Response to HCA Follow-up Questions on NMC's Regression Analysis

We have engaged in extensive conversations with a representative of the Office of the Health Care Advocate (HCA) to better understand the fundamental questions and concerns regarding the regression analysis and to better explain our intended use of the analysis, particularly given the known limitations that come with performing any analysis using a dataset that contains only 10 observations.

The primary concern of the HCA, as understood by NMC, is around using a single analysis with a small sample size to make sweeping, generalized statements about cause and effect based on the analysis alone. This is a valid concern that NMC agrees with.

It is not the intention of NMC to represent the regression analysis as an authoritative analysis, but rather as one small piece of a much broader and separately substantiated position that pricing at NMC is unsustainably low. A sample size of 10 using a single cross sectional dataset does not allow us to make definitive statements about causal relationships. Instead, this analysis was done as a thought exercise utilizing all available data, to see if any relationships exists in that dataset, and view any relationships as directional guidance. Based on that directional guidance, we then sought to look at other data knowing that further analysis may or may not be consistent with the results of the regression analysis. To this end, we turned to the publicly available pricing data that is compiled by the Vermont Department of Health and the records of historical price increases approved by the Green Mountain Care Board. We, and our intention is that the reader of our narrative and the GMCB, give far more weight to the latter two data sets than to the regression analysis.

Statements made in the appendix and in the general narrative were identified, in the opinion of the HCA, as problematic. These statements are that the results of the regression analysis:

1. "support the supposition that limiting net patient revenue will force hospitals to limit expenses."
2. "the historical and cumulative implementation of rate regulation has created a disparity between hospitals" and that hospitals "who have been successful in achieving higher rates, either through higher rate allowances or by having higher rates in 2013 when enforcement began, have been able to support higher than expected costs."

We agree that the regression analysis on its own does not represent conclusive proof to substantiate these claims. Both statements, while made in the context of the regression analysis, were intended to be considered within the broader context of the historical regulatory process and other publicly available data.

A better phrasing for 1. would be that the results of the regression analysis are "***consistent with*** the supposition that limiting net patient revenue will force hospitals to limit expenses."

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The statement in 2. requires additional supporting data which has been provided in the form of detailed pricing data from the Vermont Department of Health and the graphs in the narrative that summarize the pricing data by type. Knowing that all Vermont hospitals have similarly small operating margins allows us to make the connection between relative prices and relative costs, though this is a conclusion made outside of the context of the regression analysis.

The HCA requested technical information related to the statistical model and more extensive output data. The full dataset and the output below has been supplied to the HCA and they have indicated that it satisfies their request.

Model as Presented

Correlation Matrix:

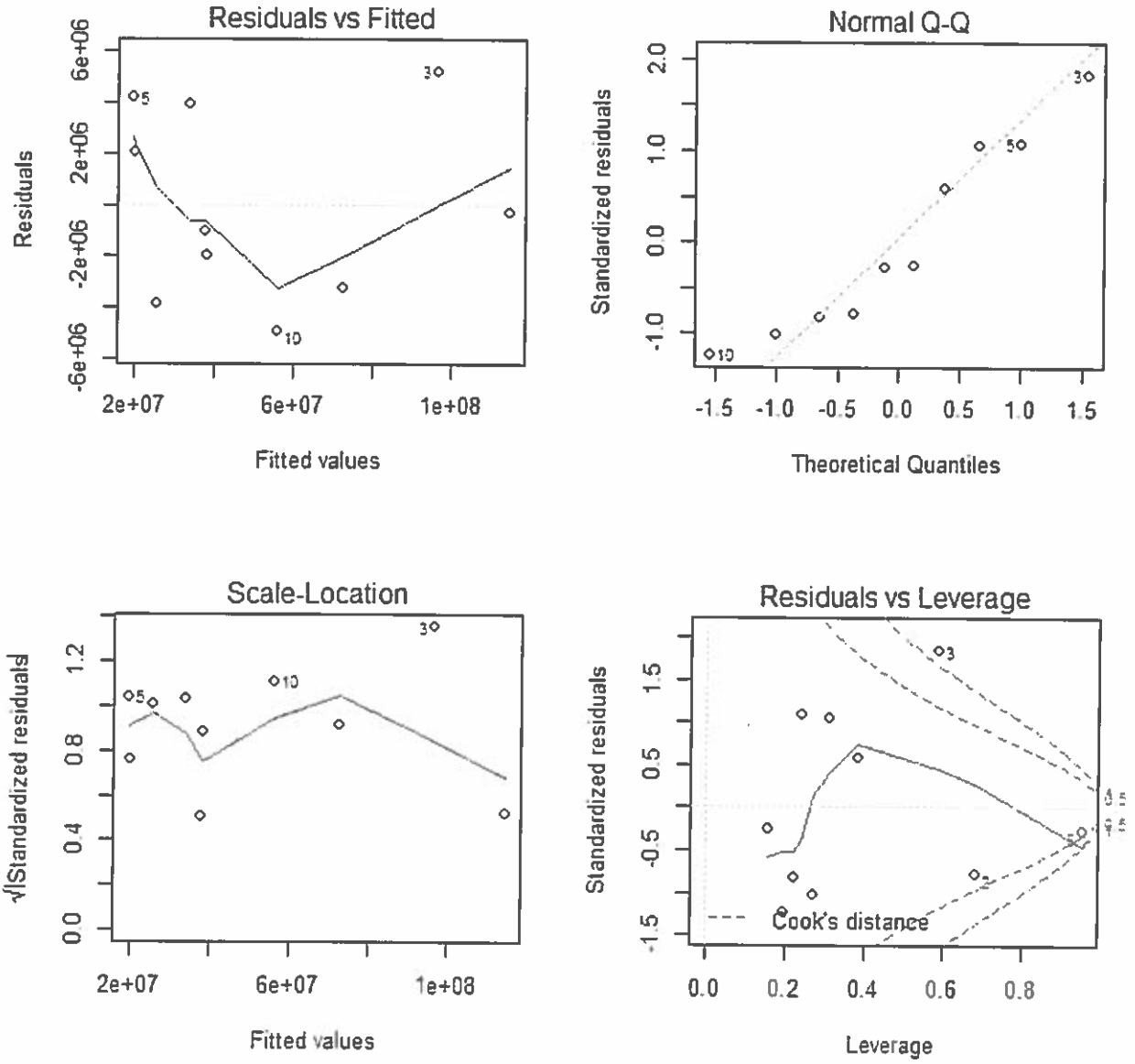
	Admissions	Operating.Room	Physician.Practice	Emergency
Admissions	1.0000000	0.43109926	0.21696902	0.8902695
Operating.Room	0.4310993	1.00000000	0.09598131	0.4786723
Physician.Practice	0.2169690	0.09598131	1.00000000	0.4116599
Emergency	0.8902695	0.47867227	0.41165991	1.0000000

Expense Model

Expense Model Output:

```
Dependent Variable: Expenses
Independent Variables = Admissions,Operating Room ,Physician Practice

Residuals:
     Min       1Q   Median       3Q      Max
-4919907 -2937383  -650628  3435534  5221002

Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)        -8633830.1  3738367.5  -2.310   0.0603 .
Admissions            41490.8     2316.0  17.915 1.95e-06 ***
Operating.Room         5339.9     2513.6   2.124   0.0778 .
Physician.Practice      178.5       54.9   3.251   0.0174 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 4452000 on 6 degrees of freedom
Multiple R-squared:  0.9881,    Adjusted R-squared:  0.9822
F-statistic: 166.1 on 3 and 6 DF,  p-value: 3.667e-06
```

Expense Model Residual Plots:



Expense Model Breusch-Pagan test:

P-Value = 0.2738

=> Cannot reject the null that the error variances are all equal.

Expense Model Standardized Residuals:

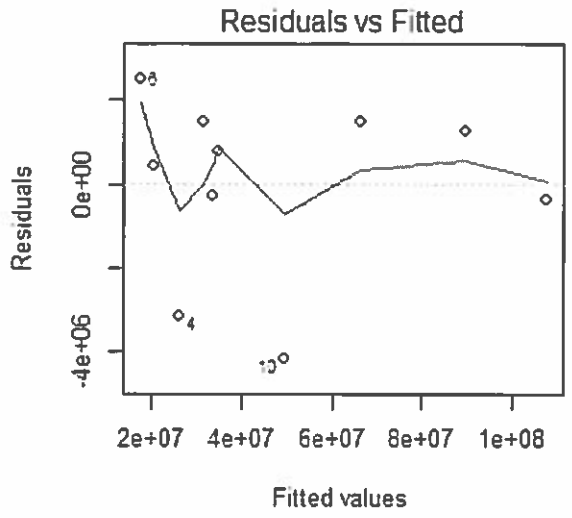
```
       1         2         3         4         5         6         7         8         9        10
1.0535456 -0.7834367  1.8273267 -1.0200061  1.0756684  0.5798670 -0.8315395 -0.2736288 -0.2524184 -1.2340090
```

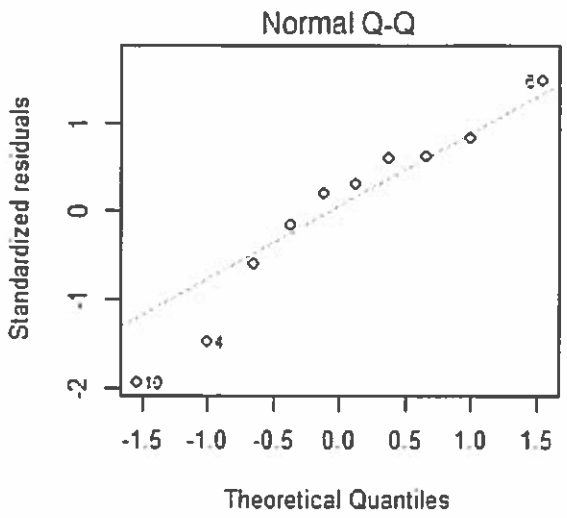
Revenue Model (With ED Visits)

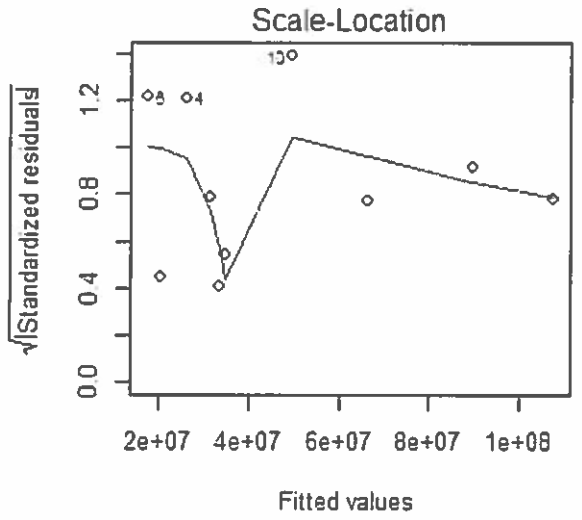
Revenue Model (With ED Visits) Output:

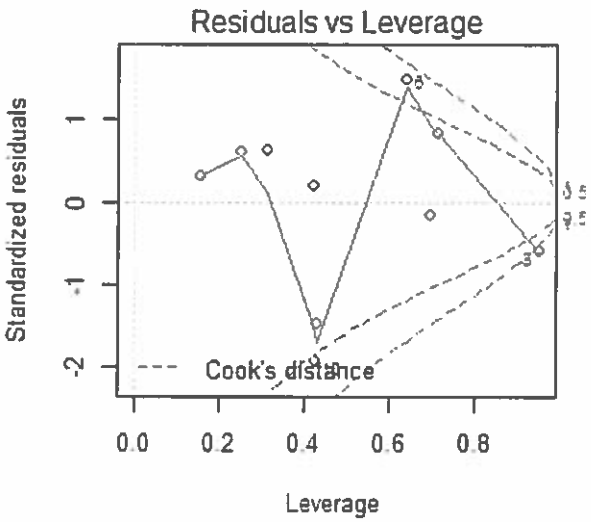
```
Dependent Variable: Net Patient Revenue
Independent Variables = Admissions,Operating Room ,Physician Practice, Emergency Room Visits

Residuals:
      1       2       3       4       5       6       7       8       9      10
1468345 -256890 1260154 -3131959  429253 2504506 1472518 -375065  774540 -4145402

Coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)       -5.701e+06  2.477e+06  -2.302  0.06963 .
Admissions         4.351e+04  3.073e+03  14.158 3.16e-05 ***
Operating.Room     4.631e+03  1.659e+03   2.792  0.03836 *
Physician.Practice 1.734e+02  4.048e+01   4.285  0.00783 **
Emergency         -1.161e+03  7.209e+02  -1.610  0.16826
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2834000 on 5 degrees of freedom
Multiple R-squared:  0.9953,    Adjusted R-squared:  0.9915
F-statistic: 263.6 on 4 and 5 DF,  p-value: 5.339e-06
```

Revenue Model (With ED Visits) Residual Plots:









Revenue Model (With ED Visits) Breusch-Pagan test:

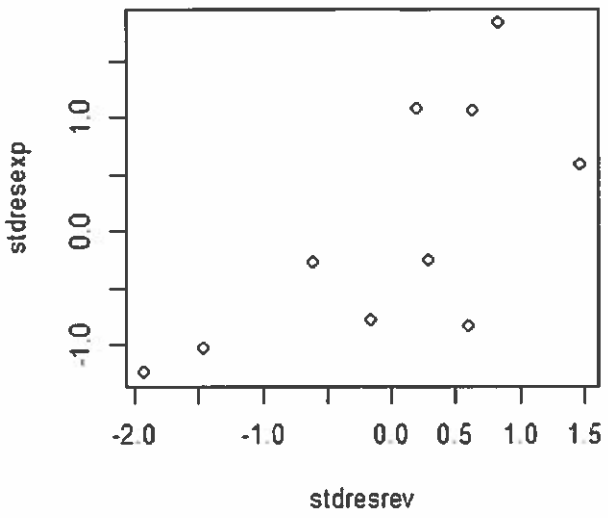
P-Value = 0.4796

=> Cannot reject the null that the error variances are all equal.

Revenue Model (With ED Visits) Standardized Residuals:

```
         1          2          3          4          5          6          7          8          9         10
 0.6252012 -0.1638669  0.8299077 -1.4649432  0.1989236  1.4720271  0.6018979 -0.6039141  0.2975524 -1.9283125
```

Revenue (With ED Visits) and Expense Models Standardized Residuals Plot:

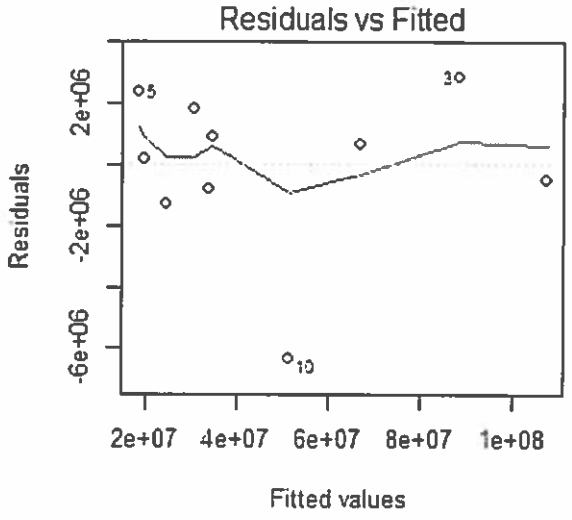


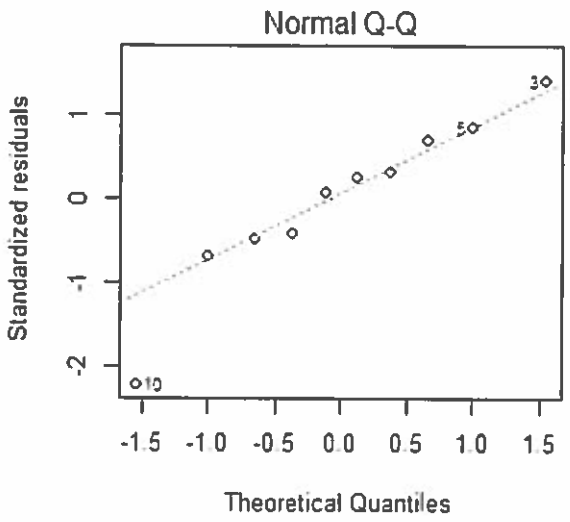
Revenue Model (Without ED Visits)

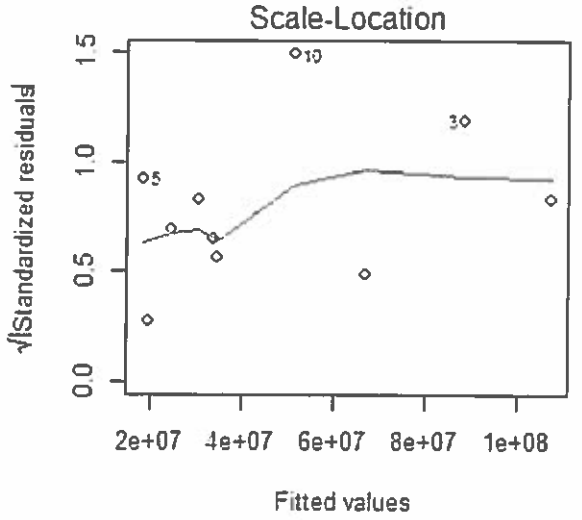
Revenue Model (Without ED Visits) Output:

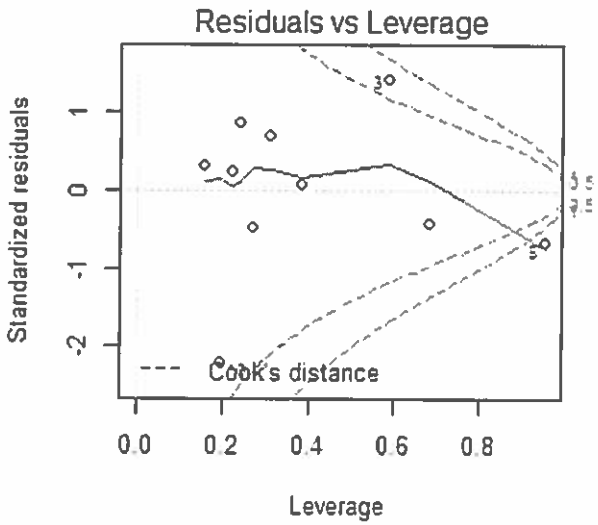
```
Dependent Variable: Net Patient Revenue
Independent Variables = Admissions,Operating Room ,Physician Practice

Residuals:
     Min       1Q   Median       3Q      Max
-6318038  -694521   433252  1606260  2872619

Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)       -6.807e+06  2.677e+06  -2.542   0.0439 *
Admissions         3.917e+04  1.659e+03  23.613 3.79e-07 ***
Operating.Room     3.927e+03  1.800e+03   2.182   0.0719 .
Physician.Practice 1.406e+02  3.932e+01   3.575   0.0117 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3189000 on 6 degrees of freedom
Multiple R-squared:  0.9928,    Adjusted R-squared:  0.9892
F-statistic:   277 on 3 and 6 DF,  p-value: 8.034e-07
```

Revenue Model (Without ED Visits) Residual Plots:









Revenue Model (Without ED Visits) Breusch-Pagan test:

P-Value = 0.5952

=> Cannot reject the null that the error variances are all equal.

Revenue Model (Without ED Visits) Standardized Residuals:

1	2	3	4	5	6	7	8	9	10
0.69014171	-0.42569282	1.40392051	-0.47853855	0.85162515	0.07664537	0.24021820	-0.68409380	0.31729096	-2.21281866

Revenue (Without ED Visits) and Expense Models Standardized Residuals Plot: