\begin{aligned} \text{PMA} = & 0.021 * (3.14 - 3.65) + 0.053 * (3.43 - 2.82) + -0.000 * (0.29 - 0.06) \\ & + 0.002 * (0.19 - 0.16) + 0.042 * (0.14 - 0.05) + 0.012 * (0.14 - 0.11) \\ & + -0.011 * (0.14 - 0.08) + -0.032 * (0.00 - 0.12) + -0.051 * (0.14 - 0.18) \\ & + -0.051 * (0.29 - 0.21) + -0.030 * (0.00 - 0.19) + -0.063 * (0.29 - 0.15) \\ & + 0.016 * (0.14 - 0.34) + 0.011 * (0.43 - 0.38) + -0.001 * (0.86 - 1.81) \\ = & \mathbf{0.022} \end{aligned}$$

Survey Mode Adjustment

- **Mode Adjustment for Nurse Communication “Top-Box”:**
 - Hospital A utilizes the **Telephone** mode for HCAHPS

HCAHPS Composite or Item: “Top-Box”	Telephone	Mixed	Active IVR
Communication with Nurses (“Always”)	-4.0%	-0.3%	-1.8%
Communication with Doctors (“Always”)	-1.3%	1.0%	-0.3%
...
Hospital Rating (“9 or 10”)	-2.8%	-1.8%	-1.6%

Quarterly HCAHPS Adjusted Score

The sum of the unadjusted composite score (Y), hospital PMA, and survey mode adjustment comprise a hospital's quarterly adjusted HCAHPS score (Y')

Nurse Communication "Top-Box" for Hospital A:

$$\begin{aligned} Y' &= Y + \text{PMA} + \text{Mode Adjustment} \\ &= 0.762 + 0.022 + -0.040 \\ &= \mathbf{0.744 \text{ (or 74.4\%)}} \end{aligned}$$

Publicly Reported HCAHPS Scores

Publicly reported HCAHPS scores are the **average of the adjusted scores from 4 consecutive quarters**

For Hospital A:

- Adjusted “Top-Box” scores for Nurse Communication for 3 previous quarters equal 71.5%, 78.8%, and 79.9%
 - Thus, the rounded publicly reported “Top-Box” score for Nurse Communication is as follows:

$$(71.5\% + 78.8\% + 79.9\% + 74.4\%) / 4 = \mathbf{76\%}$$

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Publicly Reported HCAHPS Scores *(cont'd)* Nurse Communication for Hospital A

	Adjusted "Top-Box"	Adjusted "Middle-Box"	Adjusted "Bottom- Box"
Quarter 1	71.5%	21.6%	6.9%
Quarter 2	78.8%	16.4%	4.8%
Quarter 3	79.9%	15.7%	4.4%
Quarter 4	74.4%	19.9%	5.7%
Q1-Q4 Avg.	76.2%	18.3%	5.5%
Rounded*	76%	18%	6%

*HCAHPS score publicly reported on Hospital Compare

Review of Score Calculation

- Identify eligible and completed surveys
- Calculate un-adjusted quarterly scores for each HCAHPS measure
- Calculate hospital-level patient-mix adjustment (PMA)
 - Requires calculation of means for all patient-mix variables and utilization of HCAHPS PMA Tables
- Application of survey mode adjustment
- Publicly reported HCAHPS scores = Average of the adjusted scores from 4 consecutive quarters