Cost-Quality Efficiencies: An Illustration of Data Envelopment Analysis for Mental Health Delivery

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Our Mission
- Happy Children
- Healthy Families
- Helpful Communities

The Challenge
- Cost Indicators
- Quality Indicators

The DEA: An Efficiency Measure
Provides the relative efficiency of comparable business units as they convert Resource Inputs to Quality Outputs

The DEA Quantifies Inputs : Outputs

The DEA Process
- A linear programming technique
- Compares the EXTREMES of inputs and outputs
CAMHD DEA ANALYSIS USING TWO VARIABLES:
October 2004 - March 2005

Scores Improving %

0 $20 $40 $60 $80 $100 $120
Selected Clinical Costs/Client Day/Mo

DEA in Healthcare Administration Literature

Examples of Management Questions That the DEA has Helped Answer

Dental Services

What are the relative cost efficiencies of the Public Dental Services?
(Widström, Linna, & Niskanen, 2004)

Hemodialysis Units

What are the relative efficiencies of the public versus private sector hemodialysis units?
(Kontodimopoulos & Niakas, 2005)

Hospital Operating Room

What is the growth potential for hospital operating room services?
(O’Neill & Dexter, 2005)

Physician Practice Administration

What are the best practices of an efficient group practice office?
(Andes et al., 2002).
Long-Term Care

Is there an association between quality of care and technical efficiency in the long-term care units? (Laine et al., 2005)

Hospital-to-Hospital Comparisons

What are the opportunities for realignment of resources within the Veterans Health Administration Hospitals? (Harrison & Ogniewski, 2005)

What would happen if hospital budgets were based on expected efficiencies? (Biorn, Hagen, Iversen, & Magnussen, 2003).

Mental Health Services

What are the cost inefficiencies in the residential care services for the mentally disabled? (Blank & Valdmanis, 2005)

Health System Evaluation

Which federal hospital system is more efficient? The Department of Defense hospitals or the Veterans Affairs hospitals? (Bannick & Ozcan, 1995)

SELECTED DEMOGRAPHICS of CAMHD DEA:

OCTOBER 2004 through MARCH 2005

Location of Population
Number of Youth in the Study

CAMHD Selected Demographics
- Average age: About 14 (Range 3 – 20)
- Gender:
  - About one third female
  - About two thirds male
- Approximate race distribution
  - 64% multiracial
  - 17% White
  - 6-8% Asian
  - 10% Native Hawaiian/Pacific Islander
  - 1% Black
  - 1% Other

CAMHD Selected Demographics: Disorders
- 71 – 73% Comorbid
- 44 – 45% Disruptive Behavior
- 44 – 45% Attentional
- 36% Mood
- 19% Anxiety
- 15 – 16% Substance-related
- 12% Adjustment
- 2% Mental Retardation
- 2% Pervasive Developmental

Input Variables
- Average office expenses per client day

Input Variables
- Average personnel costs per average client day per month
Input Variables

*Average FTE’s mental health care coordinators (MHCC) per average number of client days per month*

![Bar Chart] (Average FTE’s mental health care coordinators (MHCC) per average number of client days per month)

Input Variables

*Average total costs of electronic claims per average client day per month*

![Bar Chart] (Average total costs of electronic claims per average client day per month)

Input Variables

*Average out-of-home costs per average client day per month*

![Bar Chart] (Average out-of-home costs per average client day per month)

OUTPUT VARIABLES

**Measures of Quality**

Output Variables

**In-home treatment %**

![Bar Chart] (In-home treatment %)

Output Variables

**Average Coordinated Service Plans that meet standard**

![Bar Chart] (Average Coordinated Service Plans that meet standard)
**Output Variables**

The average percentage of treated youth showing improvement (ASEBA or CAFAS)

<table>
<thead>
<tr>
<th>Center</th>
<th>Improvement</th>
<th>Complaints/Grievances</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>84%</td>
<td>0%</td>
</tr>
<tr>
<td>B</td>
<td>84%</td>
<td>0%</td>
</tr>
<tr>
<td>C</td>
<td>60%</td>
<td>0%</td>
</tr>
<tr>
<td>D</td>
<td>60%</td>
<td>0%</td>
</tr>
<tr>
<td>E</td>
<td>60%</td>
<td>0%</td>
</tr>
<tr>
<td>F</td>
<td>60%</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Comment**

In an age of spiraling healthcare costs and limited resources, healthcare administrators are challenged to evaluate the efficient use of resources.

The DEA helps to evaluate both resource inputs and quality outputs—simultaneously.

The DEA methodology can be a helpful decision support tool for the administration of an evidence-based mental health delivery system.
Step 1: Set Up The Excel Worksheet with Cells for 1) Output Data, 2) Input Data, 3) Output Values, 4) Input Values, 5) Output Weights and 6) Input Weights

Step 2: Define the Output Values Using the Formula Pattern Below

Step 3: Define the Input Values Using the Formula Pattern Below
Step 4. 1) Place cursor on an Output Values cell, K9 in this example. 2) Open Tools/Solver. 3) Set up the Solver Parameters Using the Following Pattern and 4) Select “Solve”

Note: The last constraint is entered as K6:K11 <= L6:L11. The program automatically changed those values to “Outputs <= Inputs”.

Step 5. Read the Relative Efficiency Value From the “Final Value” Field as identified below. Repeat Steps 2 – 5 for Other Centers

This Table Illustrates the Calculation of the Relative Efficiency of Center D Using Solver-Generated Outputs and Weights

<table>
<thead>
<tr>
<th>OUTPUT VARIABLES</th>
<th>OUTPUTS</th>
<th>WEIGHTS</th>
<th>PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1 = In Hm Tt %</td>
<td>65.3</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>X2 = CSP at Std %</td>
<td>91.8</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>X3 = Scores Imp %</td>
<td>63.4</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>X4 = No Complaint %</td>
<td>99.7</td>
<td>0.0084</td>
<td>0.8379</td>
</tr>
</tbody>
</table>

The DEA for Center D SUM 0.8379

<table>
<thead>
<tr>
<th>INPUT VARIABLES</th>
<th>INPUTS</th>
<th>WEIGHTS</th>
<th>PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y1 = Off Exp</td>
<td>0.99</td>
<td>0.1970</td>
<td>0.1952</td>
</tr>
<tr>
<td>Y2 = Sal Exp</td>
<td>57.09</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Y3 = MHCC FTE’s</td>
<td>0.0647</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Y4 = Clinical Exp</td>
<td>109.50</td>
<td>0.0000</td>
<td>0.0000</td>
</tr>
<tr>
<td>Y5 = OOH Exp</td>
<td>86.23</td>
<td>0.0093</td>
<td>0.8648</td>
</tr>
</tbody>
</table>

SUM 1.0000

Efficiency of Center D