Costs of Pressure ulcer prevention
Is it really cheaper than treatment?
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Faculty Disclosure
Dr. Braden has listed no financial interest/arrangement that would be considered a conflict of interest.

SCOPE OF THE PROBLEM

• Retrospective analysis of MPSMS 2007 database
• Subjects: 51,842 randomly selected Medicare beneficiaries discharged from fee-for-service hospitals
  – 5.8% were admitted with pressure ulcers
  – 4.5% developed at least one new pressure ulcer during hospitalization
• Individuals who developed HAPUs were:
  • had a longer length of stay (4.8 vs 11.2)*
  • more likely to die during the hospital stay (3.3% vs 11.2%)*
  • More likely to die within 30 days of discharge (4.4% vs 15.3%)*
  • more likely to be readmitted within 30 days (17.6% vs 22.6%)*
  • All statistically significant at p<.001

Incidence by State

• Highest HAPU rates
  – New York (5.2%)
  – Missouri (5.3%)
  – New Jersey (5.3%)
  – Massachusetts (5.5%)
  – Pennsylvania (5.9%)
• Lowest HAPU rates
  – Wisconsin (3.1%)
  – Alabama (3.3%)
  – Tennessee (3.7%)
  – Puerto Rico (3.7%)
  – North Carolina (3.8%)

Incidence by Setting or Group
ECONOMIC IMPACT OF PRESSURE ULCERS

Various Perspectives
- Cost to the nation
- Costs to Medicare and Medicaid
- Costs to Hospital/Agency/Facility
- Costs by Stage
- Cost-Effectiveness
- Comparison of costs to standard care

Cost of Hospital Acquired PU
- U. S. 2007 Federal Spending
  - $43,180 per full-thickness pressure ulcer
  - 257,412 cases
  - 11 billion total
  - No other preventable complication occurred as frequently as pressure ulcers
- Important to remember this was 5 years ago
  - Health care costs have increased.
  - The total number of elders on Medicare has increased, so even if incidence is lower, total cost is likely to have increased.
Cost estimates vary

- By approach:
  - Modeling vs Case Examination
  - Length of follow-up included
    - 50% of stage II ulcers do not heal in 8 weeks*
    - 95% of stage III/IV ulcers do not heal in 8 weeks*
  - By stage of ulcer
    - Whether costs of secondary complications are included
      - Bergstrom, et. al. JAGS 2005; 53:1721-1729


- Retrospective chart analysis of patients with stage IV PU with 29 months of follow-up
- 19 patients (11 hospital-acquired, 8 community acquired) were reviewed
- Costs associated with both treatment and secondary complications were calculated
  - Physician charges were excluded
  - Actual hospital costs were calculated using department-specific conversion factors
  - Nursing time was excluded but excess LOS was included.

Secondary complications included

- Pain
- Depression
- Local infection
- Osteomyelitis
- Anemia
- Sepsis
- Gas gangrene
- Necrotizing fasciitis
- Death
Results

- Costs for stage IV HAPU averaged $127,185 during one hospital stay
- Costs for stage IV community acquired pressure ulcer averaged $124,327


- Measured cost of resources required for care:
  - Skin cleanser, moisturizer, dressings, etc.
  - Antibiotics and analgesics
  - Nursing time for risk assessment, monitoring and repositioning
  - Turning sheet and support surfaces
  - Wound debridement
  - Inpatient bed-day costs

Estimated cost of treatment in U.K. By Pressure Ulcer Severity

<table>
<thead>
<tr>
<th>Stage</th>
<th>Cost per patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>£1214 ($1,912)</td>
</tr>
<tr>
<td>Stage II</td>
<td>£5241 ($8,255)</td>
</tr>
<tr>
<td>Stage III</td>
<td>£9041 ($14,240)</td>
</tr>
<tr>
<td>Stage IV</td>
<td>£14,108 ($22,222)</td>
</tr>
</tbody>
</table>
OTHER MODELING APPROACHES

Are too complicated for me to understand or explain, which probably means they are the most accurate...so I will try

MODELING COST TO A HEALTH CARE SYSTEM


Sample

- All adults over 18
- Minimum 1 night LOS
- Discharged from selected units of all Australian public hospitals in 2001-2002
Model to Simulate Cost of PU to Australian Health Care System

- The output ‘Economic costs of PU to the Australian health care system’ is a function of $A \times B \times C \times D$
- Where $A$, $B$, $C$, and $D$ represent the following input parameters:
  - $A =$ number of discharges from Australian public hospitals
  - $B =$ incidence rate for PU
  - $C =$ independent effect of PU on length of stay
  - $D =$ opportunity cost of a bed day to the Australian health care system

- Concluded there were 95,695 cases of PU in 2001-2002 with 398,432 bed days lost & opportunity costs of AUS285 M.

Can you use this simple formula?

- Depends…do you know:
  - $A =$ number of discharges per year from your facility?
  - $B =$ your facility’s incidence rate?
  - $C =$ independent effect of HAPU on LOS
    - For hospitals, you could use an average of 11 days based on the findings of Lyder, et. al. (2012)
    - Most methodologists use 5 days, however.
  - $D =$ opportunity cost of each day of LOS increase?

- If you are making a case to the administration, however, you can use just $A*B*C$ to show the number of bed days you have saved.

COST EFFECTIVENESS
Cost-Effectiveness Analyses

- Usually looks at cost of
  - a “new” or more aggressive approach vs the cost of standard care
  - Views these costs in comparison to cost of outcomes of both types of care
- These may be done in real situations or they may be modeled.
- Often look at quality-adjusted life years (QALYs), which has a societal impact but does not necessarily incentivize individual institutions.

COST-EFFECTIVENESS IN HOSPITALS


<table>
<thead>
<tr>
<th>Intervention</th>
<th>Estimated Daily Cost (2009 $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Assessment*</td>
<td>2.50</td>
</tr>
<tr>
<td>Support Surfaces</td>
<td>0.69</td>
</tr>
<tr>
<td>Chair cushion</td>
<td>0.17</td>
</tr>
<tr>
<td>Nutrition</td>
<td>1.10</td>
</tr>
<tr>
<td>Reposition*</td>
<td>12.02</td>
</tr>
<tr>
<td>Moisture/incontinence*</td>
<td>27.10</td>
</tr>
<tr>
<td>Unforeseen cost</td>
<td>11.09</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>54.66</strong></td>
</tr>
</tbody>
</table>
**Estimated Daily Cost for HAPU stage I/II**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Total Cost (2009 $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support Surface</td>
<td>148.56</td>
</tr>
<tr>
<td>Moisture/incontinence*</td>
<td>114.34</td>
</tr>
<tr>
<td>Repositioning*</td>
<td>12.27</td>
</tr>
<tr>
<td>Chair cushion</td>
<td>0.17</td>
</tr>
<tr>
<td>Nutrition</td>
<td>1.10</td>
</tr>
<tr>
<td>Risk Assessment*</td>
<td>2.55</td>
</tr>
<tr>
<td>Topical antibiotics</td>
<td>15.40</td>
</tr>
<tr>
<td>Inpatient costs</td>
<td>1,922.04</td>
</tr>
<tr>
<td>Unforeseen costs</td>
<td>544.11</td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td><strong>2,770.54</strong></td>
</tr>
</tbody>
</table>

**Estimated cost of a Stage III/IV**

- Gross-costed based on 8 day LOS at $44,983.80
- Per day costs estimated at $5,622.98 ($4779.53-$6466.43)

**Preventive care vs Standard care**

- Modeled using probabilities and odds ratios from CDC reports, systematic reviews and large national studies of prevalence

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Cost</th>
<th>Effectiveness</th>
<th>Mortality</th>
<th>Probability of discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention</td>
<td>$7,267.35</td>
<td>11.2 QALYs</td>
<td>15.1%</td>
<td>84.9%</td>
</tr>
<tr>
<td>Standard care</td>
<td>$10,053.95</td>
<td>9.342 QALYs</td>
<td>29.5%</td>
<td>70.5%</td>
</tr>
</tbody>
</table>
COST-EFFECTIVENESS OF PREVENTION IN NURSING HOMES


- Evaluated cost-effectiveness of four evidence-based preventive strategies
  - Pressure redistribution mattresses for all residents
  - Oral nutritional supplements for high-risk residents with recent weight loss
  - Skin emollients for high-risk residents with dry skin
  - Foam cleansing for high-risk residents requiring incontinence care.

Compared evidence-based strategies to standard practice

- Pressure redistribution foam (cubed foam, visco-elastic foam, high-density foams) compared to standard hospital mattress
- Oral nutritional supplements (daily drinks of 237 ml with 2kcal/ml) + standard diet compared to standard hospital diet only
- Hyperoxygenated fatty acid regimen for skin dryness, applied twice daily to sacrum, trochanter and heels compared to “matched greasy placebo.”
- Foam cleanser combining an emollient, a water repellent barrier and a water-repellent deodorant compared to soap and water for incontinence care
**Inputs**

- Patient data from all 89 of 613 facilities in Ontario
- Costs of nursing and personal care, supplies, programming and accommodations from linked administrative database for province.
- Costs of staff time included or subtracted (if strategy saved staff time).
- Predicated on
  - 2.6% incidence of stage II-IV
  - Cost of care for stage II of $106/wk
  - Cost of care for stages III/IV of $128/wk

**Costs per strategy**

- Pressure redistribution surfaces for all residents would decrease lifetime costs by $115 per resident
- Use of foam cleansers on high risk incontinent residents would decrease lifetime cost by $179
- Nutritional supplementation increased lifetime costs by $731 per resident.
- Use of skin emollient on patients with dry skin increased lifetime costs by $24 per resident.

**Conclusions**

- Pressure redistribution foam mattresses showed the strongest evidence of cost-effectiveness
- Use of skin emollients and foam cleansers was probably cost-effective but more clinical evidence needed to confirm this.
- Oral nutritional supplementation was not cost-effective but authors allowed that there were other health benefits not measured.
An Applied Study of Costs in a SNF


- 151 bed SNF
  - Established pre-initiative facility-acquired rate.
  - Post-initiative data collection took place from Nov. 2003-Nov. 2007.
  - Both phases involved resident census, wound type and size data collected weekly.

Clinical process

- Formed interdisciplinary team with strong leadership.
- Provided intensive mandatory training for all staff on fundamentals of prevention and treatment.
- Preventive care for all residents with attention to:
  - skin lubrication
  - pressure redistribution surface for both bed and chair
  - heel protection.
Results

- Average pre-initiative incidence was 5.19%.
- Average post-initiative incidence was 0.73%.
- Incidence in fourth year was 0.06%.
- An 86% reduction overall and a 99% reduction in the fourth year.

Ancillary benefit

- Unexpected and unplanned benefit of a 37% reduction in falls.
- A monthly savings of $10,187 per month.
- An annual savings greater than $122,000.

LITIGATION AVOIDED NOT INCLUDED IN ANALYSIS OF COST-SAVINGS OF PREVENTION

- Historically, rates of litigation against nursing homes was low until the mid to late 1990’s
- This study linked information on 4716 tort claims brought against 1465 nursing homes between 1998 and 2006 to 10 quality indicators
  - On average, each nursing home received one claim every 2 years
  - Most prevalent types of harm alleged were
    - Falls (26.6% of claims)
    - Pressure ulcers (15.9% of claims)
  - 61% of claims resulted in payment, averaging $199,794 per claim ($2006 dollars).

Odds of being sued

- Odds were significantly higher among nursing homes with more deficiencies and those with serious deficiencies relative to the state average for deficiencies.
- Odds were positively associated with the incidence of pressure ulcers and weight loss.
- Odds were significantly lower among nursing homes with more nurse aide hours per resident.
- Overall, NH with best deficiency records had a 40% annual risk of being sued, while those with the worst deficiency record had a 47% chance of being sued.


- In a study of the impact of compliance on medical malpractice awards:
  - 35 plaintiffs were awarded $14,418,770
  - Had health care defendants followed guidelines, $11,389,989 might have been saved in 20 lawsuits
  - Round about way of saying that, in 15 of these cases, the guidelines on pressure ulcer were followed and the damages awarded were very, very low in these cases.
Take Away Message

• Risk of litigation may not be substantially smaller in high quality nursing homes

• It appears that awards are much lower if guidelines are followed.

• When cost of claims are considered, the cost of prevention is substantially lower than standard care.

EXPANDING PREVENTION

Operating room and Emergency Dept.


• Used a Markov simulation model to evaluated the cost-effectiveness of using a dry viscoelastic polymer overlay to prevent intraoperative pressure ulcers over a 1 year period of time.

• Compared it to use of a standard OR table mattress without additional overlay

• Simulations were performed for patients undergoing scheduled surgeries in either supine or lithotomy position that lasted 90 minutes or more, but projected incidence was based on surgical duration of 4.6 hours.

• Included hospital costs and post-discharge home care costs (assumes perspective of national payer).
Results in 2009 Canadian Dollars

- Strategy of using a dry, viscoelastic polymer overlay was estimated to decrease the intraoperative incidence of pressure ulcers by 0.51%.
  - Average cost per patient of using the overlay was $1.66 ($1.67 USD)
- Average cost savings was $46 per patient, ranging from $13 to $166 with various surgical populations (hospital + community).
- The average cost savings for hospital care was $44 per patient
- Intraoperative prevention was 99% likely to be more cost-effective than current practice.


- Examined cost-effectiveness of prevention vs standard care in ER

<table>
<thead>
<tr>
<th>Standard care</th>
<th>Thickness</th>
<th>Cost Canadian</th>
</tr>
</thead>
<tbody>
<tr>
<td>stretchers</td>
<td>3&quot;</td>
<td>$300</td>
</tr>
<tr>
<td>beds</td>
<td>5&quot;</td>
<td>$300</td>
</tr>
<tr>
<td>Preventive care Stretchers</td>
<td>5&quot;</td>
<td>$780</td>
</tr>
<tr>
<td>beds</td>
<td>8&quot;</td>
<td>$500</td>
</tr>
</tbody>
</table>

Results

- Projected incidence of PU was 1.90 with current practice and 1.48 with preventive practice
- Average cost of upgrading to pressure redistribution surface was $0.30 per patient.
- Cost savings for health care system was $32 per patient and cost savings for hospital was $30
- At the maximum cost for upgrading, the net benefit of prevention was $19 per patient.
2009 Emergency Room Visits in U.S.

- 29.6% of all ER visits were age 65 or older
- Of those admitted to the hospital from the ER, 43.3% were age 65 or over
- About 7.4 million patients 65 or older were admitted to the hospital from the ER.
- 7.4 million x $19 = 140 million dollars could be saved by upgrading all ER surfaces in the U.S.

For your own hospital

- A*B*C = D
  - Where A = number of ER admissions per year
  - B = 29.6 (the likely percent age 65 or older)
  - C = $19
  - D = likely savings from upgrading ER surfaces

So is Prevention Really Cheaper Than Treatment?
A Lot Cheaper!