Whither the Patient in the Age of Big Data?: High Tech, High Touch or Both

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Vice President, Quality Programs
No Disclosures to Declare.
Attributes of U.S. HRAs in Different Quintiles of the EOL-Ex*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Quintile of EOL-Ex</th>
<th>Ratio (Highest to Lowest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOL-Ex 3rd</td>
<td>1 (Lowest) 10 638 11 559 12 596 14 644 1.61</td>
<td></td>
</tr>
<tr>
<td>Per capita Medicare spending, 3rd</td>
<td>1392 2 439 4940 5444 6304 1.65</td>
<td></td>
</tr>
<tr>
<td>Hospital characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall supply (beds per 1000), x</td>
<td>2.4 3.6 2.9 2.9 3.2 1.32</td>
<td></td>
</tr>
<tr>
<td>Beds in teaching hospitals, %</td>
<td>10.2 18.8 13.8 20.8 25.7 2.76</td>
<td></td>
</tr>
<tr>
<td>Beds in hospitals with &gt; 300 beds, %</td>
<td>31.6 37.4 38.7 43.8 57.2 1.81</td>
<td></td>
</tr>
<tr>
<td>Physician supply (per 10,000), y</td>
<td>184.8 189.4 184.4 204.6 242.4 1.31</td>
<td></td>
</tr>
<tr>
<td>Medical specialists</td>
<td>26.0 28.5 32.3 34.6 44.4 1.65</td>
<td></td>
</tr>
<tr>
<td>General internists</td>
<td>21.3 23.4 22.6 28.5 37.5 1.75</td>
<td></td>
</tr>
<tr>
<td>Family practitioners/GP</td>
<td>35.5 31.3 29.6 25.9 26.5 0.74</td>
<td></td>
</tr>
<tr>
<td>Surgeons</td>
<td>43.5 45.5 46 50.3 56.4 1.23</td>
<td></td>
</tr>
<tr>
<td>All other specialties</td>
<td>56.8 60.3 57.5 65.1 77.7 1.37</td>
<td></td>
</tr>
<tr>
<td>Medicare enrollees in HMOs, %</td>
<td>12.1 12.6 13.7 17.7 15.3 1.24</td>
<td></td>
</tr>
<tr>
<td>Residents in metropolitan areas, %</td>
<td>77.5 81.9 82.3 79.2 97.4 1.26</td>
<td></td>
</tr>
</tbody>
</table>

*EOL-Ex = End-of-Life Expenditure Index; GP = general practitioner; HMO = health maintenance organization; HRA = hospital referral region.

x Average age-sex-race-adjusted per capita fee-for-service spending on hospital and physician services in the HRAs within each quintile for Medicare enrollees age 85–99 years who were in their last 6 months of life. For details, see Methods.

y Average age-sex-race-adjusted 1996 annual per capita fee-for-service spending on hospital and physician services in the HRAs within each quintile on all Medicare services among enrollees age 85–99 years.

z Key attributes and average per capita supply of the specified medical resource in the HRAs within that quintile. Per capita supply is calculated per 1000 or per 10,000 residents of the general population within the HRAs.
Figure 11
Days in hospitals during last six months of life among patients who received most of their care in one of 77 “best” U.S. hospitals

- NYU Medical Center: 27.1 days
- Mount Sinai Hospital: 22.8 days
- NY Presbyterian Hospitals: 21.6 days
- Cedars-Sinai Medical Center: 21.3 days
- UCLA Medical Center: 16.1 days
- UCSF Medical Center: 11.5 days
- Stanford University Hospital: 10.1 days
A Dartmouth Atlas Quick Report for Texas

Average Number of Days in Hospitals During the Last Six Months of Life

Source: A Dartmouth Atlas Quick Report for Texas – End of Life Quick Report; 23SEP03

<table>
<thead>
<tr>
<th>City, TX</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>McAllen</td>
<td>14.8</td>
</tr>
<tr>
<td>Harlingen</td>
<td>14.6</td>
</tr>
<tr>
<td>Corpus Christi</td>
<td>12.9</td>
</tr>
<tr>
<td>Victoria</td>
<td>12.2</td>
</tr>
<tr>
<td>Odessa</td>
<td>11.9</td>
</tr>
<tr>
<td>Abilene</td>
<td>11.5</td>
</tr>
<tr>
<td>Houston</td>
<td>11.4</td>
</tr>
<tr>
<td>Longview</td>
<td>11.4</td>
</tr>
<tr>
<td>Beaumont</td>
<td>11.2</td>
</tr>
<tr>
<td>Wichita Falls</td>
<td>11.1</td>
</tr>
<tr>
<td>San Antonio</td>
<td>11.0</td>
</tr>
<tr>
<td>Lubbock</td>
<td>11.0</td>
</tr>
<tr>
<td>El Paso</td>
<td>10.6</td>
</tr>
<tr>
<td>Bryan</td>
<td>10.3</td>
</tr>
<tr>
<td>Tyler</td>
<td>10.3</td>
</tr>
<tr>
<td>Dallas</td>
<td>9.7</td>
</tr>
<tr>
<td>Austin</td>
<td>9.2</td>
</tr>
<tr>
<td>San Angelo</td>
<td>9.1</td>
</tr>
<tr>
<td>Amarillo</td>
<td>9.0</td>
</tr>
<tr>
<td>Fort Worth</td>
<td>8.7</td>
</tr>
<tr>
<td>Waco</td>
<td>8.1</td>
</tr>
<tr>
<td>Temple</td>
<td>7.8</td>
</tr>
</tbody>
</table>
Figures for Lung Cancer A Retrospective Study

Figure 1. Average Medical Oncology Charge per Patient, Age < 65, 1 Standard Deviation
Figures for Lung Cancer A Retrospective Study

Figure 3. Segregation of Charges by Department, Age < 65
Figures for Lung Cancer A Retrospective Study

Figure 7. Survival - Extensive NSCLC, $P=.99$
Figure 5. Secondary and tertiary regimens.
Exponential Growth of Computing
Twentieth through twenty first century

Calculations per Second per $1,000

Year

1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100

10⁻¹⁰ 10⁻⁹ 10⁻⁸ 10⁻⁷ 10⁻⁶ 10⁻⁵ 10⁻⁴ 10⁻³ 10⁻² 10⁻¹ 10⁰ 10¹ 10² 10³ 10⁴ 10⁵ 10⁶ 10⁷ 10⁸ 10⁹ 10¹⁰

All Human Brains
One Human Brain
One Mouse Brain
One Insect Brain

Logarithmic Plot

TEXAS ONCOLOGY
Oncology Case Series: NOCR*

1st Line Stage IV NSCLC

- Taxol/Carboplatin 41%
- Taxotere/Carbo 32%
- Gemzar + a taxane 3%
- Cisplatinum/Navelbine 1%
- Gemzar/Carbo 19%
- Other 4%

Source: *Network for Oncology Communication and Research
NSCLC Treatment by Stage

KCCC: From 1/1/06 to 9/1/06
Cost Effectiveness of Evidence-Based Treatment Guidelines for the Treatment of Non-Small-Cell Lung Cancer in the Community Setting

By Marcus A. Neuhauser, MD, J. Russell Hoverman, MD, Michael Kolodziej, MD, Lonny Reiman, MD, Stephen K. Gruschuk, PhD, MPH, Susan Hoang, PharmD, Albert A. Atwa, MEd, Marilyn McArthur, MS, Michael Forsyth, RPh, Todd Rothermel, and Roy A. Beveridge, MD

Kansas City Cancer Center, Overland Park, KS; Texas Oncology, Austin; US Oncology, Houston, TX; New York Oncology/Hematology, Albany, NY; Actaa Informatics; and Actaa, Hartford, CT

Abstract

**Purpose:** The goal of this study was to evaluate the cost-effectiveness of Level I Pathways, a program designed to ensure the delivery of evidence-based care, among patients with non-small-cell lung cancer (NSCLC) treated in the outpatient community setting.

**Patients and Methods:** We included patients with NSCLC initiating a chemotherapy regimen between July 1, 2005, and December 31, 2007, at eight practices in the US Oncology network. Patients were characterized with respect to age, sex, stage, performance status, and line of therapy and were classified by whether they were treated according to Level I Pathways guidelines. Twelve-month cost of care and overall survival were compared between patients treated on Pathway and off Pathway. A net monetary benefit approach and corresponding cost-effectiveness acceptability curves were used to evaluate the cost-effectiveness of Level I Pathways.

**Results:** Overall, outpatient costs were 35% lower for on-Pathway versus off-Pathway patients (average 12-month cost, $18,042 vs $27,737, respectively). Costs remained significantly less for patients treated on Pathway versus off Pathway in the adjuvant and first-line settings, whereas no difference in overall cost was observed in patients in the second-line setting. No difference in overall survival was observed overall or by line of therapy. In the net monetary benefit analysis, after adjusting for potential confounders, we found that treating patients on Pathway was cost effective across a plausible range of willingness-to-pay thresholds.

**Conclusions:** Results of this study suggest that treating patients according to evidence-based guidelines is a cost-effective strategy for delivering care to those with NSCLC.
12-Month Cumulative Cost by Pathway Status

Source: Neubauer, Cost-Effectiveness of Evidence-based Treatment Guidelines for the Treatment of NSCLC in the Community Setting, JOP, 6:1.
Overall Survival by Pathway Status

Neubauer, Cost-Effectiveness of Evidence-based Treatment Guidelines for the Treatment of NSCLC in the Community Setting, JOP, 6:1.
A New Technology Standard: Clear Value Plus software to streamline demonstration of quality

Integrates with physician’s workflow:

- Imports patient and clinical data from commonly-used EHRs

Identifies relevant Value Pathways and NCCN Guidelines at point of care

Allows providers, payers and employers to align on quality and value in patient care
Innovent Oncology – The Solution
Addressing the Three Major Cancer Care Cost Drivers

**COST 1 DRIVER**
Variable Use of Drugs and Diagnostics During Treatment

- Reduced variability in treatment patterns
- Reduced costs of drugs, reduced medication errors
- Improved clinical efficiency
- Increased patient and caregiver satisfaction

**COST 2 DRIVER**
Deterioration of Patient Health Status Between Treatments

- Reduced hospitalizations
- Reduced ER visits
- Increased adherence to treatment plan
- Encourages patient self-management
- Increased patient and caregiver satisfaction

**COST 3 DRIVER**
Ineffective Interventions Near the End of Life

- Reduced costs of treatment near end of life
- Increased hospice utilization
- Improved symptom management
- Documentation of patient’s values and goals of treatment
- Increased patient and caregiver satisfaction

**Expected Results**

**Quality Reporting and Outcomes**
- Data Analytics

**Level I Pathways**

**Patient Support Services**

**Advance Care Planning**
Opening the Black Box: The Impact of an Oncology Management Program Consisting of Level I Pathways and an Outbound Nurse Call System

By J. Russell Howesman, MD, PhD, Ira Klein, MD, MBA, Debra W. Harrison, MSN, Jad E. Hayes, MS, ASA, MAAA, Jody S. Garey, PharmD, Robyn Harrell, MS, Maria Sipala, Scott Houldin, Melissa D. Jameson, OCN, Mitra Abdollahpour, OCN, Jessica McQueen, Greg Nelson, MIS, Diana K. Verrilli, and Marcus Neubauer, MD

US Oncology Network, McKesson Specialty Health, The Woodlands, Texas Oncology, Dallas, TX; and Aetna, Hillsborough, NJ

Abstract
Purpose: The Innovent Oncology Program aims to improve the value of cancer care delivered to patients. McKesson Specialty Health and Texas Oncology (TXO) collaborated with Aetna to launch a pilot program. The study objectives were to evaluate the impact of Innovent on Level I Pathway compliance, implement the Patient Support Services program, and measure the rate and costs associated with chemotherapy-related emergency room (ER) visits and hospital admissions.

Patients and Methods: This was a prospective, nonrandomized evaluation of patients enrolled in Innovent from June 1, 2010, through May 31, 2011. Data from the McKesson electronic health record, the McKesson Specialty Health financial data warehouse, and Aetna claims data warehouse were analyzed.

Results: A total of 221 patients were included and stratified according to disease and age groups. 76% of ordered regimens were on pathway; 24% were off pathway. Pathway adherence improved from TXO baseline adherence of 63%. Of the 221 patients, 81% enrolled in FSS. Within the breast, colorectal, and lung cancer groups, 14% and 24% of patients had an ER visit and in-patient admission (IPA; baseline) versus 10% and 18% in Innovent, respectively; average in-patient days decreased from 2.1 to 1.2 days, respectively. Total savings combined for the program was $596,481.

Conclusion: Implementation of Innovent positively affected patient care in several ways: Fewer ER visits and IPAs occurred, in-patient days decreased, cancer-related use costs were reduced, and on-pathway adherence increased.
# Aetna Innovent Commercial Pilot 2010-2012

<table>
<thead>
<tr>
<th>Study Design</th>
<th>• Prospective, non-randomized evaluation of patients enrolled in the Innovent Oncology Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>• Patients seen by Texas Oncology physicians</td>
</tr>
</tbody>
</table>
| Inclusion    | • Aetna eligible pts diagnosed with an Innovent diagnosis initiating chemotherapy during program year 1 or year 2  
• Drug costs  
• ER and in-patient admissions and costs |
| Exclusion    | • Patient eligible for the program in the last month of each program year  
• Patients with a chemotherapy claim in the month prior to the program year  
• Patients without a chemotherapy claim within each program year |
# Results of Aetna commercial pilot

- **ER visits** reduced by 38% Year 1, 52% Year 2, & 48% overall for the program
- **In-patient admissions** reduced by 16% Year 1, 50% Year 2, & 34% overall for the program
- **Hospital days** reduced by 36% Year 1, 51% Year 2, & 44% overall for the program
- **Pathway adherence was** 74% in the Innovent program and 63% prior to initiating the program
- **Total savings calculated**: $506,000
Value

Value Formula

\[ V = \frac{O}{C} \]
Value

Relative Value

RV1 = O1/C1
RV2 = O2/C2
RV3 = O3/C3
Subjective Data

- Relative value may be determined by subjective value, assessable only by the patient.

- True value to the patient cannot be determined unless subjective values are explored.
Patient Support Services

- OCN with outbound calls at chemo start. Reviews meds, side effects, ESAS, Advance Directives.
- Scheduled calls thereafter with frequency determined by risk.
- Referral to clinic for any concerns based on assessment algorithms.
- Notes appear in medical record
- Values Assessment and Advance Care Planning
- Scanty evidence base for PSS although CCO study demonstrated 35% reduction in hospital days with regular ESAS.
Value Assessment and ACP

- Experience with over 800 Value Assessments
- Little pushback
- Transition to decision making
- Too soon to measure impact
Patient Values and Goals for Healthcare

We acknowledge that every patient has a right to have his or her personal values and goals of care known and respected. We will work with each patient to plan care to match their values and goals. Should a patient’s values and goals change over time, we will support these changes through the care we provide. Please share with us how valuable each concern is to you.

<table>
<thead>
<tr>
<th>How valuable is it to me to...</th>
<th>Unsure</th>
<th>Not Valuable</th>
<th>Somewhat Valuable</th>
<th>Very Valuable</th>
</tr>
</thead>
<tbody>
<tr>
<td>have freedom from pain, even if it takes strong medication (which could impair my ability to think clearly) to bring about acceptable relief?</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>be able to sleep well and wake up feeling rested?</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>be able to move about freely, with little or no dependence on others or supportive equipment?</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>be able to express my sexuality with my partner in a way that is pleasing to me?</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>know that I am not a burden to my family, friends, or helpers?</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Value Assessment

Choose who will make medical decisions for patient, if I am unable to make decisions for myself

Be told by my physician when patient is dying

Number of Documented Values Assessments

- Unsure
- Not valuable
- Somewhat valuable
- Very valuable
Advance Care Planning*

ACP Introduced 90%

- Introduced: 181
- Not introduced: 21

ACP Counseling 60%**

- Intro but did not participate: 59
- Participated: 122

Compare to Q3: ACP was 85% enrollees Introduced and 60% enrollees Participating in Counseling

** Of total enrollees (n=202)

*From one of our currently operational Innovent programs
Critical Communication


- Mack JW, Conin A, Keating NL et al. Associations Between End-of-Life Discussion Characteristics and Care Received Near Death: A Prospective Cohort Study.
Taking Care for advanced cancer

1) goal setting
2) skilled communication
3) systematic symptom assessment
4) easy access to PC
5) systematic collection of relevant metric data with a forum for continuous feedback,
6) community resources, particularly hospice care to provide support outside the hospital and clinic. For displaced patients, these resources may need to be identified, and in some cases, created.
7) an alternative payment schedule that encourages teamwork and eliminates piece work billing.
Exponential Growth of Computing
Twentieth through twenty first century

Logarithmic Plot

Calculations per Second per $1,000

Year

1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100

10^-10 10^-5 1 10^5 10^10 10^15 10^20 10^25 10^30 10^35 10^40 10^45 10^50 10^55 10^60

All Human Brains
One Human Brain
One Mouse Brain
One Insect Brain
Projected change in frequency of invasive cancers in the United States by age and sex

Per capita health spending growth in the elderly population, 1981-2009

The Medicare Population
Cautions

- Any program will require re-engineering practice
- Greater opportunity for savings with expanded program
- Costs for personnel and infrastructure regardless of model
Next Year and the Year After

- Collect data
- Streamline processes
- Negotiate for more management opportunities
- Link physician income to performance
- Understand operational costs including data collection and analysis
- Explore new methods of retrieving and organizing information to develop risk prediction models