DIGITAL SURF
ONLINE STUDENT UNDERGRADUATE RESEARCH FESTIVAL
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Using Six Sigma to Address Effects of ER Upcoding and Find a Solution

By Parker Perry, Cassidy Coburn, and Samantha Walsh
The Six Sigma DMAIC Methodology involves the following steps:

**Define**
- Charter defines our project & focus

**Measure**
- Process Map identifies the Xs
- KJ Analysis may highlight certain Xs
- C&E reduces Xs by correlation to Y's
- FMEA determines causes of X variable failures
- Multi-vari statistic allows association of Y and key Xs
- DOE design of experiments identify the Critical X's and their sensitivity to the Y

**Analyze**
- Control Plans for Critical X's: Sustain the Gains

**Improve**
- Optimize Process

**Control**
- Y (Key Business Process Output) = f (x₁, x₂, x₃, x₄, ..., xₙ)

Y = f (x₇, x₂₂, x₅₇)
Define

When someone goes to the emergency room, their total bill is calculated according to two variables.

Provider and Facility.

The bill for each corresponds with the severity of the case.

Scale of 1-5

<table>
<thead>
<tr>
<th>Provider</th>
<th>Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99281</td>
</tr>
<tr>
<td>2</td>
<td>99282</td>
</tr>
<tr>
<td>3</td>
<td>99283</td>
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<tr>
<td>4</td>
<td>99284</td>
</tr>
<tr>
<td>5</td>
<td>99285</td>
</tr>
</tbody>
</table>
Define

Sometimes provider and facility billing codes in hospitals do not match. This means that the hospital allocated resources inefficiently while caring for the patient.

Our objective is to address billing discrepancies related to coding complexity in emergency departments and physicians, and to assess possible upcoding by facilities or professionals.
Define

Service Received

Patient Presents at ER
Provider Visit in ER Facility
Medical Record Created

Claim Billed

Medical Record goes to Billing
Codes applied for Diagnosis
Codes Applied for Complexity
Claim Submitted to BCBS

Claim Paid

Claim Automatically Paid
Check issued to Provider
Check issues to Facility
Explanation of Benefit sent to Patient

Post Billing

Identify variation of +/- 2 complexity
Medical Records request
National ED Volume Distribution Trend
Measure

Capability

Histogram of 4 (24%) (with Ho and 95% t-confidence interval for the mean)

Histogram of 4 (24%) (with Ho and 95% t-confidence interval for the mean)

Histogram of 4 (24%) (with Ho and 95% t-confidence interval for the mean)

Histogram of 4 (24%) (with Ho and 95% t-confidence interval for the mean)
Measure

Led by 3 major questions

What are the biggest causes for inaccurate codes

What are the weakness in BCBS allowing/paying on ER claims

What is the biggest problem in ER Upcoding?
Measure

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Rating of Importance to Customer (BCS87)</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>8</td>
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<tr>
<td>Provider coding</td>
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<td>Facility coding</td>
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<tr>
<td>Codes due to not match</td>
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<tr>
<td>Medical records become available to coders</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Coding process takes place</td>
<td></td>
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<tr>
<td>Expiration of benefits</td>
<td></td>
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<tr>
<td>Modifier 25 applied</td>
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</tr>
<tr>
<td>Total</td>
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<td></td>
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</tr>
</tbody>
</table>

“X variables”
Potential inputs to the problem.

“Y variables”
Outputs that result from the problem input.

Variables are rated according to severity. Isolate most significant X variable.
### Analyze

Identify at *what point* in the process things might go wrong. 
*How* they might go wrong.  *What the effects* are of the failure. *How bad* are the effects? *How likely* is the failure? *What are the current controls to prevent* these failures?

<table>
<thead>
<tr>
<th>Key Process Input</th>
<th>Potential Failure Mode</th>
<th>Potential Failure Effects</th>
<th>SEV</th>
<th>Potential Causes</th>
<th>OCC</th>
<th>Current Controls</th>
<th>DET</th>
<th>RPN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Codes applied for provider</td>
<td>Provider misdiagnoses patient</td>
<td>Could fail to give the patient proper treatment, and charge them too much/too little.</td>
<td>8</td>
<td>Most likely the patient receives care and resources that are for a higher level of severity</td>
<td>8</td>
<td>Diagnosis falls into a category level of care for both facility and provider.</td>
<td>8</td>
<td>512</td>
</tr>
<tr>
<td>Codes applied for facility</td>
<td>Facility provides resources that do not compliment the level of care provided</td>
<td>Resources allocated inefficiently or incorrectly and affect the billing process negatively.</td>
<td>9</td>
<td>Too many resources are allocated for a patient with a low level of diagnosis severity</td>
<td>8</td>
<td>Code for facility should be the same as provider</td>
<td>8</td>
<td>576</td>
</tr>
<tr>
<td>Check issued to provider</td>
<td>Bill calculated improperly according to provider guidelines</td>
<td>Bill does not reflect the correct level of treatment leading to over/under paying by patient/company.</td>
<td>7</td>
<td>Provider/facility are not precise in determining the category of care required for the case</td>
<td>3</td>
<td>5 levels of code that should all match.</td>
<td>9</td>
<td>189</td>
</tr>
<tr>
<td>Check issued to facility</td>
<td>Bill calculated improperly according to facility guidelines</td>
<td>Bill does not reflect the correct level of treatment leading to over/under paying by patient/company.</td>
<td>7</td>
<td>Provider/facility are not precise in determining the category of care required for the case</td>
<td>3</td>
<td>5 levels of code that should all match.</td>
<td>9</td>
<td>189</td>
</tr>
<tr>
<td>Variation of codes identified</td>
<td>Either provider or facility code do not match</td>
<td>No way to know if accurate coding and procedures are being followed</td>
<td>8</td>
<td>Case severity receives incorrect allocation of facility resources, which skews billing.</td>
<td>7</td>
<td>5 levels of code that should all match.</td>
<td>10</td>
<td>560</td>
</tr>
</tbody>
</table>
We identified some “problem” hospitals which showed coding that differed greatly from the national averages. We then changed their numbers to see what they would look like if they had been closer to the national averages.

Facility Savings
$1,091,097.22

Professional Savings
$317,885.25
Analyze

The question here: is there a relationship between HOSPITAL and UPCODING?

We determined this by counting the amount of times the code differential was greater or equal to 2 and the amount of time the code differential was less than 2.

The hypothesis is:
H0: the data is independent (there is no relationship)
H1: the data is dependent (there is a relationship)

The analysis shows a p-value of 0.000. P is low, so H0 must go.

H1 indicates there is a relationship between HOSPITAL and CODEDIFF (upcoding).

<table>
<thead>
<tr>
<th>Chi-Square Test</th>
<th>Chi-Square</th>
<th>DF</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson</td>
<td>11.830</td>
<td>2</td>
<td>0.003</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>18.407</td>
<td>2</td>
<td>0.000</td>
</tr>
</tbody>
</table>

1 cell(s) with expected counts less than 5.
Improve

- Auditing Program
- Develop training to bridge the gap between coding and care.
- Eliminate the “Modifier 25”
Control

Guidelines that the solution should meet or exceed

Solution that ranked the highest according to guidelines

Only Autopay on claims with matching codes and review all codes 4 and 5

Each solution is compared to guidelines and ranked

<table>
<thead>
<tr>
<th>Pugh Concept Selection Matrix</th>
<th>Concept #</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product or Process</td>
<td>Concept</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detects Discrepancy</td>
<td></td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>S</td>
</tr>
<tr>
<td>Prevents Discrepancy</td>
<td></td>
<td>P</td>
<td>P</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>Incentivizes Congruent Coding</td>
<td></td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>P</td>
<td>S</td>
</tr>
<tr>
<td>Addresses Discrepancy After the fact</td>
<td></td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>S</td>
</tr>
<tr>
<td>Inexpensive (money still being saved after)</td>
<td></td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>Able to be placed in Current Claim System</td>
<td></td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>Doesn't alienate BCBS Clients</td>
<td></td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>P's</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>S's</td>
<td></td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>N's</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

"P" = Better Than Datum
"S" = Same As Datum
"N" = Worse Than Datum
Summary

\[ Y \ (ER\ Upcoding) = f \ (x_1, x_2, x_3, x_4, \ldots, x_n) \]

\[ Y = f \ (X_1: \text{Discrepancies in codes}) \]
Acknowledgements

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