The Future of Anesthesia: What We All Need to be Worrying About

Warren S. Sandberg, M.D., Ph.D.
Professor & Chair, Anesthesiology
Vanderbilt University School of Medicine
Disclosures

• None
Learning Objectives

At the conclusion of the activity participants should be able to:

1. Describe the relationship between healthcare cost vs. GDP per capita over time
2. Interpret the concept of disruptive innovation as it applies to healthcare generally and anesthesiology specifically
3. Evaluate future potentially disruptive forces acting on anesthesiology
4. Formulate a personal plan for responding to market force pressures and innovation that creates value by leading and contributing to perioperative quality & throughput initiatives
Future of Anesthesiology:
A Lifetime of Pumping Gas is Not in the Cards

Warren S. Sandberg, M.D., Ph.D.
Professor & Chair,
Department of Anesthesiology,
Vanderbilt University School of Medicine
Not the Best Value

- Cost rising faster than GDP
- Big spend does not translate to longevity or better access
- Payers (employers) committed to bending the cost curve

Not the Best Value

The Cost of Care

The United States spends more on medical care per person than any country, yet life expectancy is shorter than in most other developed nations and many developing ones. Lack of health insurance is a factor in life span and contributes to an estimated 45,000 deaths a year. Why the high cost? The U.S. has a fee-for-service system—paying medical providers piecemeal for appointments, surgery, and the like. That can lead to unneeded treatment that doesn’t reliably improve a patient’s health, says Gerard Anderson, a professor at Johns Hopkins Bloomberg School of Public Health who studies health insurance worldwide. “More care costs.”

Timeline of Total Health Care Expenditures as a Percentage of GDP

U.S. v. average of 14 other OECD countries

Mean HCE %GDP of 14 other OECD countries

Notes:
1. The "14 other OECD countries" are from the original 20 and have fewer than 25% missing values.
2. The line from roughly 4 to 14 of the vertical axis is the trend based on US-OECD avg. over 1960-80.
   http://thehealthcareblog.com/blog/2013/04/16/a-fresh look-at-health-care-cost-growth/
A High Stakes Resource

• Anesthesiologists (anesthetists) are everywhere
• Necessary adjunct to procedural medicine
• Expensive!
  • Typical academic dept: 50 anesthesiologists
  • Total expense/FTE: about $600K/year
• Revenue does not keep up with expenses
  • Institutional support to academic depts: averages about $165K/FTE-year
• This is real money ($8.25M/year)
A Higher Stakes Resource

• ‘Well - I’ll just do a fellowship’
• Differential for some fellowship trained specialties is about $40k/year
• But they fill important super-specialized niches
  • Not generalists
  • Not efficient to have lots of queues
• Faculty hires tend to ‘stick’
• Does fellowship training assure career security?
Danger of Going Up-Market

Impact of Sustaining and Disruptive Change

Performance demanded at **high** end of market
Danger of Going Up-Market

Impact of Sustaining and Disruptive Change

Product Performance vs. Time

- Performance demanded at **high** end of market
- Performance demanded at **low** end of market

Sustaining Development
Danger of Going Up-Market

Impact of Sustaining and Disruptive Change

Performance demanded at high end of market

Disruptive Innovation

Performance demanded at low end of market

Time
Danger of Going Up-Market

Impact of Sustaining and Disruptive Change

Performance demanded at **high** end of market

Performance demanded at **low** end of market

Disruptive Innovation
Danger of Going Up-Market

Impact of Sustaining and Disruptive Change

Performance demanded at **high** end of market

Disruptive Innovation

Performance demanded at **low** end of market

Product Performance

Time
Danger of Going Up-Market

Impact of Sustaining and Disruptive Change

Performance demanded at high end of market

Disruptive Innovation

Performance demanded at low end of market
Niche = necessary?

• Maybe for now
• But...
  • APRNs doing pain procedures (supervised by chiropractors)
  • NPs doing critical care
  • CRNAs doing thoracic, cardiac & pedi cardiac
  • Hospitalists doing postops, preops and postop care
  • QZ billing - 1:6, 1:8 coverage ratios
  • CRNAs practicing independently (coming soon to VHA)
  • Nurses with doctorates
• These were all interesting ‘concepts’ 10y ago
One Role Group: Everywhere

Anesthesia, Critical Care & Pain Management

- GI Procedures
- Radiology
- Operating Room
- OR Admin
- Cath Lab
- Research
- Labor & Delivery
- Code Team
- Critical Care

VANDERBILT UNIVERSITY School of Medicine
Work Force Estimates

Currently: matched supply & demand

No consideration of external pricing pressure
Anesthesia Group = Morsel

• VC Groups buying out private practice groups
• Partners sell their interest
• No more partnership tracks - everyone is an employee
• VCs rake off some of the revenue
• New hires come in at low salaries
• Time to ROI = ??
• Salaries adjusted to make the #s work
• Once ROI achieved, dump if unprofitable
Consolidation: Banking (since 1995)
My Speculation:

• New healthcare economy WILL push salaries down into CRNA ranges

\textit{and / or}

• Payors will stop considering professional fees for anesthesia services
• Anesthesiologists WILL do what is necessary to preserve earnings - by maximizing their individual productivity
• What is perceived as a shortage will become a glut
Bright Spots: Technology as Second Disruptor
Information to the Clinician

• Most information is concealed - have to search.
• Moving up the slope of increasing value & impact of information:
  • Transparency
  • Active information
  • Integration
  • Augmented vigilance
  • Decision support

Managerial | Process of Care | Clinical

• Automated Process Monitoring & Process Control
Decision Support (DS)

• Recommends one or more possible actions based on
  • Integrated data
  • Best practices

• Delivered through augmented vigilance
Electronic Framing/Coordination

• Hard stop - can’t document case without it
• (escape for emergency)
• Prior to implementation Vandy performed at national average (estimate 1:10,000 to 1:25,000 cases)
• After implementation in Spring 2010: No wrong sided or wrong site surgery - (0 for ~120,000 cases)
• Reduction in injury settlements returned the investment in one year
Automated Process Monitoring (APM) and Process Control (APC)

• Compare PLANNED to ACTUAL
• “Second set of eyes” on decision opportunities
• Real-time
• Decision support recommendation elevated - must perform
• Unique circumstances can still be considered
• For an automated system to “know what to do”, need a PROCESS MODEL
Requirements

• Integrator
• Process model (flow chart representation of process)
• Inputs-
  — Sensors- OR equipment, tracking systems, patient ID systems
  — Data sources- HIS, PACS, Admin data
• Triggers- ‘business’ rules (compare planned process to events)

• Annunciation pathway
• Short latency
• Hard to ignore
‘Business’ Rule: Example

Patients leaving the OR should have PACU orders
Diabetics Should Have Intra-Op Glucose Checks

• Not great at monitoring...
• Created an automated alert system
• Good functional outcome
Glucose: A Modest Success Story

- Nice associations
- Not able to demonstrate causation.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Baseline Cohort 5/10-12/10</th>
<th>Post-Intervention 7/11-7/12</th>
</tr>
</thead>
<tbody>
<tr>
<td># Patients</td>
<td>4,447</td>
<td>8,937</td>
</tr>
<tr>
<td>PACU Length of Stay (hrs:min)</td>
<td>2:21</td>
<td>2:23</td>
</tr>
<tr>
<td>Post-Op LOS (days)</td>
<td>5.7</td>
<td>5.6</td>
</tr>
<tr>
<td>SSI %</td>
<td>0.49%</td>
<td>0.21%</td>
</tr>
<tr>
<td>PACU Blood Glucose (&gt;300, &lt;50 mg/dL)</td>
<td>1.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>14 Day Hospital Readmission %</td>
<td>2.8%</td>
<td>2.2%</td>
</tr>
</tbody>
</table>
Storm Clouds: Technology as Further Disruptor
Distant Future: 20 Years

• Surgery fully planned in advance

“In the distant future (20-50 years), certain parts of the procedure will become automated.

Eventually the whole operation can be automated.”

* source: Satava, RM: The Operating Room of the Future: Observations and Commentary”; Seminars in Laparoscopic Surgery; vol. 10; no 3; 2003 pp. 99-105
Image: courtesy of R. Satava, MD
Distant Future: 20 Years

• Surgery fully planned in advance

“... this scenario will be one in which the surgeon performs the virtual operation on the patient’s image and "edits" the procedure until it is perfect...” *
Distant Future: 20 Years

• Surgery fully planned in advance

“...then pushes the “operate” button and a “perfect” operation is performed, with all the errors edited out.” *
Disruption in Anesthesia?

http://muhc.ca/newsroom/news/mcsleepy-meets-davinci
Predictable Response:

• Resistance to change is a recurring theme
  • By our professional organizations
  • By regulatory agencies
  • By individuals
• It never works -
  • It’s never productive in the long run
  • The collateral damage is immense
  • Fighting a rear-guard action isn’t leading
• Then you lose, and the other guy writes the history
My Further Proposition:

• Excellent clinical skills, professionalism and medical knowledge (& the rest of the CCs) are required for a place at the table.

• To stay off the menu - need to offer something that can’t be commoditized.
  • That wouldn’t be ‘caring’, ‘professionalism’, ‘ownership’, ‘vigilance’ - We all do that!

• Anesthesiologists had the safety / effectiveness / technology high ground.

• Time to take it back.
This is Not the Whole Answer - For Sure!
Safer anesthetics: Evanescent Drugs & Etomidate Analogs
Designer Etomidate Analogs

• Designed out adrenal suppression
• Some have very fast offset times
• Commercial potential...

Fig. 1. Structures of etomidate, methoxycarbonyl etomidate, dimethyl-methoxycarbonyl etomidate (DMMM), and cyclopropyl-methoxycarbonyl etomidate (CPMM).
Reversal Agents: NMB and now GA
Sugammadex

- Time to TOF = 0.9 after rocuronium (1.2 mg/kg)
- Median:
  - 1.6 minutes (sugammadex 12 mg/kg)
  vs.
  - 111 minutes (placebo)
- ‘Square wave’ relaxation control
Issues with Sugammadex:

- Allergic reactions:
  Needs to be taken into account in preclinical drug safety assessments of drug-carrier complexes.
- Interference with coagulation:
  Increased clotting time – need to check INR.
- Hormonal contraceptives:
  Decreased progestogen concentrations.
- Has not achieved FDA approval
- Cost (estimated $90-$360/dose) - more later
General Anesthesia: Active Reversal

- Methylphenidate: inhibits DA and NE reuptake
- Droperidol: DA inhibitor
- Rat in chamber @ 1 MAC Iso
- (Essentially dissolved in anesthetic)
General Anesthesia: Active Reversal

- Methylphenidate: moves EEG power spectrum towards ‘Awake’
Paradoxically, these all jeopardize us…

- Anesthesiology that has grown up around the administration of drugs with therapeutic indices of 10
  - i.e., $ED_{90} = LD_{10}$
- Making it safer & more reliable takes out the ‘magic’
- Also, Speed and reliability do matter in the age of capitation
  - Recall that staffed OR time is charged at $1.00 per second!
Bundled Payments, Value Based Purchasing, Quality & Costs
Speed & Reliability Will Matter

• Under capitation, every cost matters
• Speed and RELIABILITY newly matter in the age of capitation
  • Recall that staffed OR time is charged at $1.00 per second!
  • Collection ratio is ~40% - we’re collecting (collectively!) $0.40/second when working
• Shaving 10’ off every wakeup WILL be beneficial IFF there is another (new) case to do or staffed hours can be reduced
• (But until then it’s a waste)
Solution Oriented Problem Solvers:

- Catalysts work by bringing things into proximity and constraining their options
- Do not change the free energy of a reaction
- Lower the ACTIVATION energy

Problem: Congested PACU and hospital
Goal: Directly discharge Lap chole patients home from PACU
Obstacle: Aligning Anesthesia, Surgery & Nursing
Solution: Catalyze project in a small, multidisciplinary team
Multidisciplinary Approach

• Pre-surgical teaching in surgeon’s office.
• Modification in surgical technique.
  • (Local anesthetic instillation)
• Specific anesthetic interventions (not stringently applied).
  • Minimize benzos.
  • Intensification of antiemetic prophylaxis.
  • Long acting opioid up front.
  • Succinylcholine infusion.
• Direct communication of discharge plan to PACU.
Direct Discharge: LOS Analysis

- Direct Discharge patients were in the hospital ~ 3 fewer hours than Same Day Discharge patients.
- Wholesale move of 23hr patients to Direct Discharge

Impact of Direct Discharge

OR → PACU → Floor
Impact of Direct Discharge

• Anticipate that unloading floor decompresses PACU so that...
Impact of Direct Discharge

Extra cases can flow through...
What Did We Learn?

- Lap chole direct discharge project was a ‘classic’ process improvement project
- Labor intensive
- Solved ONE problem
- Once & done (maybe don’t look back)
  - Is it still working?
  - Have conditions changed?
- Is this a good use of clinician time & effort?
- Curriculum 2.0
Anesthesiologists Need to Get Beyond the OR

• Our abilities as system thinkers and ‘Doctors to the System’ are valuable
• Being chased up market by replacement providers and technology anyway
• No easy way to make the finances work for true perioperative medicine
• BUT we:
  • Have access to, and are willing to use advanced information technology
  • Are incredibly self-disciplined
Impact of Pulse Oximetry Surveillance on Rescue Events and Intensive Care Unit Transfers

A Before-and-After Concurrence Study

Andreas H. Taenzer, M.D., F.A.A.P.,* Joshua B. Pyke, B.E.,† Susan P. McGrath, Ph.D.,‡ George T. Blike, M.D.§

Anesthesiology, V 112 • No 2 • February 2010

Fig. 1. Rescue events per 1,000 patient discharges before and after. PSS = patient surveillance system unit. Plot elements: filled circles = outside values; - = adjacent value; ++ = top and bottom of box are twenty-fifth and seventy-fifth percentiles; — = median.

Fig. 2. Transfers to ICU on the PSS unit per 1,000 patient days before and after implementation. ICU = intensive care unit; PSS = patient surveillance system. Plot elements: - = adjacent value; ++ = top and bottom of box are twenty-fifth and seventy-fifth percentiles; — = median.
And Don’t Forget the Periop Surgical Home (aka: “We’re Here to Help”)
The Future Plays Into Our Strengths

• Risk - moderated but serious
• Rapidly changing situation
• Decision making pressure with incomplete data
• Drastic action may be required
• Toys and better drugs factor into the equation
• Efficiency will be rewarded
• Quality will be rewarded (for real)
• We can leverage technology to take care of the whole hospital
My Proposal:

• What separates ‘-ologists’ from ‘-ists’ are:
  • Complexity (management of)
    — Individual case level
    — System level
      • Management
      • Leadership
      • Policy
  • Creation of new knowledge that improves the science and the process
What I Ask Potential New Hires

• What is your appetite for change?
• Describe any quality improvement projects you have done, including implementation, uptake and assessment of outcomes / impact.
• Describe any research projects that you carried out to the point of submission to a peer-reviewed journal.
• Who could I call at your prior institution who would describe you as a solution-oriented problem solver in the practice?
Comments?
“Science and technology revolutionize our lives but memory, tradition and myth frame our response.”

— Arthur Schlesinger, Jr.