1. Descriptive analysis for qualitative variables

Research Question:

How do Alabama hospitals score in national comparison measure for readmission rates?

Summary:

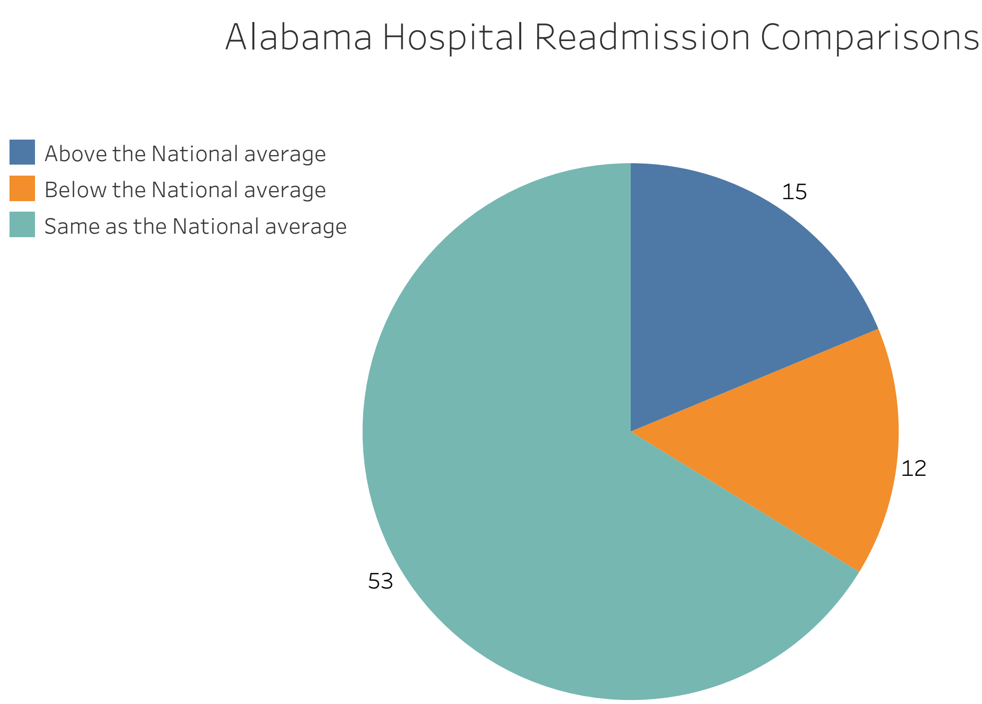
Most of Alabama's hospitals in this sample fall into the Same as National Average category (66.25%) followed by Above National Average (18.75%) and Below National Average (15%).

R Results:

```
> local({
+   .Table <- with(Alabama, table(Readmission_1))
+   cat("\ncounts:\n")
+   print(.Table)
+   cat("\npercentages:\n")
+   print(round(100*.Table/sum(.Table), 2))
+ })

counts:
Readmission_1
  Below the National average Same as the National average   Above the National average
                          12                           53                           15

percentages:
Readmission_1
  Below the National average Same as the National average   Above the National average
                       15.00                        66.25                        18.75
```



2. Descriptive analysis for quantitative variables

Research Question:

How do Alabama hospitals score for overall ratings by CBSA type?

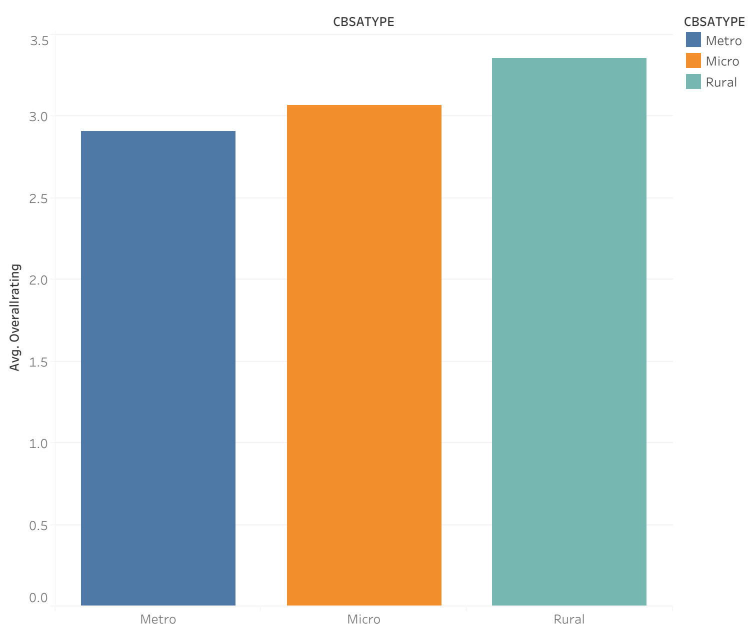
Summary:

When comparing the means for overall ratings in Alabama hospitals, Rural had the highest with an average score of 3.35, then Micro with 3.07, then Metro with 2.91.

R Results:

```
> numSummary(Alabama[,"Overallrating", drop=FALSE], groups=Alabama$CBSATYPE,
+   statistics=c("mean", "sd", "se(mean)", "IQR", "quantiles", "cv"), quantiles=c(0,.25,.5,
+   .75,1))
          mean        sd  se(mean) IQR        cv 0% 25% 50% 75% 100% Overallrating:n
Metro 2.906977 0.7500461 0.1143810   1 0.2580159  2   2   3   3    5              43
Micro 3.066667 0.4577377 0.1181874   0 0.1492623  2   3   3   3    4              15
Rural 3.350000 0.7451598 0.1666228   1 0.2224358  2   3   3   4    5              20
      Overallrating:NA
Metro                4
Micro                0
Rural                5
```

Average Overall Rating by CBSA Type in Alabama



2. Single Sample t-test

Research question:

Is there a difference in the overall rating mean for critical access hospitals from the overall population mean?

Null Hypothesis:

Critical Access Hospitals do not differ from the overall population (mean= 3.059) with respect to the overall rating.

Summary:

A single-sample t-test was conducted to test the null hypothesis that the average overall rating of critical access hospitals was not different from the overall population mean of 3.059. There was a statistically significant difference ($p < 0.05$) in means between critical access hospitals (x =3.323) and population (μ=3.059); $t(596)=11.479$. The effect size, Cohen' d=0.469 indicating 0.469 standard deviation above the population mean.

R Results:

```
 Overallrating
 Min.   :1.000
 1st Qu.:3.000
 Median :3.000
 Mean   :3.059
 3rd Qu.:4.000
 Max.   :5.000
 NA's   :2421
```

```
                    HospitalType_1
Acute Care Hospitals     :3370
Childrens                :  99
Critical Access Hospitals:1338
NA's                     :1198
```

```
        One Sample t-test

data:  Overallrating
t = 11.479, df = 596, p-value < 2.2e-16
alternative hypothesis: true mean is not equal to 3.059
95 percent confidence interval:
 3.278066 3.368500
sample estimates:
mean of x
 3.323283
```

4. Independent Samples t-test

Research Question:

Does ER status affect excessive readmission ratio for AMI?

Null Hypothesis:

ER status does not affect excessive readmission ratio for AMI.

Summary:

Because the significance (probability) level is greater than .05 (pr(<F)= .1492), we fail to reject the null hypothesis that there is no difference in average/mean excessive readmission ratio for AMI between providers with an ER and without. We conclude that the mean excessive readmission ratio for AMI of patients with an ER are statistically the same as those without an ER.

An independent-samples t-test was conducted to compare the average excessive readmission ratio for AMI for providers with and without an ER. There was no statistically significant difference in the excessive readmission ratio for AMI between providers without an ER (mean=0.994, SD=0.058) and with an ER (mean=1.002, SD=00.067).

R Results:

```
> leveneTest(ExcessReadRatio_AMI ~ ER_1, data=Dataset, center="mean")
Levene's Test for Homogeneity of Variance (center = "mean")
        Df F value Pr(>F)
group    1  2.0815 0.1492
      2117
```

```
> numSummary(Dataset[,"ExcessReadRatio_AMI", drop=FALSE], groups=Dataset$ER_1,
+   statistics=c("mean", "sd", "se(mean)", "IQR", "quantiles"), quantiles=c(0,.25,.5,.7
         mean         sd    se(mean)    IQR     0%     25%     50%     75%   100%
No  0.9944594 0.05818135 0.010285107 0.0412 0.8359 0.98415 1.01115 1.02535 1.0903
Yes 1.0023157 0.06655378 0.001456839 0.0825 0.7043 0.96045 1.00020 1.04295 1.2491
    ExcessReadRatio_AMI:n ExcessReadRatio_AMI:NA
No                     32                    263
Yes                  2087                   2425
```

```
        Two Sample t-test

data:  ExcessReadRatio_AMI by ER_1
t = -0.66385, df = 2117, p-value = 0.5069
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.03106486  0.01535218
sample estimates:
 mean in group No mean in group Yes
        0.9944594         1.0023157
```

5. One Way ANOVA

Research Question:

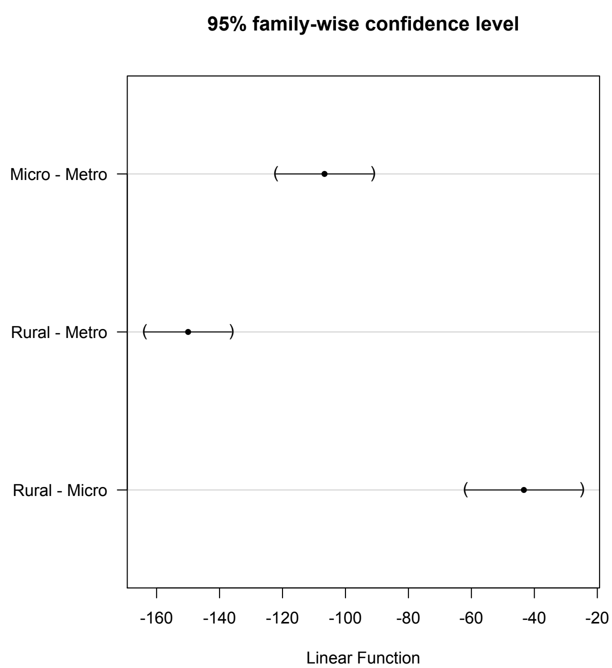
Is there a difference in number of beds across different CBSA types?

Null Hypothesis:

CBSA type does not have a statistically significant effect on number of beds.

Summary:

A one-way between-groups analysis of variance was conducted to explore the impact of CBSA category on number of beds. There was a statistically significant difference at the 0.001 level in number of beds for three CBSA categories [F (2, 5918) = 386.9, p=.000]. The effect size, calculated using Eta-squared, was 11.56%. Post-hoc comparisons using the Tukey Contrasts indicated that the mean number of beds was significantly different between Micro and Metro, Rural and Metro, and Rural and Micro. Metro (M = 193.5, SD = 210.4), Micro (M = 86.8, SD = 80.0), and Rural (M = 43.5, SD = 43.4)



R Results:

```
> summary(AnovaModel.1)
              Df    Sum Sq  Mean Sq F value Pr(>F)
CBSATYPE       2  23720396 11860198   386.9 <2e-16 ***
Residuals   5918 181428554    30657
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
84 observations deleted due to missingness

> with(Dataset, numSummary(HOSPBD, groups=CBSATYPE, statistics=c("mean", "sd")))
           mean        sd data:n
Metro 193.46780 210.35901   3929
Micro  86.80980  79.96825    857
Rural  43.48194  43.40969   1135
```

```
         Simultaneous Tests for General Linear Hypotheses

Multiple Comparisons of Means: Tukey Contrasts


Fit: aov(formula = HOSPBD ~ CBSATYPE, data = Dataset)

Linear Hypotheses:
                    Estimate Std. Error t value    Pr(>|t|)
Micro - Metro == 0  -106.658      6.601 -16.157 < 0.0000001 ***
Rural - Metro == 0  -149.986      5.900 -25.420 < 0.0000001 ***
Rural - Micro == 0   -43.328      7.924  -5.468 0.000000111 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Adjusted p values reported -- single-step method)
```

```
         Simultaneous Confidence Intervals

Multiple Comparisons of Means: Tukey Contrasts


Fit: aov(formula = HOSPBD ~ CBSATYPE, data = Dataset)

Quantile = 2.3327
95% family-wise confidence level


Linear Hypotheses:
                   Estimate  lwr       upr
Micro - Metro == 0 -106.6580 -122.0566  -91.2594
Rural - Metro == 0 -149.9859 -163.7495 -136.2222
Rural - Micro == 0  -43.3279  -61.8113  -24.8444

Metro Micro Rural
  "c"   "b"   "a"
```

6. Chi-Square test

Research Question:

Does hospital type have an effect on CBSA type?

Null Hypothesis:

CBSA type is unrelated to hospital type.

Summary:

A Chi-square test was conducted to explore whether CBSA type is related to hospital type. A p-value of 0.000 shows there is a statistically significant relationship between CBSA type and hospital type. For example, most acute care hospitals (75.3%) were CBSA type metro, all (100%) of children's hospitals were also metro. Most (63.2%) critical access hospitals were rural and a relatively small percentage (8.3%) of acute care hospitals were rural.

R Results:

```
Frequency table:
        HospitalType_1
CBSATYPE Acute Care Hospitals Childrens Critical Access Hospitals
   Metro                 2493        94                       257
   Micro                  543         0                       229
   Rural                  274         0                       833

Column percentages:
        HospitalType_1
CBSATYPE Acute Care Hospitals Childrens Critical Access Hospitals
   Metro                 75.3       100                      19.5
   Micro                 16.4         0                      17.4
   Rural                  8.3         0                      63.2
   Total                100.0       100                     100.1
   Count               3310.0        94                    1319.0

        Pearson's Chi-squared test

data:  .Table
X-squared = 1763.9, df = 4, p-value < 2.2e-16
```

7. Correlation test

Research Question:

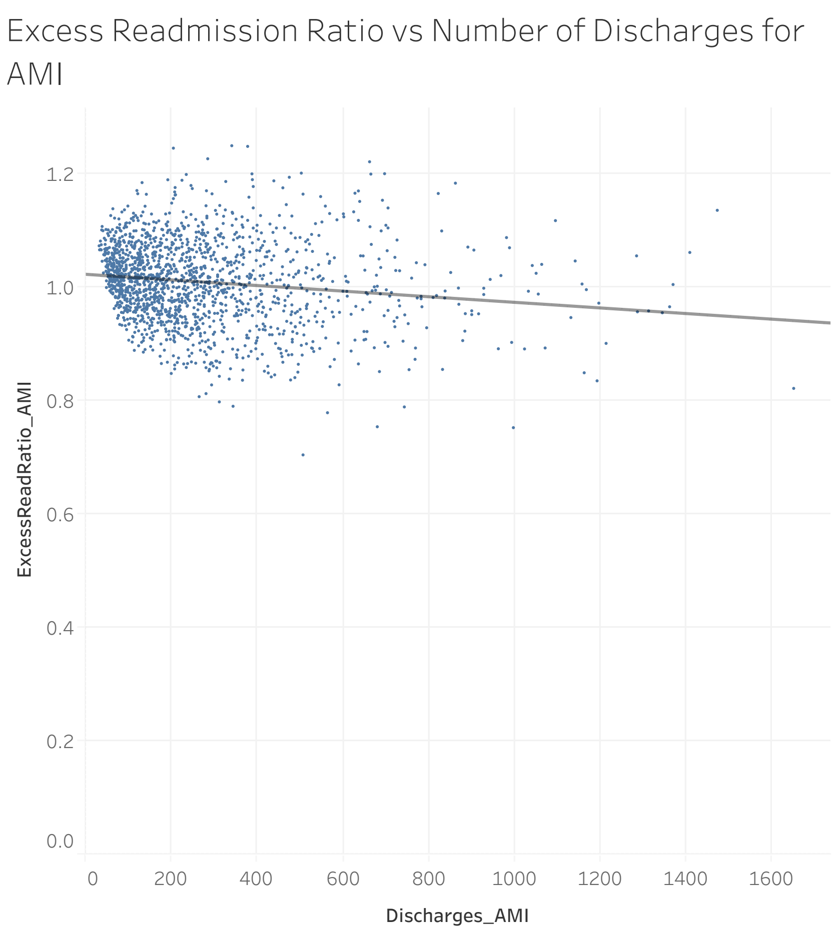
Is a high discharge count for AMI associated with excessive readmission ratios?

Null Hypothesis:

There is no statistically significant relationship between readmissions for AMI and excessive readmission ratio for AMI.

Summary:

The relationship between beginning number of discharges and excessive readmissions ratios for AMI was investigated using Pearson product-moment correlation test. Preliminary analyses were performed to ensure no violation of assumptions of normality and linearity. A statistically significant negative correlation between the two variables was observed [r =-0.197 n = 1682, p <0.001], indicating that high values for discharges are associated with lower excessive readmission ratios.



R Results:

```
        Pearson's product-moment correlation

data:  Discharges_AMI and ExcessReadRatio_AMI
t = -6.2606, df = 1680, p-value = 4.859e-10
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.1973627 -0.1039452
sample estimates:
      cor
-0.150991
```

8. Correlation Matrix

Research Question:

Is there a relationship between number of AMI discharges, AMI excessive readmissions ratio (ERR), and overall hospital rating?

Null Hypothesis:

There is no statistically significant relationship between number of AMI discharges, AMI excessive readmissions ratio, and overall hospital rating.

Summary:

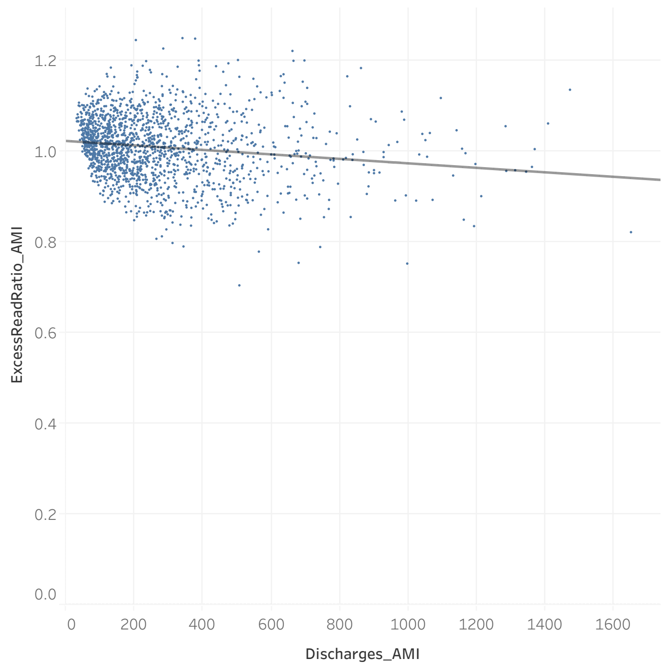
The relationship between number of AMI discharges, AMI excessive readmissions ratio (ERR), and overall hospital rating (OHR) was investigated using Pearson product-moment correlation matrix. Preliminary analyses were performed to ensure no violation of assumptions of normality and linearity. A statistically significant negative correlation was observed between discharges and ERR [$r = -0.151$, $n = 1682$, $p < 0.001$], and between ERR and OHR [$r = -0.341$, $n = 2119$, $p < 0.001$], indicating that high ERR values are associated with lower OHR and discharge values . A statistically significant positive correlation was also observed between OHR and discharges [$r = 0.0784$, $n = 1708$, $p < 0.05$], indicating that high values for OHR are associated with high discharge values.

Pearson Product-Moment Correlations among Hospital Performance Measures:

Measures	1. AMI Discharges	2. AMI ERR
1. AMI Discharges		
2. AMI ERR	-0.151**	
3. Overall Rating	0.0784*	-0.341**

**p<0.001, * p<0.05

Excess Readmission Ratio vs Number of Discharges for AMI



R Results:

```
 Pearson correlations:
                    Discharges_AMI ExcessReadRatio_AMI Overallrating
Discharges_AMI              1.0000             -0.1510        0.0784
ExcessReadRatio_AMI        -0.1510              1.0000       -0.3414
Overallrating               0.0784             -0.3414        1.0000

 Number of observations:
                    Discharges_AMI ExcessReadRatio_AMI Overallrating
Discharges_AMI                1726                1682          1708
ExcessReadRatio_AMI           1682                2119          2119
Overallrating                 1708                2119          3584

 Pairwise two-sided p-values:
                    Discharges_AMI ExcessReadRatio_AMI Overallrating
Discharges_AMI                     <.0001              0.0012
ExcessReadRatio_AMI <.0001                             <.0001
Overallrating       0.0012         <.0001

 Adjusted p-values (Holm's method)
                    Discharges_AMI ExcessReadRatio_AMI Overallrating
Discharges_AMI                     <.0001              0.0012
ExcessReadRatio_AMI <.0001                             <.0001
Overallrating       0.0012         <.0001
```

9. Simple linear regression using a quantitative independent variable

Research Question:

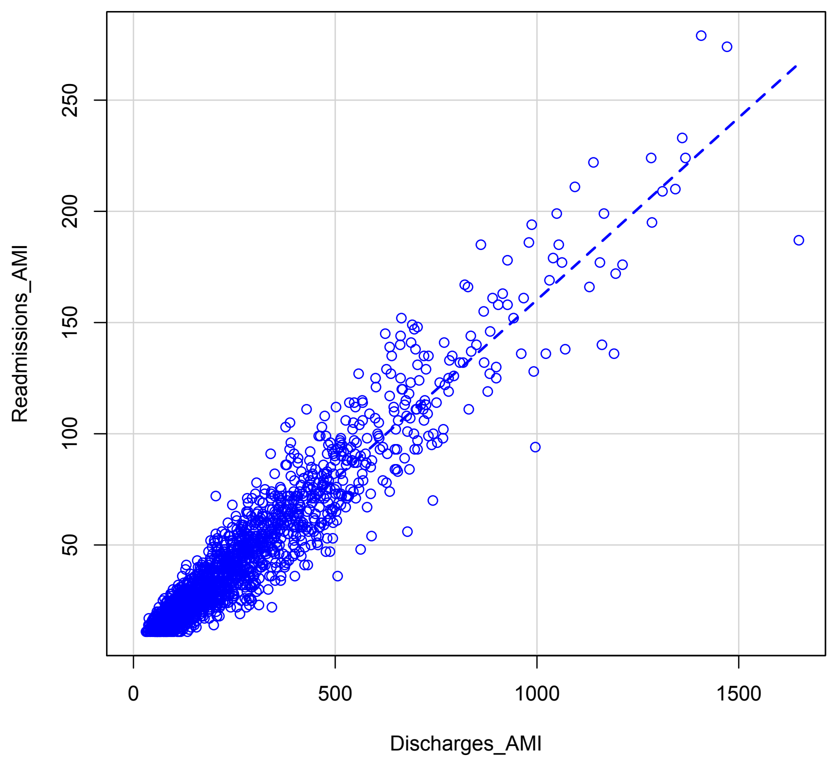
Can the number of readmissions be predicted by number of discharges in COPD patients?

Null Hypothesis:

Number of COPD discharges does not predict stroke readmissions.

Summary:

A simple regression analysis was conducted to test if AMI discharges significantly predicted readmissions. The results of the regression indicated AMI discharges explained 95.2% of variances of readmissions (R2=.952, F(1, 2568)= 5.075e+04, p<.0001).



R Results:

```
Call:
lm(formula = Readmissions_COPD ~ Discharges_COPD, data = Dataset)

Residuals:
    Min      1Q  Median      3Q     Max
-53.894  -5.696   0.213   5.747  87.479

Coefficients:
                  Estimate Std. Error t value Pr(>|t|)
(Intercept)     -4.3219913  0.3691760  -11.71   <2e-16 ***
Discharges_COPD  0.2148850  0.0009539  225.28   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 11.16 on 2568 degrees of freedom
  (3435 observations deleted due to missingness)
Multiple R-squared:  0.9518, Adjusted R-squared:  0.9518
F-statistic: 5.075e+04 on 1 and 2568 DF,  p-value: < 2.2e-16
```

10. Simple linear regression using a qualitative independent variable

Research Question:

Does having an ER influence overall ratings?

Null Hypothesis:

ER status does not affect overall ratings.

Summary:

A simple regression analysis was conducted to test if ER status significantly predicted overall rating. The results of the regression indicated the ER status explained 0.22% of variances of current salary (R2=.0022, F(1, 3582)=7.94, p<0.01). Overall rating for hospitals with an ER was .27 less than hospitals without an ER (p<0.01).

R Results:

```
Call:
lm(formula = Overallrating ~ ER, data = Dataset)

Residuals:
     Min       1Q   Median       3Q      Max 
-2.32000 -0.05301 -0.05301  0.94699  1.94699 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept)  3.32000    0.09378  35.404  < 2e-16 ***
ER          -0.26699    0.09477  -2.817  0.00487 ** 
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.8121 on 3582 degrees of freedom
  (2421 observations deleted due to missingness)
Multiple R-squared:  0.002211, Adjusted R-squared:  0.001932 
F-statistic: 7.937 on 1 and 3582 DF,  p-value: 0.004871
```