Targeted Increases in Patient Flow – Lessons from Operating Room Management

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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
Targeted Increases in Patient Flow

• Focus on turnover times
  - Well studied scientifically
  - Non-value added time

• Fewer patient safety related issues than reducing anesthesia or surgical times
Targeted Increases in Patient Flow

• Target reductions in turnover times
  ➢ Increase OR efficiency on the day of surgery by reducing over-utilized OR time
    – Increase OR efficiency, even if under-utilized OR time, by reducing staffing
    – Increase number of cases

• Time of day with most prolonged turnovers, not time with longest average turnovers
Example of Under-Utilized OR Time

- OR staffing is planned from 7 AM to 3 PM
- Yesterday, the last case of the day in OR 1 ended at 1 PM
- There were 2 hours of under-utilized OR time
  - Under-utilized time was from 1 PM to 3 PM

Strum DP et al. Anesthesiology 1999
Example of Over-Utilized OR Time

- OR staffing is planned from 7 AM to 3 PM
- Two days ago, the last case of the day in OR 1 ended at 5 PM
- There were 2 hr of *over-utilized OR time*
  - Over-utilized OR time was from 3 PM to 5 PM
Precise Meaning of “Maximize Efficiency of Use of OR Time”

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. Anesthesiology 1999
Reducing Turnover Times on Day of Surgery

- OR nurses and nurse anesthetists are full-time, hourly employees
- Staffing is planned from 7 AM to 3 PM
- There is estimated to be 9 hr of cases including turnover times
- Because of quick setup and cleanup times, OR finishes at 3 PM, instead of at 4 PM
- Has ↓ turnover times ↑ OR efficiency?
Reducing Turnover Times on Day of Surgery

- OR nurses and nurse anesthetists are full-time, hourly 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 ($) \approx \ (\text{Cost per hour of under-utilized OR time}) \times (\text{hours of under-utilized OR time}) + (\text{Cost per hour of over-utilized OR time}) \times (\text{hours of over-utilized OR time})

Dexter F, Traub RD. Anesth Analg 2002
McIntosh C et al. Anesth Analg 2006
Meaning of Maximizing OR Efficiency on Day of Surgery

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

(Cost per hour of over-utilized OR time)

$\times$ (hours of over-utilized OR time)
Meaning of Maximizing OR Efficiency on Day of Surgery

Inefficiency of use of OR time ($) \approx (\text{Cost per hour of over utilized OR time}) \times (\text{hours of over-utilized OR time})

Constant
Meaning of Maximizing OR Efficiency on Day of Surgery

Inefficiency of use of OR time ($) \approx

(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
Reducing Turnover Times on Day of Surgery

• Scenario
  - Staffing is planned from 7 AM to 3 PM
  - By reducing turnover times, cases finished in 8 hr instead of in the expected 9 hr
  - Finished at 3 PM instead of at 4 PM
Reducing Turnover Times on Day of Surgery

• Scenario
  - Staffing is planned from 7 AM to 3 PM
  - By reducing turnover times, cases finished in 8 hr instead of in the expected 9 hr
  • Finished at 3 PM instead of at 4 PM

Reducing turnover times increased OR efficiency by preventing 1 hr of over-utilized OR time
Reducing Turnover Times on Day of Surgery

• Scenario
  - Staffing is planned from 7 AM to 3 5 PM
  - By reducing turnover times, cases finished in 8 hr instead of in the expected 9 hr
  • Finished at 3 PM instead of at 4 PM
Reducing Turnover Times on Day of Surgery

• Scenario
  - Staffing is planned from 7 AM to 3 PM
  - By reducing turnover times, cases finished in 8 hr instead of in the expected 9 hr
  - Finished at 3 PM instead of at 4 PM
  - Reducing turnover times did not increase OR efficiency by preventing 10 hr of over-utilized OR time
Reducing Turnover Times on Day of Surgery

- Efforts to reduce turnover times should be targeted based on OR staffing

McIntosh C et al. Anesth Analg 2006
Impact of Staffing on Benefit of Turnover Time Reduction

- Outpatient Surgery Center with 6 ORs, all staffed from 7 AM to 5 PM
- Mean ORs in use before intervention
  - 2 PM – 5 ORs
  - 3 PM – 2 ORs
  - 4 PM – 1.4 ORs
  - 5 PM – 0.3 ORs
- Mean ORs in use after intervention
  - 2 PM – 4 ORs
  - 3 PM – 1.2 ORs
  - 4 PM – 0.8 ORs
  - 5 PM – 0.1 ORs
- Increased OR efficiency?
Impact of Staffing on Benefit of Turnover Time Reduction

1) Evaluate the OR allocation (staffing)
Impact of Staffing on Benefit of Turnover Time Reduction

• Outpatient Surgery Center with 6 ORs, all staffed from 7 AM to 5 PM

• Mean ORs in use before intervention
  2 PM – 5 ORs        4 PM – 1.4 ORs
  3 PM – 2 ORs        5 PM – 0.3 ORs

• Mean ORs in use after intervention
  2 PM – 4 ORs        4 PM – 0.8 ORs
  3 PM – 1.2 ORs      5 PM – 0.1 ORs

• Increased OR efficiency?
Impact of Staffing on Benefit of Turnover Time Reduction

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- Mean ORs in use after intervention
  - 2 PM – 4 ORs
  - 3 PM – 1.2 ORs
  - 4 PM – 0.8 ORs
  - 5 PM – 0.1 ORs

- Increased OR efficiency?

Unchanged
Impact of Staffing on Benefit of Turnover Time Reduction

2) Evaluate the over-utilized OR time
### Impact of Staffing on Benefit of Turnover Time Reduction

- **Outpatient Surgery Center** with 6 ORs, all staffed from 7 AM to 5 PM
- **Mean ORs in use before intervention**
  - 2 PM – 5 ORs
  - 3 PM – 2 ORs
  - 4 PM – 1.4 ORs
  - 5 PM – 0.3 ORs
- **Mean ORs in use after intervention**
  - 2 PM – 4 ORs
  - 3 PM – 1.2 ORs
  - 4 PM – 0.8 ORs
  - 5 PM – 0.1 ORs
- **Increased OR efficiency?**
**Impact of Staffing on Benefit of Turnover Time Reduction**

- Outpatient Surgery Center with 6 ORs, all staffed from 7 AM to 5 PM

- Mean ORs in use before intervention
  - 2 PM – 5 ORs
  - 3 PM – 2 ORs
  - 4 PM – 1.4 ORs
  - 5 PM – 0.3 ORs

- Mean ORs in use after intervention
  - 2 PM – 4 ORs
  - 3 PM – 1.2 ORs
  - 4 PM – 0.8 ORs
  - 5 PM – 0.1 ORs

- Increased OR efficiency? **Small & same**
Impact of Staffing on Benefit of Turnover Time Reduction

1) Evaluate the OR allocation (staffing)
2) Evaluate the over-utilized OR time
   - No impact on OR efficiency, because staffing and over-utilized OR time are effectively the same
Impact of Staffing on Benefit of Turnover Time Reduction

- Outpatient Surgery Center with 6 ORs, all staffed from 7 AM to 5 PM

- Mean ORs in use before intervention:
  - 2 PM – 5 ORs
  - 3 PM – 2 ORs
  - 4 PM – 1.4 ORs
  - 5 PM – 0.3 ORs

- Mean ORs in use after intervention:
  - 2 PM – 4 ORs
  - 3 PM – 1.2 ORs
  - 4 PM – 0.8 ORs
  - 5 PM – 0.1 ORs

- Increased OR efficiency?
Impact of Staffing on Benefit of Turnover Time Reduction

- *Increase* in OR efficiency by reducing hours of over-utilized OR time
  - From 3.7 hr a day down to 2.1 hr a day
Impact of Staffing on Benefit of Turnover Time Reduction

• Which is right?
Impact of Staffing on Benefit of Turnover Time Reduction

- Which is right? Plan staffing from 7 AM to 3 PM or to 5 PM to maximize OR efficiency?

McIntosh C et al. Anesth Analg 2006
Precise Meaning of “Maximize Efficiency of Use of OR Time”

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. Anesthesiology 1999
Impact of Staffing on Benefit of Turnover Time Reduction

• Which is right? Plan staffing from 7 AM to 3 PM or to 5 PM to maximize OR efficiency?
  ➢ Suppose that from long-term perspective the relative cost of an hour of over-utilized OR time to hour of under-utilized OR time is 2.0
Impact of Staffing on Benefit of Turnover Time Reduction

• Which is right? Plan staffing from 7 AM to 3 PM or to 5 PM to maximize OR efficiency?
  - Suppose that from long-term perspective the relative cost of an hour of over-utilized OR time to hour of under-utilized OR time is 2.0
    ➢ Reasonable, as equals time and a half plus increment for intangible cost of working late
Impact of Staffing on Benefit of Turnover Time Reduction

• Which is right? Plan staffing from 7 AM to 3 PM or to 5 PM to maximize OR efficiency?
  - Suppose that from long-term perspective the relative cost of an hour of over-utilized OR time to hour of under-utilized OR time is 2.0
  • Reasonable, as equals time and a half plus increment for intangible cost of working late
  ➢ Staff so 2/3rd ORs finish early, 1/3rd finish late
Impact of Staffing on Benefit of Turnover Time Reduction

• Which is right? Plan staffing from 7 AM to 3 PM or to 5 PM to maximize OR efficiency?
  - Suppose that from long-term perspective the relative cost of an hour of over-utilized OR time to hour of under-utilized OR time is 2.0
  • Reasonable, as equals time and a half plus increment for intangible cost of working late

• Staff so 2/3rd ORs finish early, 1/3rd finish late

Staffing based on maximizing efficiency of use of OR time should be 7 AM to 3 PM
Impact of Staffing on Benefit of Turnover Time Reduction

• If:
  – Staffing planned and cases scheduled based on maximizing the efficiency of use of OR time

• And:
  – There are more than 8 hr of cases and turnover times in ORs

• Then:
  – Reducing turnover times can increase OR efficiency
Impact of Staffing on Benefit of Turnover Time Reduction

• If:
  - Staffing planned and cases scheduled based on maximizing the efficiency of use of OR time

• And:
  - There are more than 8 hr of cases and turnover times in ORs

• Then:
  - Reducing turnover times can increase OR efficiency
• 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
Target to ORs
Applying the Science

• For 11 of 13 suites, staffing plan to maximize OR efficiency had 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

Freytag S et al. Der Chirurg 2005
McIntosh C et al. Anesth Analg 2006
Impact of Staffing on Benefit of Turnover Time Reduction

• If:
  - Staffing planned and cases scheduled based on maximizing the efficiency of use of OR time

• And:
  - There are more than 8 hr of cases and turnover times in ORs

• Then:
  - Reducing turnover times can increase OR efficiency

Easy Screening Question
Screening Question Useful Since Often Fewer Than 8 Hr of Cases

- Average 5.5 hr of OR time per OR per day at 8 US community hospitals’ ORs with knee and hip replacement surgery
- Average 6.0 hr of anesthesia time per OR per day at 11 US community anesthesia groups
- Average 55% utilization of staffed OR time at UK day surgery ORs

Commission for Healthcare Audit and Inspection, July 2005
Abouleish AE et al. Anesthesiology 2002
Targeted Increases in Patient Flow

• Target reductions in turnover times
  - Increase OR efficiency on the day of surgery by reducing over-utilized OR time
  ➢ Increase OR efficiency, even if under-utilized OR time, by reducing staffing
  ➢ Increase number of cases

• Time of day with most prolonged turnovers, not time with longest average turnovers
Increasing OR Efficiency Even If Under-Utilized OR Time

- Facility with 6 ORs, all staffed for the same period, calculated based on OR efficiency
- Mean ORs in use before intervention
  - 2 PM – 5 ORs  4 PM – 2.0 ORs
  - 3 PM – 4 ORs  5 PM – 0.6 ORs
- Mean ORs in use after intervention
  - 2 PM – 4 ORs  4 PM – 1.3 ORs
  - 3 PM – 2.0 ORs  5 PM – 0.1 ORs
- Increased OR efficiency?
Increasing OR Efficiency Even If Under-Utilized OR Time

- Mean ORs in use before intervention
  2 PM – 5 ORs
  3 PM – 4 ORs
  4 PM – 2.0 ORs
  5 PM – 0.6 ORs

- If staffing options are 7 AM to 3 PM or 7 AM to 5 PM, staff 7 AM to 5 PM to maximize efficiency of use of OR time
  - Excess over-utilized OR time if 7 AM to 3 PM
Increasing OR Efficiency Even If Under-Utilized OR Time

- Mean ORs in use after intervention:
  - 2 PM – 4 ORs
  - 3 PM – 2.0 ORs
  - 4 PM – 1.3 ORs
  - 5 PM – 0.1 ORs

- If staffing options are 7 AM to 3 PM or 7 AM to 5 PM, staff 7 AM to 3 PM to maximize efficiency of use of OR time:
  - Excess under-utilized OR time if 7 AM to 5 PM
Increasing OR Efficiency Even If Under-Utilized OR Time

• Facility with 6 ORs, all staffed for the same period, calculated based on OR efficiency

• Mean ORs in use before intervention 7 AM - 5 PM
  
  2 PM – 5 ORs  
  3 PM – 4 ORs

• Mean ORs in use after intervention 7 AM - 3 PM
  
  2 PM – 4 ORs  
  3 PM – 2.0 ORs

• Increased OR efficiency?
Increasing OR Efficiency Even If Under-Utilized OR Time

• On day of surgery, no impact of intervention on OR efficiency, because staff scheduled to 5 PM have no less over-utilized OR time
• On long-term basis, if staffing were changed from 7 AM – 5 PM to 7 AM – 3 PM, then intervention would increase OR efficiency
Service, Day of Week, and Procedure Specific Analysis

- Orthopedics’ staffing is 3 OR each day for 8 hr
- Mean 6.8 hr (SD 0.8 hr) cases per OR per day
- Even if reduce turnover times, would still have 3 ORs for 8 hr
  - No increase in OR efficiency
  - No resulting reduction in staffing cost
Service, Day of Week, and Procedure Specific Analysis

• ENT’s staffing is 3 OR each day for 10 hr
• Mean 11 hr (SD 0.8 hr) cases per OR per day
• If reduce turnover time, would reduce over-utilized OR time, and perhaps also reduce some OR’s staffing to 8 hr
  - Increase in OR efficiency
  • Resulting reduction in staffing cost
Monitor Impact of Reducing Turnover Times by Service

1. Calculate current service-specific staffing
2. Reduce all turnovers that are longer than a collective maximum value to the maximum
3. Recalculate service-specific staffing
4. Report reduction in staffing costs, if any, in units of minutes per 8 hr of staffed OR time

Abouleish AE et al. Anesthesiology 2004
McIntosh C et al. Anesth Analg 2006
## Monitor Impact of Reducing Turnover Times by Service

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Service, Day of Week, and Procedure Specific Analysis

- Factors to consider about each service:
  - Mean turnover time
    - Opportunity if mean is long
  - Turnover times per OR each day
    - Opportunity if many turnovers per OR
  - Hours of cases including turnovers each day
    - Hours of under- and over-utilized OR time
  - Variability in workload among weeks
    - Benefit if less variability
Service, Day of Week, and Procedure Specific Analysis

- Factors to consider about each service:
  - Mean turnover time
    - Opportunity if mean is long
  - Turnover times per OR each day
    - Opportunity if many turnovers per OR
  - Hours of cases including turnovers each day
    - Hours of under- and over-utilized OR time
  - Variability in workload among weeks
    - Benefit if less variability

Conclusion
Targeted Increases in Patient Flow

• Target reductions in turnover times
  - Increase OR efficiency on the day of surgery by reducing over-utilized OR time
  - Increase OR efficiency, even if under-utilized OR time, by reducing staffing

➢ Increase number of cases

• Time of day with most prolonged turnovers, not time with longest average turnovers
Targeted Increases in Patient Flow

• Target reductions in turnover times
  - Increase OR efficiency on the day of surgery by reducing over-utilized OR time
  - Increase OR efficiency, even if under-utilized OR time, by reducing staffing
  - Increase number of cases

➢ Time of day with most prolonged turnovers, not time with longest average turnovers
Time of Day with the Most Prolonged Turnovers

- Benchmarking report of typical turnovers
  - Turnovers longer than 90 min are excluded
  - “Average” assesses setup & cleanup times

Dexter F et al. Anesthesiology 2005
Time of Day with the Most Prolonged Turnovers

• Benchmarking report of typical turnovers
  - Turnovers longer than 90 min are excluded
  - “Average” assesses setup & cleanup times
  - Turnover “prolonged” if time from one elective case ends until another starts in the same OR is > 15 min longer than the average turnover
Monitor Incidence of Prolonged Turnovers Times by Time of Day

Turnovers > 15 min Over Avg with 95% (Simultaneous) Confidence Intervals

Start of the Hour of the Day

Prolonged Turnovers (Over 56 Wk)
Monitor Incidence of Prolonged Turnovers Times by Time of Day

Turnovers > 15 min Over Avg with 95% (Simultaneous) Confidence Intervals

Most Turnovers
Early in Day
Monitor Incidence of Prolonged Turnovers Times by Time of Day

Turnovers > 15 min Over Avg with 95% (Simultaneous) Confidence Intervals

Prolonged Turnovers (Over 56 Wk)

Start of the Hour of the Day

Longer Later in Day
Time of Day with the Most Prolonged Turnovers

• Balance of incidence (earlier in day) and magnitude (later in day) is for most prolonged turnovers to occur in the middle of the day.
Time of Day with the Most Prolonged Turnovers

- Balance of incidence (earlier in day) and magnitude (later in day) is for most prolonged turnovers to occur in the middle of the day
Targeted Increases in Patient Flow

• Target reductions in turnover times
  - Increase OR efficiency on the day of surgery by reducing over-utilized OR time
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• Time of day with most prolonged turnovers, not time with longest average turnovers
Additional Information on Operating Room Management

- [www.FranklinDexter.net](http://www.FranklinDexter.net)
  - Review article on which lecture is based
  - Comprehensive bibliography of peer reviewed articles in operating room and anesthesia group management
  - Lectures on service-specific OR staffing, day of surgery decision making, anesthesia staffing, drug and supply costs, comparing surgical services among hospitals, strategic decision making, and PACU staffing
  - Contact information
Targeted Increases in Patient Flow

- Potential benefits of reducing turnover times
  - Increase OR efficiency on the day of surgery by reducing over-utilized OR time
  - Increase OR efficiency, even if under-utilized OR time, by reducing staffing
  - Increase number of cases
- Focus not just on setup and cleanup times, but also the frustrating prolonged turnovers
Irrational: Reduce Turnover Times to Permit Another Case

- Staffing is planned from 7 AM to 5 PM
- Laparoscopic surgeon does 4 cases per day, finishing between 4 PM and 4:30 PM
- Turnover times 40 min, because of …
  - Cleaning up OR in haphazard manner
  - Setting up poorly organized instruments
  - Wheeling and setting up incompatible video
- “If reduce turnover times, we would not reduce staffing to 8 hr, but do 5th case a day to increase revenue.”
Irrational: Reduce Turnover Times to Permit Another Case

- Argument
  - “If reduce turnover times, we would not reduce staffing to 6 hr, but do 5th case a day to increase revenue.”
Irrational: Reduce Turnover Times to Permit Another Case

• Argument
  – “If reduce turnover times, we would not reduce staffing to 6 hr, but do 5th case a day to increase revenue.”

• Question
  – If objective were to increase revenue, would the rational decision be to do the 5th case even if turnover times were not reduced?
Irrational: Reduce Turnover Times to Permit Another Case

- Variable costs
  - Change relative to volume of activity
  - Examples of variable costs
    - Patient-care employees’ time
      - Maybe: discussed later
    - Implants
    - Disposable supplies
    - Medications
Irrational: Reduce Turnover Times to Permit Another Case

• Fixed costs
  - Do not change relative to volume of activity
  - Examples of fixed costs
    • Maintenance of building and grounds
    • Billing office and information systems
    • OR equipment and instruments
  - Since fixed costs are fixed, irrelevant to decisions regarding reducing turnover times
Profit = revenue − variable costs − fixed costs

Contribution margin = revenue − variable costs

If contribution margin is positive, case contributes to covering a facility’s fixed costs

Financial goal of tactical decision-making is not to increase revenue, but to increase contribution margin

Irrational: Reduce Turnover Times to Permit Another Case
Irrational: Reduce Turnover Times to Permit Another Case

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

Irrational: Reduce Turnover Times to Permit Another Case

- 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 per OR Hr by Surgeon ($)

Cont. Margin = Revenue - Variable Costs
Irrational: Reduce Turnover Times to Permit Another Case

- Summary of contribution margins (FY04 US$)
  - $1,864 per OR hour, 97% surgeons > $0
  - $1,773 per OR hour, 99% surgeons > $0
    - Dexter F et al. Anesth Analg 2005
  - $1,530 per OR hour, 100% surgeons > $0
Irrational: Reduce Turnover Times to Permit Another Case

- Summary of contribution margins (FY04 US$)
  - $1,864 per OR hour, 97% surgeons > $0
  - $1,773 per OR hour, 99% surgeons > $0
    - Dexter F et al. Anesth Analg 2005
  - $1,530 per OR hour, 100% surgeons > $0

- Irrational financially not to encourage nurses and anesthesia providers to get cases done regardless of whether reduce turnover time
Irrational: Reduce Turnover Times to Permit Another Case

- Staffing is planned from 7 AM to 5 PM
- **Laparoscopic surgeon** does 4 cases per day, finishing between 4 PM and 4:30 PM
- Turnover times 40 min, because of …
  - Cleaning up OR in haphazard manner
  - Setting up poorly organized instruments
  - Wheeling and setting up incompatible video
- “If reduce turnover times, we won’t reduce staffing to 8 hr, but **do 5th case a day!**”
Irrational: Reduce Turnover Times to Permit Another Case

- Laparoscopic surgery (e.g., cholecystectomy) consistently achieves a contribution margin around $1,800 per OR hour.
- Even if paid nurses $300 per hour, revenue far exceeds costs for the case.
Laparoscopic surgery (e.g., cholecystectomy) consistently achieves a contribution margin around $1,800 per OR hour.

Even if paid nurses $300 per hour, revenue far exceeds costs for the case. The irrational manager reduces turnover times to permit another case.

Rational manager has case done regardless of whether turnover time is reduced.
Laparoscopic surgery (e.g., cholecystectomy) consistently achieves a contribution margin around $1,800 per OR hour.

Even if paid nurses $300 per hour, revenue far exceeds costs for the case.

Rational manager has case done regardless of whether turnover time is reduced.

Conclusion even stronger if goal were to increase revenue, as then costs are ignored.

Irrational: Reduce Turnover Times to Permit Another Case
Irrational: Reduce Turnover Times to Permit Another Case

- Variable costs
  - Change relative to volume of activity
  - Examples of variable costs
- Patient-care employees’ time
  - Maybe: discussed later
  - Conclusion even stronger if were to consider employees’ time to be a fixed cost, because then contribution margin is even larger
Reducing Turnover Times *Can* Increase Number of Cases

- When turnover times are reduced, some surgeons schedule additional cases that could otherwise have been scheduled, but which *the surgeon* otherwise chose not to schedule.

Sandberg WS et al. Anesthesiology 2005
Dexter F. Anesthesiology 2005
Cendán J C, Good M. Arch Surg 2006
Reducing Turnover Times *Can* Increase Number of Cases

- When turnover times are reduced, some surgeons schedule additional cases that could otherwise have been scheduled, but which *the surgeon* otherwise chose not to schedule.

- Reducing turnover times can rationally increase cases and revenue.
Reducing Turnover Times *Can* Increase Number of Cases

- When turnover times are reduced, some surgeons schedule additional cases that could otherwise have been scheduled, but which *the surgeon otherwise chose not to schedule*

  ➢ Reducing turnover times can rationally increase cases and revenue *indirectly*
Reducing Turnover Times *Can* Increase Number of Cases

- When turnover times are reduced, some surgeons schedule additional cases that could otherwise have been scheduled, but which *the surgeon* otherwise chose not to schedule.
- Reducing turnover times can rationally increase cases and revenue *indirectly*.
  - Small reductions in turnover time are sufficient to increase surgeons’ feelings of personal competence and achievement.

Stahl J E et al. Surgery 2005
Reducing Turnover Times *Can* Increase Number of Cases

- When turnover times are reduced, some surgeons schedule additional cases that could otherwise have been scheduled, but which *the surgeon* otherwise chose not to schedule.
- Reducing turnover times can rationally increase cases and revenue *indirectly*.
  - Small reductions in turnover time are sufficient to increase surgeons’ feelings of personal competence and achievement.

**Conclusion**