The Economics of OSA and Wellness in Transportation: an introduction

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Health Care Spending in Relation to GDP
16% in 2007 → 25% in 2025

Source: Congressional Budget Office; www.cbo.gov

Note: Amounts for Medicare are net of beneficiaries’ premiums. Amounts for Medicaid are federal spending only.
National Health Expenditures per Capita 1990-2018

The Bleeding: Convergence of Problems

• Spiraling Health Related Costs
• Aging Population: *the Baby Boomers*
• Deteriorating Public Health
• Increased Health Regulations
• Healthcare Reform
I think you should be more explicit here in step two.
An Actual Solution to the Problem

Preventable Chronic Disease
## Preventable Chronic Diseases: Annual Healthcare Cost Breakdown

*Source: National Institute of Health Website*

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cost [ Bn ]</th>
<th>% Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular Disease (CVD)</td>
<td>$475</td>
<td>19.0%</td>
</tr>
<tr>
<td>Obesity</td>
<td>$149</td>
<td>6.0%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>$147</td>
<td>5.9%</td>
</tr>
<tr>
<td>Stroke/TIA</td>
<td>$73</td>
<td>2.9%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>$47</td>
<td>1.9%</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>$37</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

**Sub-Total**             | **$928**    | **37%**        |

...                        | ...         | ...            |

**Total**                  | **$2,500**  | **100%**       |
Obesity Epidemic in the United States

Source: Centers for Disease Control and Prevention; www.cdc.gov

• More than 60% of the United States population is *overweight* or *obese*

• If the current trend continues 50% of the population will be *obese* by 2030
Annual Incremental Obesity-Related Costs

The incremental costs of being **obese** are **8 times** the incremental costs of being **overweight**

<table>
<thead>
<tr>
<th>Overall Annual Costs of Overweight &amp; Obesity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overweight</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
</tbody>
</table>

Costs increase *exponentially* with degree of obesity

- Incremental annual costs per employee with severe obesity (BMI > 35) range from $2,491 to $6,694 per employee

- Individuals with BMI > 35 represent 37% of the obese population, but are responsible for 61% of the costs resulting from weight

(Finkelstein et al., *JOEM*; 52:9, 2010)
### Prevalence in Adult Population

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010 (estimate)</th>
<th>2020 (estimate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>People with prediabetes</td>
<td>26.3%</td>
<td>28.4%</td>
<td>36.8%</td>
</tr>
<tr>
<td>People with undiagnosed diabetes</td>
<td>2.9%</td>
<td>3.1%</td>
<td>4.1%</td>
</tr>
<tr>
<td>People with type 1 diabetes</td>
<td>0.2%</td>
<td>0.2%</td>
<td>0.2%</td>
</tr>
<tr>
<td>People with type 2 diabetes</td>
<td>7.6%</td>
<td>8.2%</td>
<td>10.8%</td>
</tr>
<tr>
<td>Total ⁹</td>
<td>37.0%</td>
<td>39.9%</td>
<td>51.9%</td>
</tr>
</tbody>
</table>

### Health Costs Attributable to Diabetes (in billions)

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010 (estimate)</th>
<th>2011-2020 (projection)</th>
</tr>
</thead>
<tbody>
<tr>
<td>People with prediabetes</td>
<td>$27</td>
<td>$34</td>
<td>$585</td>
</tr>
<tr>
<td>People with undiagnosed diabetes</td>
<td>$12</td>
<td>$15</td>
<td>$253</td>
</tr>
<tr>
<td>People with type 1 diabetes</td>
<td>$4</td>
<td>$5</td>
<td>$73</td>
</tr>
<tr>
<td>People with type 2 diabetes</td>
<td>$110</td>
<td>$140</td>
<td>$2,439</td>
</tr>
<tr>
<td>Total ⁹</td>
<td>$153</td>
<td>$194</td>
<td>$3,351</td>
</tr>
</tbody>
</table>

*“Intensive, Practical Intervention Strategies [must be] Proposed to Reverse the Trend, and Prevent [this] Health Care Catastrophe”*

– UnitedHealth Group
Sleep Disorders: The Silent Epidemic

☑ 30% of Americans

☑ Untreated Sleep Disorders Cause
   ✔ Weight Gain
   ✔ High Blood Pressure
   ✔ Heart Disease
   ✔ Stroke
   ✔ Type II Diabetes
   ✔ Attention Deficit/Hyperactivity Disorder (ADHD)

☑ Children, Adults and Seniors
The Silent Cause of Chronic Disease

- Diabetes: Type 2 Diabetes up to 65%
- Obesity: 30%
- Hypertension: Hypertension 37%, Drug-Resistant Hypertension 83%
- CVD: Coronary Artery Disease 30%
- Stroke/TIA: up to 70%
- Heart Failure: Congestive Heart Failure 60%
The Economics: Sleep Apnea (CAN)

10 yrs Before Diagnosis:

- Total Physician Claims
  - $686,000 vs $356,000
    (Sleep Apnea) vs (Controls)

(Roland et al, Sleep, 1999)
10 yrs Before Diagnosis:

- **Physician Fees**
  - Double in OSA
- **Physician Visits**
  - 13/yr vs 7/yr

(Banno et al, *Sleep*, 2009)
Result of Treating Sleep Apnea (US)

By Treating Sleep Apnea:

- Life Expectancy (↑8%)
- QALY Expectancy (↑18%)
- 10 yr Risk MI (↓49%)
- 10 yr Risk Stroke (↓31%)
- 10 yr Risk Death MVC (↓52%)
- 10 yr # of MVC/person (↓52%)
- $/QALY gained ($15,915)

(Pietzsch et al, Sleep, 2011)
Cost-Effectiveness in Context

**More Cost Effective:**
- Ibuprofen for RA
- Aspirin for CVD

**Less Cost Effective:**
- Diabetes Screening
- Annual Mammogram

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**Table 6**—Cost per Quality-Adjusted Life Year (QALY) gained from selected clinical strategies (results of this study are in bold)

<table>
<thead>
<tr>
<th>Intervention</th>
<th>ICER ($/QALY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corticosteroids vs. nonsteroidal anti-inflammatory drugs (NSAIDs) in combination with any disease-modifying anti-rheumatic drug (DMARD) in patients with rheumatoid arthritis (age 50)</td>
<td>$2,840</td>
</tr>
<tr>
<td>Aspirin vs. no aspirin in combination with usual care in patients at high risk for cardiovascular disease</td>
<td>$12,120</td>
</tr>
<tr>
<td>Mechanical thrombectomy vs. best medical therapy alone in patients with large-vessel ischemic stroke who are ineligible to receive tissue plasminogen activator (age 61)</td>
<td></td>
</tr>
<tr>
<td>CPAP therapy vs. no treatment in patients with a diagnosis of moderate-to-severe OSA (50-year-old male)</td>
<td>$15,915</td>
</tr>
</tbody>
</table>
| Annual screening for proteinuria and subsequent treatment with ACE inhibitor or ARB therapy vs. routine clinical practice (No Screening) in patients with hypertension at annual physical (age 50) &
  Adult Treatment Panel III (ATP III) guidelines vs. alternate risk and age based strategies for identifying patients for
  Cholesterol lowering statin therapy in the general population (ages 35-85) &
  Ileocolonoscopy with follow-up computed tomographic enterography (CTE) vs. ileocolonoscopy only for the diagnosis of small-bowel Crohn disease in patients with 75% pretest probability of small-bowel Crohn disease (30 year old) &
  HIV antibody screening every 5 years vs. one-time screening, for the diagnosis of HIV in general population with 1% pretest probability of HIV (age 42) &
  Annual mammogram from ages 40 to 80 vs. annual mammogram from ages 45 to 80 for the diagnosis of breast cancer in average risk women in the general population &
  Bone densitometry vs. no densitometry for the diagnosis of osteoporosis and fracture risk assessment in men with no history of clinical fracture (age 70) &
  One-time whole-body CT scan vs. routine preventive care at age 50 &
  Dynamic susceptibility-weighted contrast material-enhanced (DSC) magnetic resonance (MR) imaging vs. standard clinical workup for the diagnosis of Alzheimer disease in community dwelling patients with mild to moderate dementia |               |

Values are given in 2008 U.S. dollars, with adjustment using the GDP deflator. Numbers are the ratios of the added cost per person to the gain in QALYs per person.

*(Pietzsch et al, Sleep, 2011)*
Result of Treating Sleep Apnea (UK)

UK National HS data
14 year projection

- QALY ($8400/yr saved)
- CVE (↓60%)
- Stroke (↓63%)
- Auto Accident (↓41%)
- Cost/Person (↓$3100/yr)

Sleep Medicine is the Prevention Specialty

- **Diabetes**: $147 Bn
  - Type 2 Diabetes up to 65%
  - 65%

- **Obesity**: $149 Bn
  - 30%

- **Hypertension**: $47 Bn
  - Hypertension 37%
  - Drug-Resistant Hypertension 83%
  - 37%

- **CVD**: $475 Bn
  - Coronary Artery Disease 30%
  - 30%

- **Stroke/TIA**: $73 Bn
  - up to 70%
  - 70%

- **Heart Failure**: $37 Bn
  - Congestive Heart Failure 60%
  - 60%
What Can You SAVE?
Sleep Medicine: Prevention in Action

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Healthcare expenses $10 million/yr
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Healthcare expenses $10 million/yr
Avoidable legal defense $3 million/yr
Sleep Medicine: Prevention in Action

What Can You SAVE?

- Healthcare expenses: $10 million/yr
- Avoidable legal defense: $3 million/yr
- Additional recruiting costs: $6,000/ person
Sleep Medicine: Prevention in Action

What Can You SAVE?

- Healthcare expenses: $10 million/yr
- Avoidable legal defense: $3 million/yr
- Additional recruiting costs: $6,000/person
- A good reputation: Priceless