

Operating Room Staffing and Allocation

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Operating Room Staffing and Allocation



Franklin Dexter, M.D., Ph.D.

Director, Operations Research

Professor, Departments of Anesthesia
and Health Management & Policy

University of Iowa

Franklin-Dexter@UIowa.edu

Financial Disclosure

- Employment
 - I am employed by the University of Iowa, in part, to consult and analyze data for hospitals, anesthesia groups, and companies
 - Department of Anesthesia bills for my time
 - I receive no funds other than from the University of Iowa, including no travel reimbursement or honorarium
 - I own no healthcare stocks (other than indirectly through mutual funds)
 - I have tenure with no incentive program

Sequence of the Talk Based on Review Article

- What precisely is OR efficiency?
- OR efficiency applies to existing workload
- Teach principles using scenarios
- Service-specific staffing based on OR efficiency
 - Important to use the statistical methods
 - How to use the statistical methods



Sequence of the Talk Based on Review Article

- McIntosh C, Dexter F, Epstein RH. [Impact of service-specific staffing, case scheduling, turnovers, and first-case starts on anesthesia group and operating room productivity: tutorial using data from an Australian hospital.](#)
Anesthesia & Analgesia 103: 1499-1516, 2006



Sequence of the Talk

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Example of a Decision on Operating Room Staffing

- How many operating room teams should we plan in the Fall, on Mondays, in the "main surgical suite," for orthopedics between 7 AM and 5 PM?



Example of a Decision on Operating Room Staffing

- How many operating room teams should we plan in the Fall, on Mondays, in the "main surgical suite," for orthopedics between 7 AM and 5 PM?

Focus in on these words



Example of a Decision on Operating Room Allocation

- How many operating room teams should we plan in the Fall, on Mondays, in the "main surgical suite," for orthopedics between 7 AM and 5 PM?

All of the other words are the same for OR allocation



Staffing and OR Allocation are Synonymous

- If staff are present to do a case in an OR, then the OR time has been allocated
 - OR time that is staffed but not allocated to a service has effectively been allocated to the unblocked, open, first-come, first-served OTHER service
 - Different names at different facilities



Staffing and OR Allocation are Synonymous

- If staff are present to do a case in an OR, then the OR time has been allocated
 - OR time that is staffed but not allocated to a **service** has effectively been allocated to the unblocked, open, first-come, first-served OTHER service

Next definition



Service Is the Unit of Operating Room Allocation

- *Service* can represent a ...
 - Surgical group
 - Department
 - Specialty
 - Surgeon
 - Any combination of the above
- If one or more surgeons is allocated OR time, he, she, or they is (are) a service



Service Is the Unit of Operating Room Allocation

- *Service* can represent a ...
 - Surgical group
 - Department
 - Specialty
 - Surgeon
 - Any combination of the above
- If one or more surgeons is allocated OR time, he, she, or they is (are) a service
- Focus of talk is service-specific staffing



Example of *Under-Utilized OR Time*

- Staffing is planned from 7 AM to 3 PM
- An OR's last case of the day ends at 1 PM
- There are 2 hr of *under-utilized OR time*
 - Under-utilized time is from 1 PM to 3 PM



Under-Utilized OR Time Affects Adjusted Utilization

- Adjusted utilization = $100\% - \frac{(\text{hours of under-utilized OR time})}{(\text{staffed hours of OR time})}$
- Just as adjusted utilization cannot exceed 100%, average hours of under-utilized OR time does not equal the OR allocation minus the average hours of cases



Example of *Over-Utilized OR Time*

- OR staffing is planned from 7 AM to 3 PM
- OR's last case of the day ends at 6 PM
- There are 3 hr of *over-utilized OR time*
 - Over-utilized OR time is from 3 PM to 6 PM

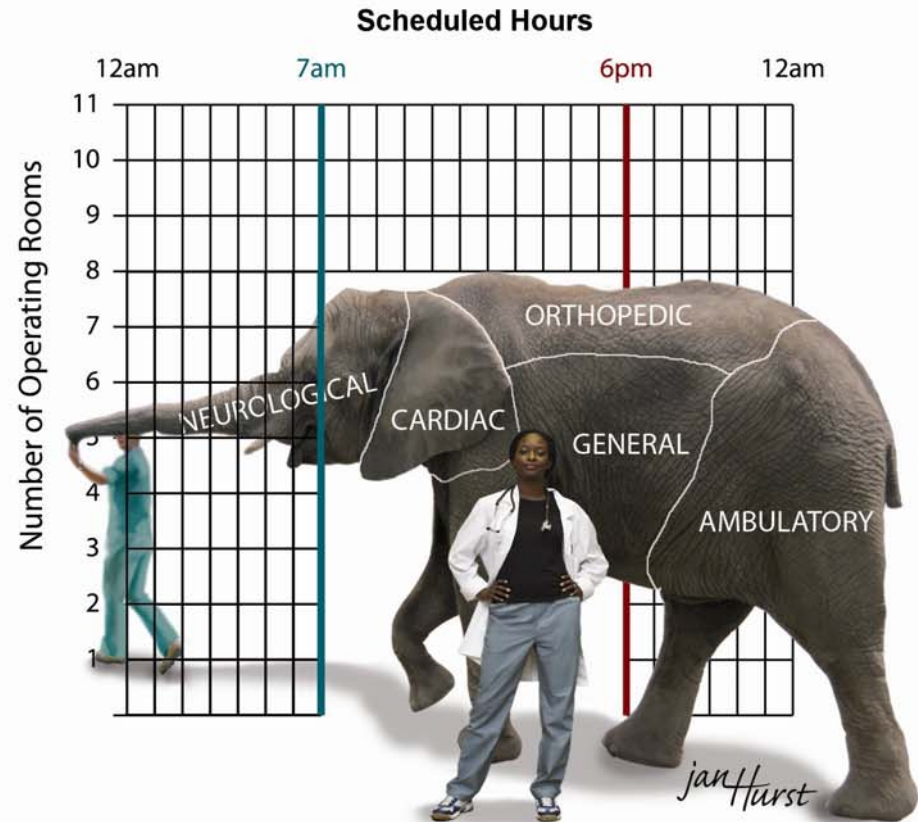
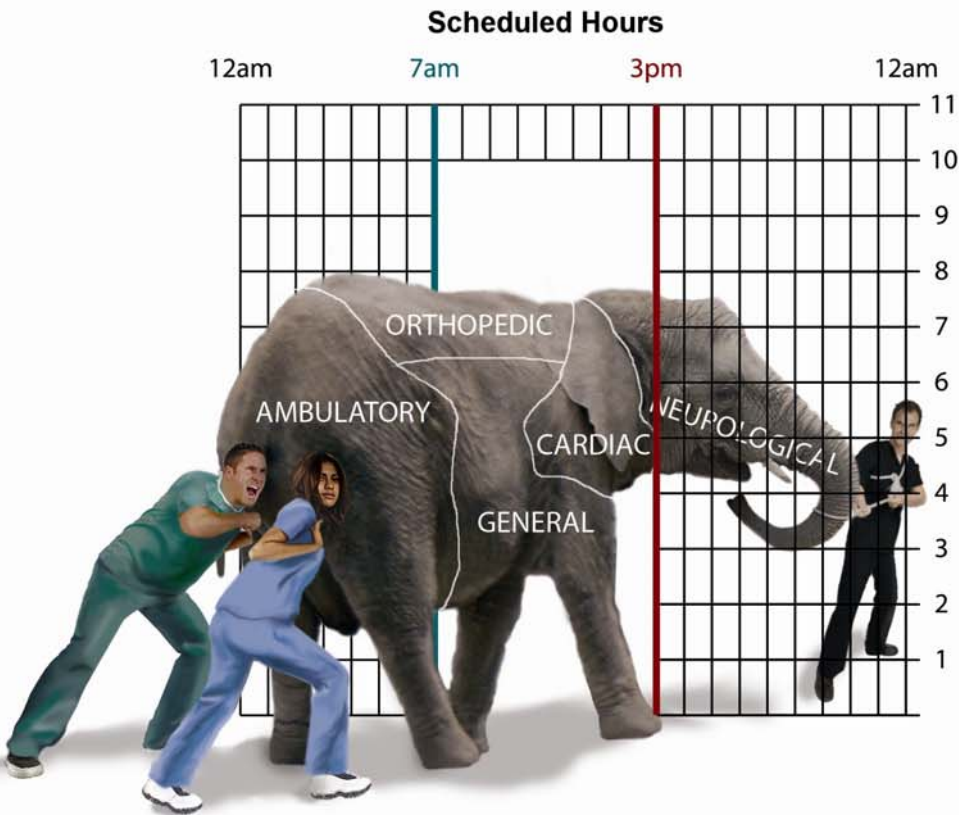


Precise Meaning of *Maximize OR Efficiency*

Inefficiency of use of OR time (\$) =
(Cost per hour of under-utilized OR time)
× (hours of under-utilized OR time)
+ (Cost per hour of over-utilized OR time)
× (hours of over-utilized OR time)

Strum DP et al. J Med Syst 1997





“You are not going to get the elephant to shrink or change its size. You need to face the fact that the elephant is 8 OR tall and 11 hr wide.”

Steven Shafer, MD

Sequence of the Talk

- What precisely is OR efficiency?
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Allocating OR Time is a Two-Stage Process

- Tactical decisions determine initial increases in OR time allocations for each subspecialty
 - Rarely reductions, just increases or no changes
- Operational decisions based on OR efficiency fill the OR time once actual workload known
 - Schedule cases based on OR efficiency
 - Release allocated but unused OR time
 - Adjust staffing

Dexter F et al. Anesth Analg 2005



OR Efficiency Applies to Operational Decision Making

- Operational decision making
 - How to get the existing cases done
 - Making decisions on the day of surgery
 - Scheduling cases
 - Planning staffing and OR allocations
- Operational decision making is almost never made based on financial criteria



OR Efficiency Does Not Apply to Tactical Decision Making

- Tactical decision making
 - Decisions over many months to years
 - Invariably includes financial criteria
 - That is a different talk



Planning Fixed “Blocks” of OR Time and Resources

- Based on total hours of cases (i.e., utilization)
- Based on revenue and variable costs
- Conceptual model for tactical decision making
- Very rarely used in practice for operational OR management decision making
 - Reason: Fixed hours means *literally* fixed
 - This does not and should not match the reality of operational decision making

Dexter F et al. Anesthesiology 1999



OR Staffing, OR Allocation, and OR Efficiency

- Service has 9.5 ± 3 hr (SD) of elective cases including turnover times on Mondays
- Why the cases are done is irrelevant, as OR allocation problem is whether to staff for 8 hr, 10 hr, 13 hr, or 16 hr
- OR efficiency differs depending on the OR staffing and allocation, not the workload
 - OR efficiency is an operational concept, not related to tactical decision making



Surgeons Have Open Access to OR Time on Any Future Workday

- From an operational perspective, surgeons schedule cases on any future workday
- Major limitation is what can be done safely
- Future slides will show that *in practice* this is what is used almost everywhere for *operational* OR management decisions



Open Access Case Scheduling Is Current Practice (Example 1)

- Dr. Jones has been allocated 8 hours of OR time every Friday for the past decade
 - Staffed hours are 7 AM to 3 PM
- Dr. Jones always underestimates the durations of his cases
- Dr. Jones never finishes before 5 PM and usually ends between 6 PM and 7 PM



Open Access Case Scheduling Is Current Practice (Example 1)

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- Make a list of services at your facility who schedule cases like Dr. Jones



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- Dr. Jones is, in practice, scheduling his cases on any workday



Open Access Case Scheduling Is Current Practice (Example 1)

- Planning staffing from 7 AM – 7 PM, instead of 7 AM – 3 PM, increases OR efficiency
 - Reduction in hours of over-utilized OR time
 - No increase in hours of under-utilized OR time
- This is not providing increased OR resources (OR time) to Dr. Jones
 - Doing so would be tactical, not operational
 - Open Access changes *when* a case gets done, not total workload



Open Access Case Scheduling Is Current Practice (Example 2)

- University Hospital's staffing for General Surgery is 2 ORs, 7 AM to 5 PM Mon-Fri
- No case is scheduled unless it will fit into the 10 hr based on historical case duration data
- General Surgery schedules 20% of its cases as add-on or urgent
 - Yet, patients could safely wait days for surgery



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 - Yet, patients could safely wait days for surgery
- Make a list of services at your facility who schedule cases like General Surgery



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- University Hospital's staffing for General Surgery is 2 ORs, 7 AM to 5 PM Mon-Fri
- No case is scheduled unless it will fit into the 10 hr based on historical case duration data
- General Surgery schedules 20% of its cases as add-on or urgent
 - Yet, patients could safely wait days for surgery
- General Surgery is, in practice, scheduling its cases on any workday



Open Access Case Scheduling Is Current Practice (Example 2)

- Increase OR allocations (staffing) to match the reality of existing OR workload
 - Reduces over-utilized OR time with minimal or no increase in under-utilized OR time
 - Increases OR efficiency
- Operational change, not tactical
 - Open Access changes *when* a case gets done, not total workload



Open Access Case Scheduling Is Current Practice (Example 3)

- Physicians at a hospital are salaried employees of the health care system
- Staffing is planned from 8 AM to 5 PM
- As per official policy, surgeons schedule almost all cases for 8 AM to 5 PM
 - Unlike General Surgery of Example 2, the surgeons' add-on cases are truly urgent



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- As per official policy, surgeons schedule almost all cases for 8 AM to 5 PM
 - Unlike General Surgery of Example 2, the surgeons' add-on cases are truly urgent
- The surgeons are, in practice, scheduling their elective cases on any workday



Open Access Case Scheduling Is Current Practice (Example 3)

- Implication
 - Open Access for operational decision-making applies even at facilities that only do elective cases during limited hours



Open Access Case Scheduling Makes Economic Sense in US

- Hospital 1 with annual loss \$114 million
- Hospital 2 with positive operating margin

Macario A et al. Anesth Analg 2001

Dexter F et al. Anesth Analg 2002

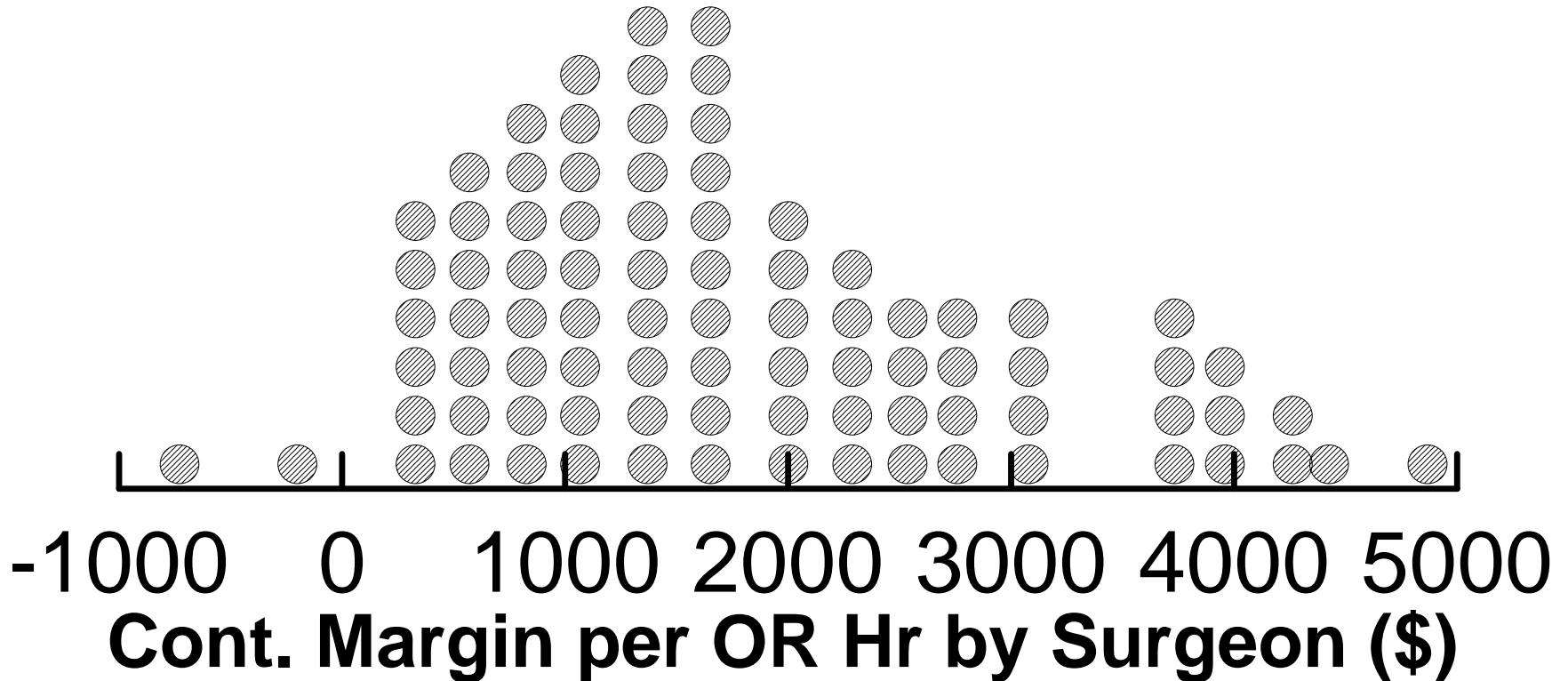


Open Access Case Scheduling Makes Economic Sense in US

- Methodology
 - Limit to outpatient and same day admit cases, since once patient is admitted want no delay
 - Operating room time used by each surgeon from operating room information system
 - Overall contribution margin for each surgeon from hospital accounting information system
 - Make a graph with one circle for each surgeon

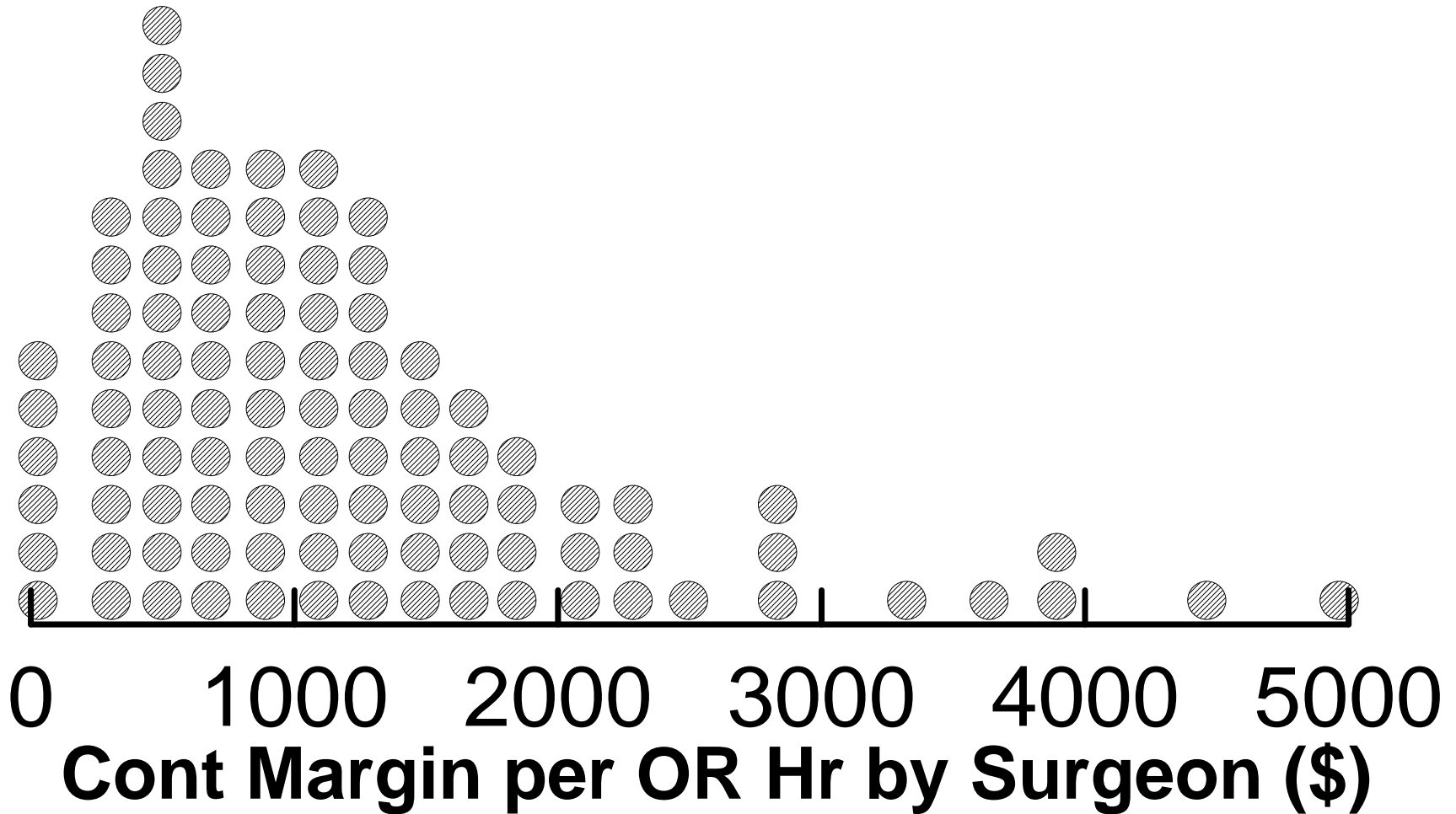


Hospital Losing Money Has + Cont. Margin For 97% Surgeons



Cont. Margin = Revenue - Variable Costs

Other Hospital Positive Contribution Margin all Surgeons



There Are Exceptions For Some Procedures

- At some hospitals, for some surgeons, contribution margin is consistently negative for some procedures because of implants
- Time and the place to address this is not at the OR nursing desk when Mrs. Jones is being scheduled as an add-on case
 - Since operational decision-making is not based on financial criteria, it needs to be economically rationale for the average case



Interpretation of Finding for Operational Decision-Making

- Since contribution margin is positive, it makes economic sense to do cases
 - If you can do the case safely, do the case



Interpretation of Finding for Operational Decision-Making

- Since contribution margin is positive, it makes economic sense to do cases
 - If you can do the case safely, do the case
- However, safety is a large practical limit



Interpretation of Finding for Operational Decision-Making

- Since contribution margin is positive, it makes economic sense to do cases
 - If you can do the case safely, do the case
- However, safety is a large practical limit
 - Safety includes limited ICU beds, hospital ward beds, PACU beds, fluoroscopy equipment, non-fatigued staff, implants, ...
 - ***Tactical planning*** sets these and other capital planning (capacity) constraints



Allocating OR Time 1st Tactically and 2nd Operationally (Example 1)

- Tactical – different lecture
 - Dr. Jones, 1 OR every Friday
 - Has financial implications (do by surgeon)
 - Affects surgical practices' schedules and growth
- Operational – this lecture
 - Nursing and anesthesia staffing planned to 7 PM to match Dr. Jones' workload
- If operational decisions were affecting Dr. Jones, he would usually be done by 3 PM



Understanding Operational Decision Making Is Important

- Implication for operations research is that staffing is appropriately planned separately for each combination of surgical suite, service, and day of the week
 - At most outpatient facilities and smaller hospitals, the staffing decision involves only 1 to 3 choices
 - Staff an OR for 8 hr, 10 hr, or 12 hr



Understanding Operational Decision Making Is Important

- Most of the surgeons in a department are away at their national conference
- There is substantial under-utilized OR time
- Who is responsible for the poor OR efficiency?
 - Is this an example of the surgeons' lack of responsibility for hospital resources?
 - Is this an example of bad management?



Understanding Operational Decision Making Is Important

- Fixed hours of OR time (tactical perspective)
 - Surgeons are responsible for increasing OR efficiency by *scheduling* their cases into their block time
- Maximizing OR efficiency (operational)
 - Managers are responsible for increasing OR efficiency by adjusting *staffing* to match the surgeons' and patients' hours (e.g., 8 or 13 hr)
 - Managers have responsibility and authority



Understanding Operational Decision Making Is Important

- Fixed hours of OR time
 - Surgeons are responsible for increasing OR efficiency by *scheduling* their cases into their block time
- Maximizing OR efficiency
 - Managers are responsible for increasing OR efficiency by adjusting *staffing* to match the surgeons' and patients' hours (e.g., 8 or 13 hr)
 - Managers have responsibility and authority

Rest of talk



Sequence of the Talk

- What precisely is OR efficiency?
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Use Scenarios to Teach Organizations Decision Making

- Listed in order of priority
 1. Patient safety and quality of care are preeminent
 2. Every surgeon has open access to OR time on *Any* future *Workday*
 3. Maximize OR efficiency
 4. Reducing patient waiting on the day of surgery
 5. Professional satisfaction



Ordered Priorities Can be Applied to ...

- Staffing and OR allocations
- Scheduling elective cases
- Sequencing elective cases
- Releasing allocated OR time
- Scheduling delays between surgeons' cases
- Choosing patient arrival times
- Scheduling add-on cases
- Assigning and relieving staff
- Moving cases on the day of surgery
- Sequencing urgent cases



Statement is Not Intuitively Obvious – Why do Math

- Staffing and OR allocations
- Scheduling elective cases
- Sequencing elective cases
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Next Several Slides Show Over-Simplified Scenarios

- Scenarios will not seem like your facility
- Scenarios ignore uncertainty in case duration
- Lecture is not how scenarios are truly used
 - Although the concepts apply everywhere, every facility is an exception to a description
 - Customize to provide appropriate employee types, OR names, times of the day, units of OR allocation, surgeon names, equipment limiting what cases can be scheduled, etc.



Generate Customized Scenarios for Organizations

Surgical suite

Export 3-12 months of OR information system data

Science

100+ scenarios, with explanations, showing how to make decisions based on the ordered priorities

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Math

Pick appropriate ORs, names, blocks, & times for each scenario

Science

100+ scenarios, with explanations, showing how to make decisions based on the ordered priorities



Generate Customized Scenarios for Organizations

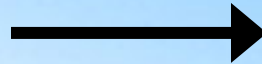
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Science

100+ scenarios, with explanations, showing how to make decisions based on the ordered priorities

Concrete examples

Customized educational materials

Scenario 1 – Can Working Fast Increase OR Efficiency?

- OR nurses, nurse anesthetists, and anesthesiologists are full-time employees
- Staffing is planned from 7 AM to 3 PM
- There is estimated to be 9 hr of cases
- Anesthesiologist gets every IV first stick, A lines and C lines first stick, and does a fiberoptic intubation in 8 minutes
- The OR finishes at 3 PM
- Has anesthesiologist increased OR efficiency?



Scenario 1 – Can Working Fast Increase OR Efficiency?

- OR nurses, nurse anesthetists, and anesthesiologists are full-time employees
- On the day of surgery, the cost of an hour of under-utilized OR time is negligible relative to the cost of an hour of over-utilized OR time



Meaning of Maximizing OR Efficiency on Day of Surgery

Inefficiency of use of OR time (\$) \cong
~~(Cost per hour of under-utilized OR time)~~
× (hours of under-utilized OR time)
+ (Cost per hour of over-utilized OR time)
× (hours of over-utilized OR time)

Dexter F, Traub RD. Anesth Analg 2002



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Meaning of Maximizing OR Efficiency on Day of Surgery

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~~(Cost per hour of over utilized OR time)~~

\times (hours of over-utilized OR time)

Constant

- Implication

- Maximize OR efficiency on the day of surgery by minimizing hours of over-utilized OR time



Meaning of Maximizing OR Efficiency on Day of Surgery

Inefficiency of use of OR time (\$) \cong

~~(Cost per hour of over utilized OR time)~~
 \times (hours of over-utilized OR time)

Constant

- Implication

- Maximize OR efficiency *on the day of surgery* by minimizing hours of over-utilized OR time



Scenario 1 – Can Working Fast Increase OR Efficiency?

- Scenario
 - Staffing is planned from 7 AM to 3 PM
 - Fast anesthesiologist finished cases in 8 hr instead of in the expected 9 hr
 - Fast anesthesiologist increased OR efficiency by preventing 1 hr of over-utilized OR time



Scenario 1 – Can Working Fast Increase OR Efficiency?

- OR nurses, nurse anesthetists, and anesthesiologists are full-time employees
- Staffing is planned from **7 AM to ~~3 PM~~ 5 PM**
- There is estimated to be 9 hr of cases
- Anesthesiologist gets every IV first stick, A lines and C lines first stick, and does a fiberoptic intubation in 8 minutes
- The OR finishes at 3 PM
- **Has anesthesiologist increased OR efficiency?**



Scenario 1 – Can Working Fast Increase OR Efficiency?

- Scenario
 - Staffing is planned from ~~7 AM to 3 PM~~ **5 PM**
 - Fast anesthesiologist finished cases in 8 hr instead of in the expected 9 hr
 - Fast anesthesiologist ~~increased~~ *did not increase* OR efficiency



Scenario 1 – Can Working Fast Increase OR Efficiency?

- Scenario
 - Staffing is planned from ~~7 AM to 3 PM~~ **5 PM**
 - Fast anesthesiologist finished cases in 8 hr instead of in the expected 9 hr
 - Fast anesthesiologist ~~increased~~ *did not increase* OR efficiency

Good (rational) OR management operational decision-making is highly sensitive to the service-specific staffing, and requires knowing the service-specific staffing

Scenario 2 – Anesthesiologist Reduces Turnover Times

- Staffing is planned from 7 AM to 3 PM
- Anesthesiologist is assigned to supervise resident physicians in OR 1 and OR 2
- These ORs have just finished their first cases
- The last case of the day in OR 1 is expected to be finished at 2:30 PM
- The last case of the day in OR 2 is expected to be finished at 4:30 PM
- Which OR should anesthesiologist start next?



Scenario 2 – Anesthesiologist Reduces Turnover Times

- *Patient safety* is unaffected by decision
- Open *access* is unaffected by the decision
- *OR efficiency*
 - OR 1 expected 0 over-utilized hours
 - OR 2 expected 1.5 over-utilized hours
- If the patient for OR 2 is ready, the anesthesiologist should start OR 2 first



Scenario 2 – Anesthesiologist Reduces Turnover Times

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- Which OR should anesthesiologist start next?



Scenario 2 – Anesthesiologist Reduces Turnover Times

- *Patient safety* is unaffected decision
- Open *access* is unaffected by decision
- *OR efficiency* is unaffected by decision
 - OR 1 expected 0 over-utilized hours
 - OR 2 expected ~~1.5~~ 0 over-utilized hours
- *Patient waiting* is unaffected by decision
 - Last case of the day in both ORs
- *Professional satisfaction* may be affected
 - Whatever anesthesiologist thinks best



Scenario 2 – Anesthesiologist Reduces Turnover Times

- Moral
 - Good (rational) OR management operational decision-making is highly sensitive to the service-specific staffing, and requires knowing the service-specific staffing
 - System fails well-intentioned individuals if it does not provide them with the information that they need to make good decisions



Scenario 3 – Which OR Should Housekeeper Clean First?

- Right when two ORs are finishing their first cases of the day, only one person is free to clean the two ORs
- Last case of the day in OR 1 is expected to end at 2 PM
- Last case of the day in OR 2 is expected to end at 4:30 PM
- Staffing is planned from 7 AM to 3 PM
- Which OR should housekeeper clean first?



Scenario 3 – Which OR Should Housekeeper Clean First?

- *Patient safety* is unaffected by the decision
- Open *access* is unaffected by the decision
- *OR efficiency* is affected by the decision
 - OR 1 expected 0 over-utilized hours
 - OR 2 expected 1.5 over-utilized hours
- Cleaning OR 2 first is likely to increase OR efficiency



Scenario 3 – Which OR Should Housekeeper Clean First?

- Right when two ORs are finishing their first cases of the day, only one person is free to clean the two ORs
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- Staffing is planned from 7 AM to ~~3 PM~~ **5 PM**
- Which OR should housekeeper clean first?



Scenario 3 – Which OR Should Housekeeper Clean First?

- *Patient safety* is unaffected by the decision
- Open *access* is unaffected by the decision
- *OR efficiency* is unaffected by the decision
 - OR 1 expected 0 over-utilized hours
 - OR 2 expected ~~1.5~~ **0** over-utilized hours
- *Patient waiting* is unaffected by the decision
 - Last case of the day in each OR
- *Professional satisfaction* is basis for decision



Scenario 4 – Decision Based on Patient Safety

- At 12:15, one OR is finished its elective cases
- All other ORs are scheduled to be full until 5 PM, the end of planned staffed hours
- Orthopedic surgeon called three hours ago for repair of a patient's fractured hip
- Vascular surgeon has a ruptured AAA
- What should be the sequence of cases based on the ordered priorities?



Scenario 4 – Decision Based on Patient Safety

- *Patient safety* is affected by decision
 - Ruptured AAA is done first



Scenario 5 – Case Scheduling to Maximize OR Efficiency

- Staffing planned for Ophthalmology Associates is OR 1 and OR 2 from 7 AM to 3 PM
- Dr. Smith has scheduled cases in OR 1 that are scheduled to finish at 2 PM
- OR 2 is empty
- Dr. Reynolds wants an afternoon start
 - She asks to start an elective 3-hour case at 2:30 PM in OR 1
- Schedule the case into OR 1?



Scenario 5 – Case Scheduling to Maximize OR Efficiency

- Starting the case at 3 PM would be expected to result in over-utilized OR time, thereby reducing OR efficiency
- Options available to Dr. Reynolds:
 - Take first-case of the day start in OR 2
 - Choose a different workday



Scenario 5 – Case Scheduling to Maximize OR Efficiency

- Starting the case at 3 PM would be expected to result in over-utilized OR time, thereby reducing OR efficiency
- Options available to Dr. Reynolds:
 - Take first-case of the day start in OR 2
 - Choose a different workday



Scenario 5 – Case Scheduling to Maximize OR Efficiency

- Starting the case at 3 PM would be expected to result in over-utilized OR time, thereby reducing OR efficiency
- Options available to Dr. Reynolds:
 - Take first-case of the day start in OR 2
 - Most facilities do not schedule an OR over-utilized while other allocated OR is empty
 - Choose a different workday



Scenario 5 – Case Scheduling to Maximize OR Efficiency

- Starting the case at 3 PM would be expected to result in over-utilized OR time, thereby reducing OR efficiency
- Options available to Dr. Reynolds:
 - Take first-case of the day start in OR 2
 - Choose a different workday
 - She has OR time available every workday



Scenario 6 – Reduce Turnover Times to Increase OR Efficiency?

- Outpatient Surgery Center with 6 ORs, all staffed from 7 AM to 5 PM
- Mean ORs in use before intervention
 - 2 PM – 6 ORs
 - 3 PM – 5 ORs
 - 4 PM – 2 ORs
 - 5 PM – 0.2 ORs
- Mean ORs in use after intervention
 - 2 PM – 5 ORs
 - 3 PM – 4 ORs
 - 4 PM – 1 ORs
 - 5 PM – 0 ORs
- Increased OR efficiency?



Scenario 6 – Reduce Turnover Times to Increase OR Efficiency?

- No impact on OR efficiency, because hours of over-utilized OR time are the same
- Decision making on the day of surgery has a negligible impact on OR efficiency if there are no hours of over-utilized OR time

Dexter F et al. Anesth Analg 2003



Scenario 6 – Reduce Turnover Times to Increase OR Efficiency?

- No impact on OR efficiency, because hours of over-utilized OR time are the same
- Decision making on the day of surgery has a negligible impact on OR efficiency if there are no hours of over-utilized OR time
- Because principal determinant of OR efficiency is OR staffing, the impact of other interventions is highly sensitive to the service-specific staffing



You Cannot Have Made These Decisions Based on Utilization



Utilization

Scenario 7 – OR Allocation Markedly Affects OR Efficiency

- Staffing is planned from 7 AM to 5 PM
- Anesthesiologist arrives at 6 AM, and works fast and non-stop until his list is done
- Some days he finishes at 2 PM, some days at 8 PM, average is 5 PM
- What has been the anesthesiologist's impact on OR efficiency?



Scenario 7 – OR Allocation Markedly Affects OR Efficiency

- Staffing is planned from 7 AM to 5 PM
- Some days he finishes at 2 PM
 - Under-utilized OR time = 3 hours
- Some days he finishes at 8 PM
 - Over-utilized OR time = 3 hours



Scenario 7 – OR Allocation Markedly Affects OR Efficiency

- Staffing is planned from 7 AM to 5 PM
- Some days he finishes at 2 PM
 - Under-utilized OR time = 3 hours
- Some days he finishes at 8 PM
 - Over-utilized OR time = 3 hours
- Valiant and noble effort, but of no substantive impact on OR efficiency



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 - Over-utilized OR time = 3 hours
- Valiant and noble effort, but of no substantive impact on OR efficiency

★ If OR staffing is chosen poorly, actions on day of surgery have little to no benefit ★

Sequence of the Talk

- What precisely is OR efficiency?
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Tiny Example of Allocating OR Time to Maximize OR Efficiency

- Example of the calculations
 - On three Mondays a service did 12, 7, and 15 hours of cases including turnover times
 - Staff plan an 8-hour scheduled day
 - $1.75 =$ relative cost of 1 hour of over-utilized OR time to 1 hour of under-utilized OR time



Cost of Inefficient Use of OR Time with Different Staffing

- Weekly values: 12, 7, and 15 hours of work
- If staff 1 OR for 8 hours for the service
 - $20.25 \text{ hr} = (0 + 1 + 0) + 1.75 \times (4 + 0 + 7)$
- If staff 2 OR for 8 hours for the service
 - $14.00 \text{ hr} = (4 + 9 + 1) + 1.75 \times (0 + 0 + 0)$
- If staff 3 OR for 8 hours for the service
 - $38.00 \text{ hr} = (12 + 17 + 9) + 1.75 \times (0 + 0 + 0)$



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Not Same Process to Allocate Based on OR Utilization

- Allocation based on OR utilization:
 - starts with a goal OR utilization
 - OR efficiency gives the answer based on the existing OR workload
 - considers just the under-utilized OR time
 - Larger concern is over-utilized OR time
 - ignores variation among weeks in workload
 - Average workload not used to calculate under-utilized and over-utilized OR time



Why Not Same Result Based on OR Utilization?

- Why not same result based on OR utilization?
 - If a service has 80% adjusted utilization, should there be under-utilized OR time and no over-utilized OR time?
 - Under what conditions does this not hold?



Sequence of the Talk

- What precisely is OR efficiency?
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Example of “Real World” OR Allocation (Staffing) Problem

- Officially, on paper, a service has been allocated three ORs for 8 hr Mon-Fri
- In reality, its total hours of elective cases including turnover times each day of the week averages 29 hours, with a range of 26 hours to 32 hours
- OR allocation based on maximizing OR efficiency adjusts staffing to match reality



Example of “Real World” OR Allocation (Staffing) Problem

- Staff work 5 days a week for 8 hr, 4 days a week for 10 hr, or 3 days a week for 13 hr
- Reasonable allocation choices:
 - Two OR for 13 hr
 - One OR for 8 hr + two for 10 hr
 - Two OR for 8 hr + one for 13 hr
 - Three OR for 10 hr
 - One OR for 8 hr + one for 10 hr + one for 13 hr
 - Four OR for 8 hr
 - Two OR for 10 hr + one for 13 hr



Example of “Real World” OR Allocation (Staffing) Problem

- Based on 2002 mean US compensation, the range in annual OR & anesthesia costs among allocations is \$245,000 per year

Abouleish AE et al. Anesth Analg 2003

Kuehl NK. AORN J 2003



Example of “Real World” OR Allocation (Staffing) Problem

- Based on 2002 mean US compensation, the range in annual OR & anesthesia costs among allocations is \$245,000 per year
- My interpretation of the message
 - Implementation means using the statistics
 - As for any statistics problem, **be sure** that you are getting the correct answer



Examples of Applying Statistical Method to Anesthesia Staffing

- For 11 of 13 suites, statistical method found a staffing plan with costs at least 10% less than that being used by the managers
 - Managers did not have right number of staff, working the right number of hours, on the right days of the week, for specific surgical services

Dexter F et al. Anesth Analg 2001

Abouleish AE et al. Anesth Analg 2003

Freytag S et al. Der Chirurg 2005

McIntosh C et al. Anesth Analg 2006



Experimental Studies Explain Why Method Apparently Unused

- Two psychological biases
 - Anchor on mean demand
 - Essentially plan staffing based on relative cost ratio of 1.10 instead of 1.75
 - Ignore analysis of 9 months of data in lieu of service's usage during past 2 weeks
 - Recency bias

Wachtel RE, Dexter F. Anesth Analg 2010



Experimental Studies Explain Why Method Apparently Unused

- Two psychological biases
 - Anchor on mean demand
 - Essentially plan staffing based on relative cost ratio of 1.10 instead of 1.75
 - Ignore analysis of 9 months of data in lieu of service's usage during past 2 weeks
 - Recency bias
- Issue is psychology, not politics, culture, buy in, personalities, or organizational inertia



Experimental Studies Explain Why Method Apparently Unused

- Two psychological biases
 - Factors with little or no impact
 - More frequent feedback
 - Graphical user interface
 - Information in reports
 - Education
 - Experience



Experimental Studies Explain Why Method Apparently Unused

- Two psychological biases
 - Factors with little or no impact
 - More frequent feedback
 - Graphical user interface
 - Information in reports
 - Education
 - Experience
- Implementation is the mathematics




Sequence of the Talk






- What precisely is OR efficiency?
- OR efficiency applies to existing workload
- Teach principles using scenarios
- Service-specific staffing based on OR efficiency
 - Important to use the statistical methods
 - How to use the statistical methods
 - Types of data
 - Seasonal variation in OR workload
 - How many months of data to use



OR Information System, AIMS, or Anesthesia Billing Data

Microsoft Excel - XLSInputDataSample.xls

File Edit View Insert Format Tools Data Window Help 

     100%

N29 =

	A	B	C	D	E	F	G	H	I
1	Room	DateIn	TimeIn	DateOut	TimeOut	Service	NoAnesthesia	Urgent	Holiday
2	1	1/1/1998	8:09	1/1/1998	9:04	ORT			X
3	1	1/1/1998	23:00	1/2/1998	1:12	SUR			X
4	1	1/2/1998	9:13	1/2/1998	10:37	GYN			
5	1	1/2/1998	16:30	1/2/1998	18:37	POD			
6	2	1/2/1998	7:36	1/2/1998	7:59	GYN			
7	2	1/2/1998	8:16	1/2/1998	9:11	GYN			
8	2	1/2/1998	10:37	1/2/1998	11:02	POD			
9	2	1/2/1998	11:20	1/2/1998	12:23	POD			
10	2	1/2/1998	12:38	1/2/1998	13:58	POD			
11	2	1/2/1998	14:17	1/2/1998	16:15	POD			
12	3	1/2/1998	8:44	1/2/1998	9:00	ENT			
13	3	1/2/1998	8:10	1/2/1998	8:30	ENT			
14	3	1/2/1998	11:30	1/2/1998	12:02	ENT			
15	3	1/2/1998	9:14	1/2/1998	9:46	ENT			
16	3	1/2/1998	10:05	1/2/1998	11:21	ENT			
17	3	1/2/1998	12:20	1/2/1998	13:40	ENT			

If Many Data Options, Why Not Used Widely?

- Service-specific staffing
 - Implementable with many types of data
 - Lack of data is not valid reason for lack of implementation
 - Minimally affects customers, because matching staffing to workload
- What then are barriers to implementation?
 - What do you “see” if a problem at your site?
 - Who precisely will “do” the work?



Seasonal Variation Does Not Need to be Considered Routinely

- Statistical methods assume that trends affect total group workload slowly
 - Little systematic variation month to month
 - Instead, change occurs year to year
- Is this simplification appropriate for most anesthesia groups and surgical suites?

Dexter F, Traub RD. Anesth Analg 2000

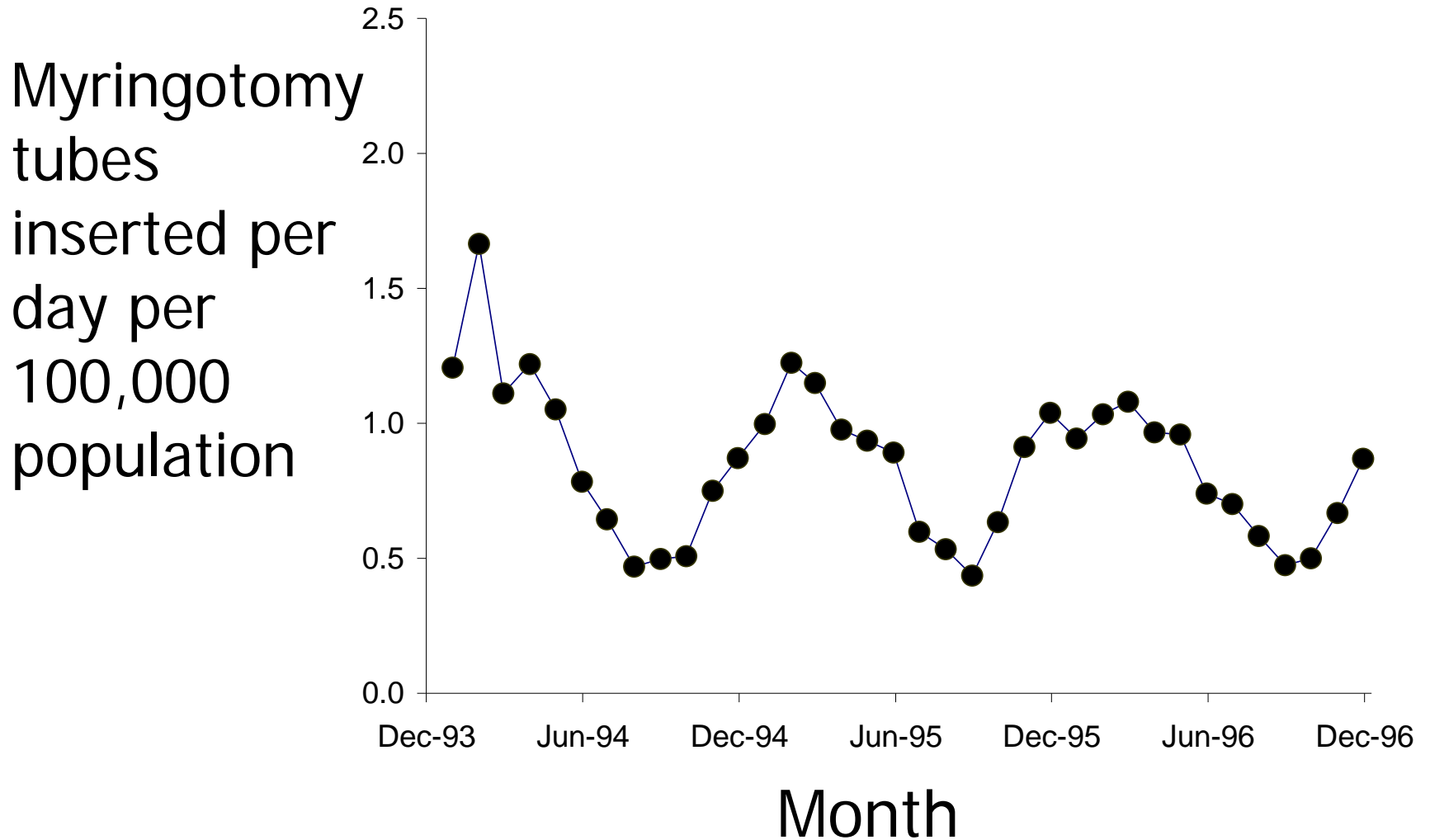


Seasonal Variation Does Not Need to be Considered Routinely

- Analyze data from the US National Survey of Ambulatory Surgery (1994 – 1996)
- Expect anesthesia workload not to vary systematically over 11-month periods
- Positive control
 - Myringotomy tube placement
 - Incidence of otitis media peaks toward the end of winter

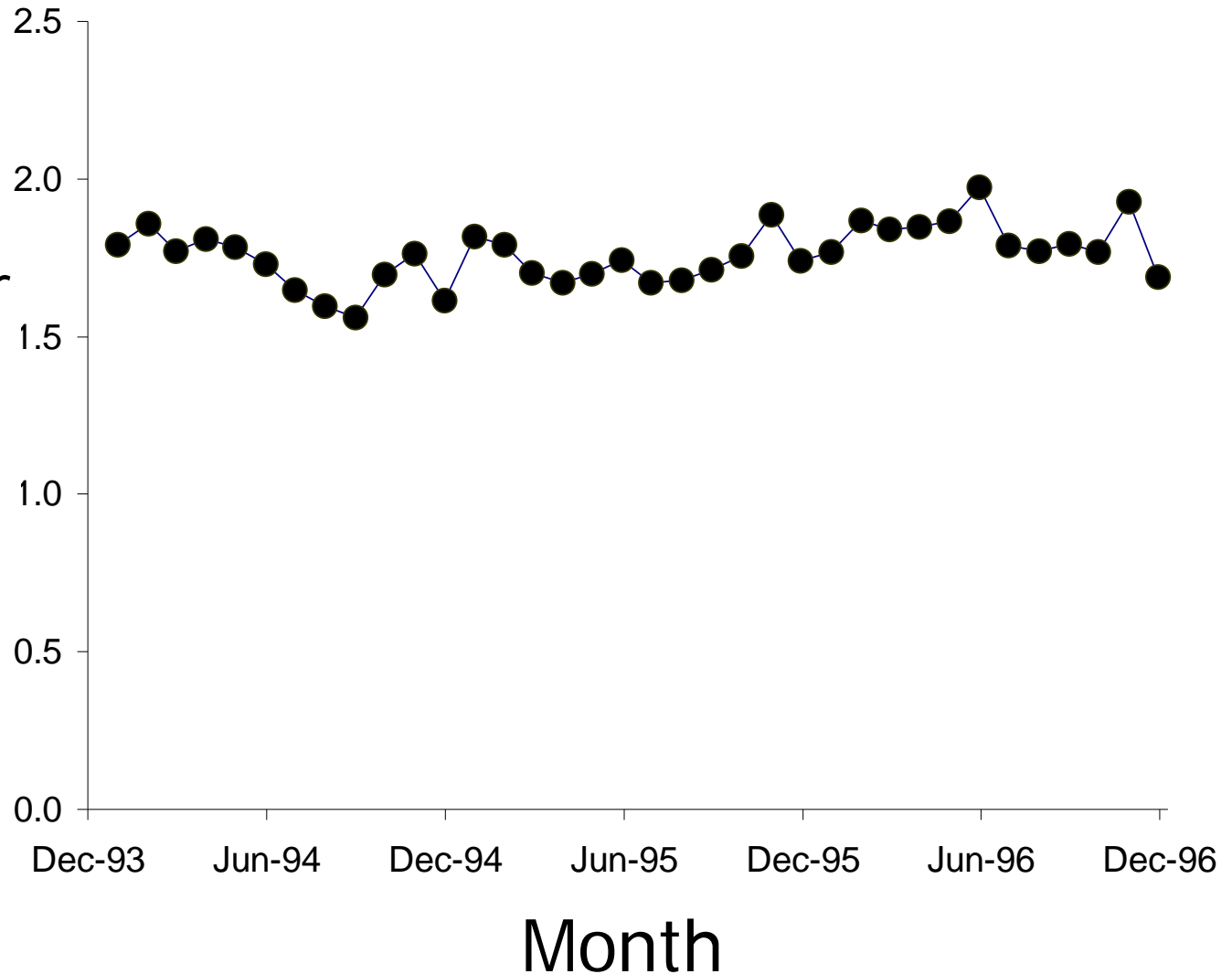


Positive Control – Seasonal Variation in Myringotomy Tubes



Anesthesia Caseload Does Not Vary Systematically Over < 1 Yr

Cases with anesthesia provider per day per 10,000 population



Months of Data for Accurate OR Allocations

- Use two years of data from a 7 OR, community, multiple specialty hospital
- Divide the 507 workdays of data into:
 - Training dataset to identify staffing solution
 - From 30 to 270 consecutive workdays
 - Testing dataset to evaluate its performance
 - Repeat the process hundreds of times

Epstein RH, Dexter F. Anesth Analg 2002

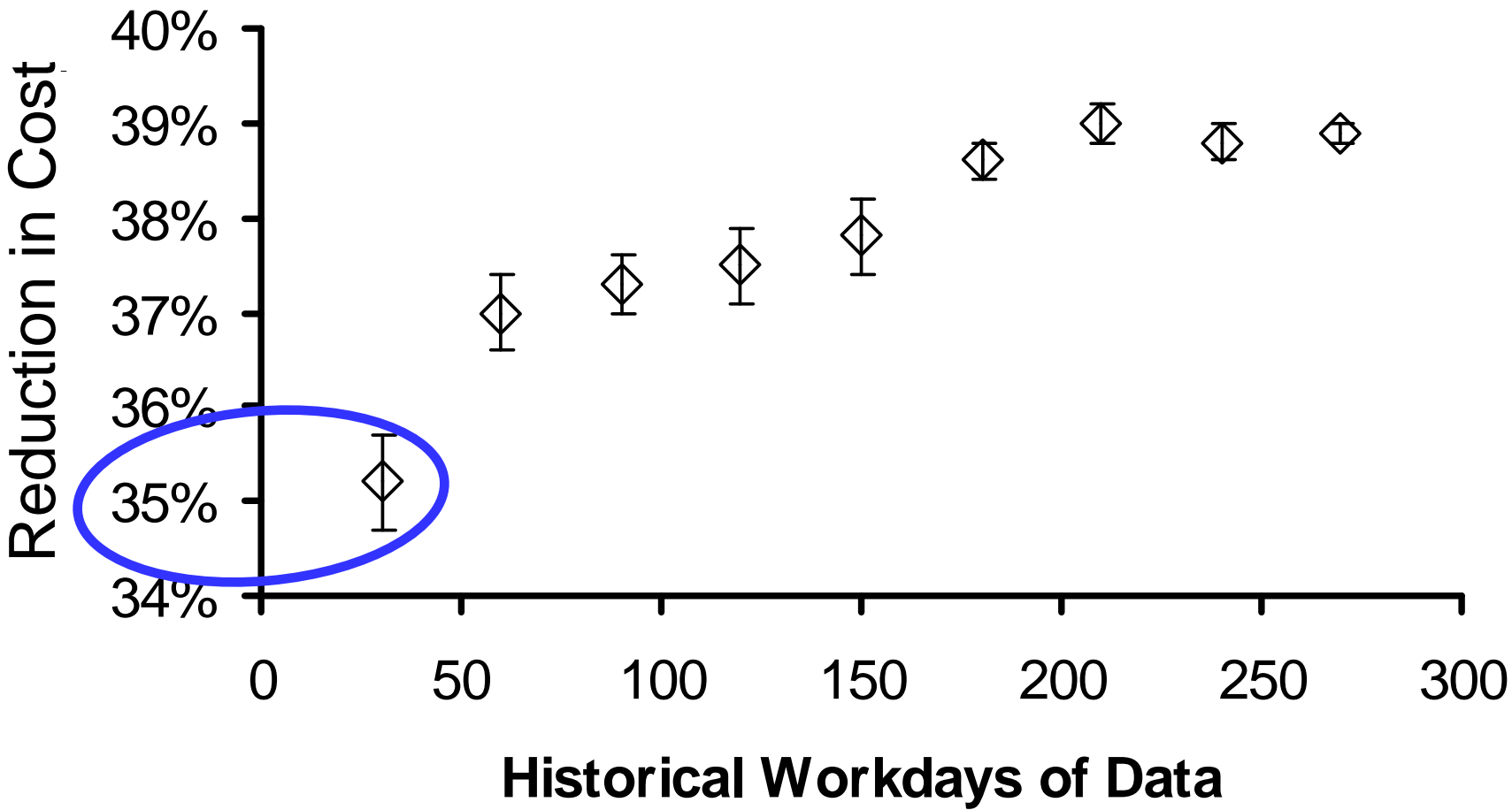


Least Amount of Data for OR Allocations and Staffing

- Suppose install a new information system
 - Operating room
 - Anesthesia electronic medical record
 - Anesthesia billing
- Data will be used partly to adjust OR staffing (allocations) based on OR efficiency
- How soon can the data be used, so that a return on investment can be achieved?



Staffing Solutions to ↓ Staffing Cost Identified with 30 Workdays of Data

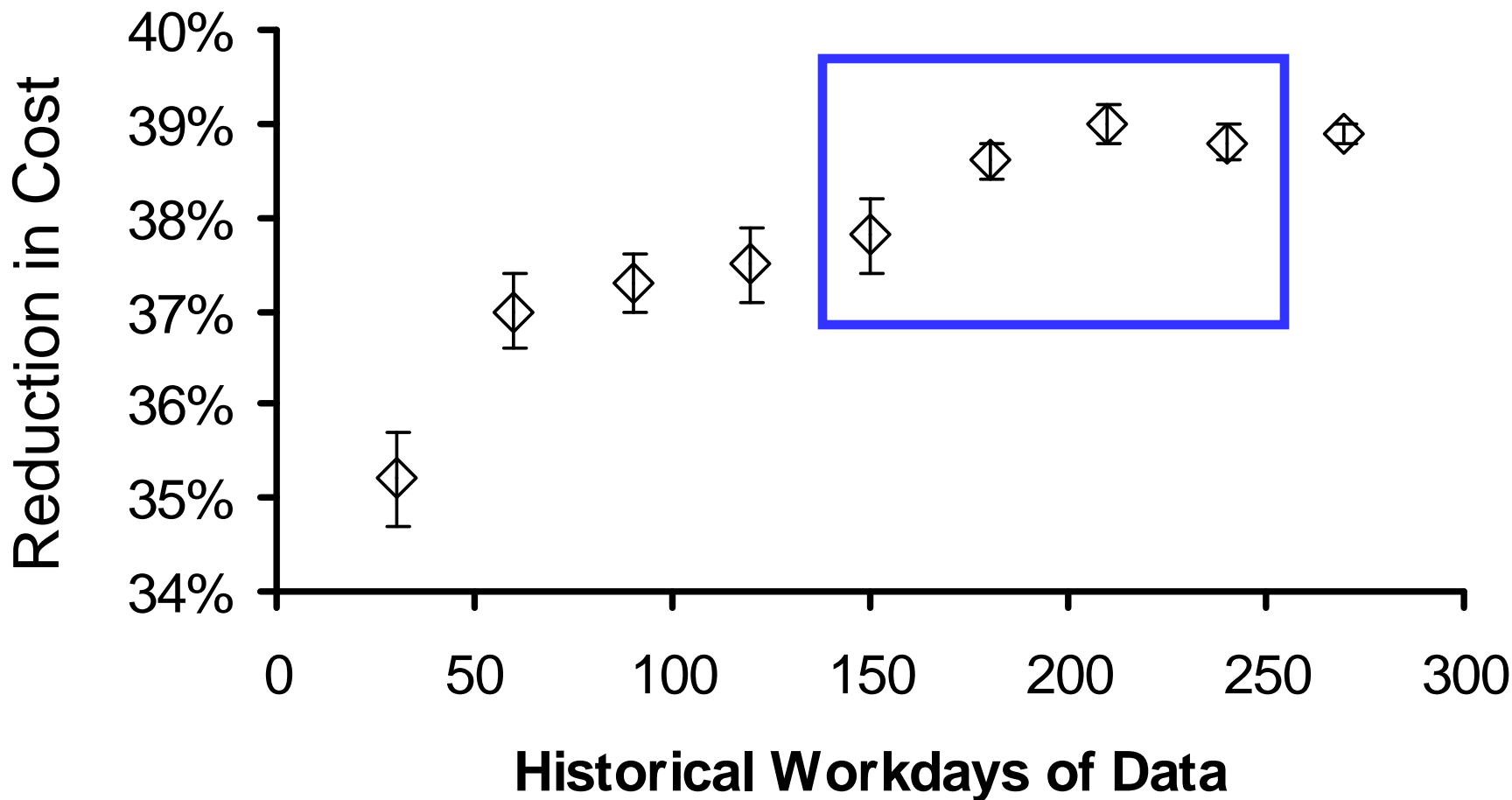


Months of Data to Use Routinely for OR Allocation

- Staffing is re-evaluated quarterly
- How many months of OR workload data should be used in the calculations?
 - If too brief, results may be spurious due to events such as surgeon illness, holidays, etc.
 - If too long, results may not reflect trends in workload, such as recruitment of new surgeon



No Significant ↓ Staffing Cost by Using More > 9 Months of Data

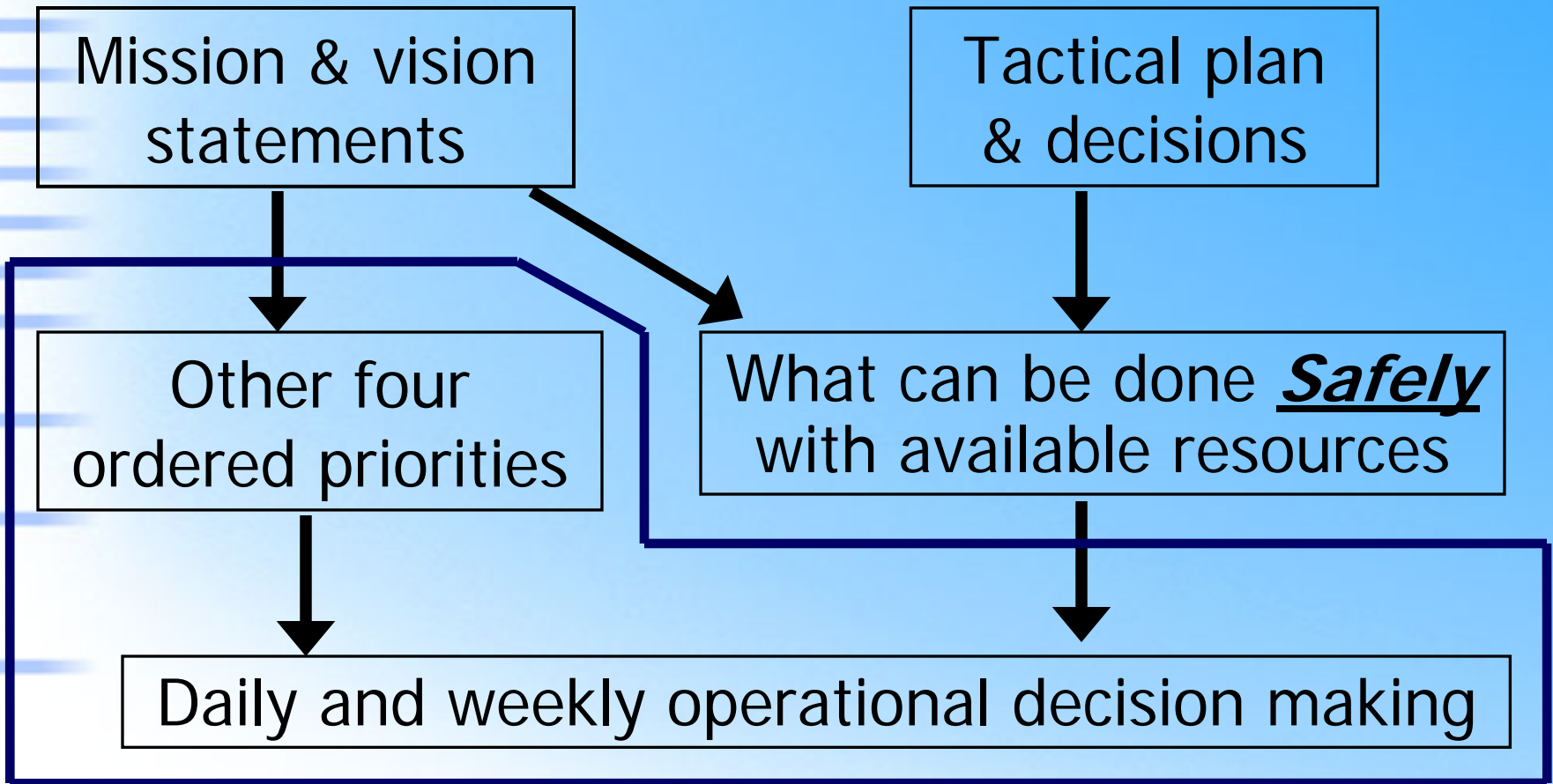


Review – Topics of the Talk

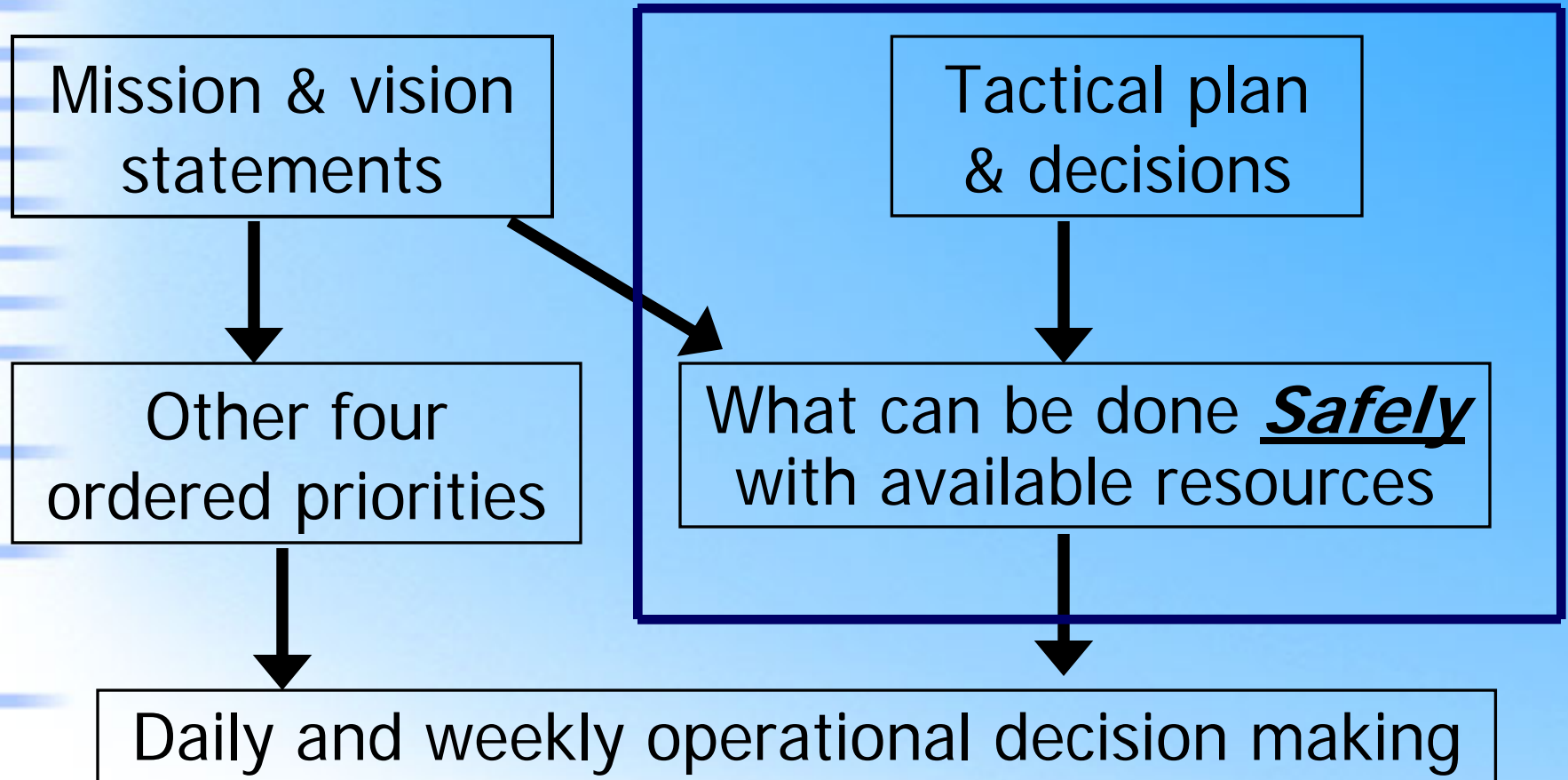
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Reminder – Topic of Talk Was Operational Decision Making



Tactical Decision Making is Other Talk (e.g., # ORs & ICUs)



- Such tactical issues limit how much work gets done

Additional Information on Operating Room Management

- McIntosh C, Dexter F, Epstein RH. [Impact of service-specific staffing, case scheduling, turnovers, and first-case starts on anesthesia group and operating room productivity: tutorial using data from an Australian hospital.](#)
Anesthesia & Analgesia 103: 1499-1516, 2006



Additional Information on Operating Room Management

- www.FranklinDexter.net
 - Comprehensive bibliography of peer reviewed articles in operating room and anesthesia group management
 - Lectures on drug and supply costs, day of surgery decision making, PACU staffing, anesthesia staffing, financial analysis, comparing surgical services among hospitals, and strategic decision making
 - Contact information

