

# Reducing Variability in Anesthesia Work Hours by Good Decision in the Scheduling Office

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# **Reducing Variability in Anesthesia Work Hours by Good Decision in the Scheduling Office**

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# Financial Disclosure

- 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, and the income is used to fund our research
  - I receive no funds personally other than my salary and allowable expense reimbursements from the University of Iowa, and have tenure with no incentive program
  - I own no healthcare stocks (other than indirectly through mutual funds)

# Topics of Talk on Reducing Variability

- Review of principles in calculating allocated OR time for use in reducing over-utilized time
- Making good staff scheduling decisions to facilitate assignments the day before surgery
- Decision-making 1-2 days before surgery to reduce over-utilized time
- Review of bin packing principles



# Example of *Under-Utilized OR Time*

- Allocated time is from 7:15 AM to 3:30 PM
  - These are hours into which cases are scheduled
- An OR's last case of the day ends at 1:30 PM
- There are 2 hours of under-utilized OR time
  - Under-utilized time is from 1:30 PM to 3:30 PM

McIntosh C et al. Anesth Analg 2006

Dexter F, Epstein RH. Periop Care Oper Room Manag 2024



# Example of *Over-Utilized OR Time*

- Allocated time is 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

Dexter F, Epstein RH. Periop Care Oper Room Manag 2024

# Calculating Allocated OR Time

- On Mondays, hospital currently plans 3 ORs for orthopedics, each OR for 10 hr
  - $3 \text{ ORs} \times 10 \text{ hr} = 30 \text{ hr}$
- On Mondays, total hours of orthopedic cases including turnovers follows a normal distribution with a mean of 30 hr
- Relative cost of 1 hr over-utilized OR time =  $2.0 \times$  that of 1 hr under-utilized OR time

McIntosh C et al. Anesth Analg 2006

Pandit JJ, Dexter F. Anesth Analg 2009

Dexter F, Epstein RH. Periop Care Oper Room Manag 2024



# Calculating Allocated OR Time

- Consider standard deviation of orthopedics' workload on Mondays = 5 hr, a typical value
- Since workload follows a normal distribution, need inverse of normal distribution function
  - Ratio of 2.0:1.0 over-utilized: under-utilized
  - Excel "= NORM.INV( 2/3, 30, 5 )"
- The 66<sup>th</sup> percentile of the normal distribution function with mean 30 hr and standard deviation 5 hr equals **32 hr**



# Calculating Allocated OR Time

- Consider standard deviation of orthopedics' workload on Mondays = 5 hr, a typical value
- Using the mean of 30 hr, what OR allocation maximizes efficiency of use of OR time?
  - 1) 3 ORs:  $2 \times 8 \text{ hr}$ ,  $1 \times 10 \text{ hr}$
  - 2) 3 ORs:  $1 \times 8 \text{ hr}$ ,  $2 \times 10 \text{ hr}$
  - 3) 3 ORs:  $0 \times 8 \text{ hr}$ ,  $3 \times 10 \text{ hr}$
  - 4) 4 ORs:  $4 \times 8 \text{ hr}$ ,  $0 \times 10 \text{ hr}$
  - 5) 4 ORs:  $3 \times 8 \text{ hr}$ ,  $1 \times 10 \text{ hr}$
  - 6) 4 ORs:  $2 \times 8 \text{ hr}$ ,  $2 \times 10 \text{ hr}$

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# Calculating Allocated OR Time

- Consider standard deviation of orthopedics' workload on Mondays = **10** hr, a large value
- Since workload follows a normal distribution, need inverse of normal distribution function
  - Ratio of 2.0:1.0 over-utilized: under-utilized
  - Excel "= NORMINV( 2/3, 30, **10** )"
- The 66<sup>th</sup> percentile of the normal distribution function with mean 30 hr and standard deviation **10** hr equals **34 hr**



# Calculating Allocated OR Time

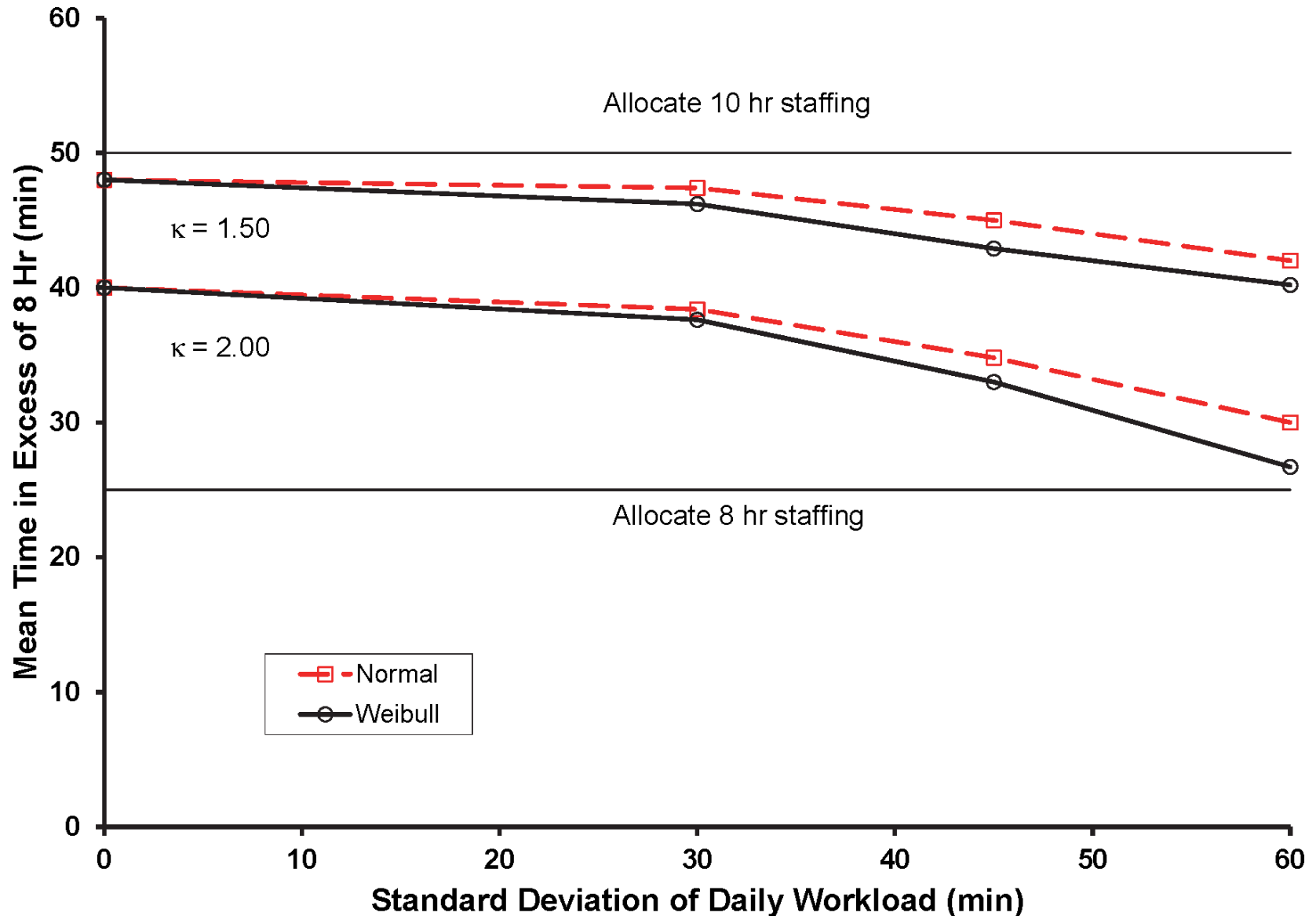
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# Allocated Times for Single ORs From Pandit & Dexter 2009



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## From Pandit & Dexter 2009

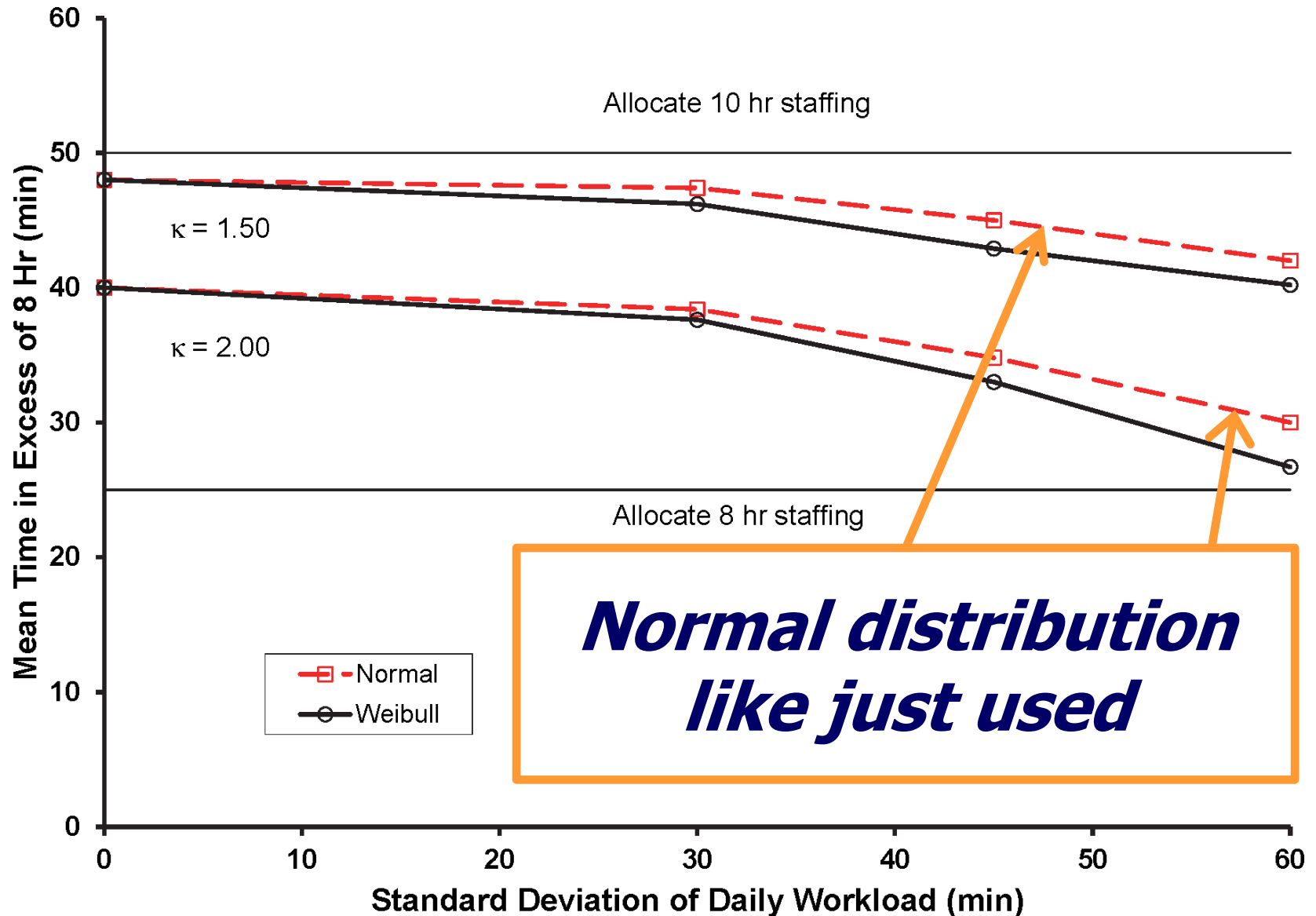
- Suppose normal distribution, mean workload 30 hours, standard deviation 5 hours, relative cost ratio of 2.00, and 10 hours allocated time
- Inefficiency of use of OR time proportional to:

```
= AVERAGE ( LET ( X,  
                  NORM.INV ( RANDARRAY (1000000), 30, 5 ),  
                  IF ( X < 10, 10 - X, 2.0 * ( X - 10 ) ) ) )
```

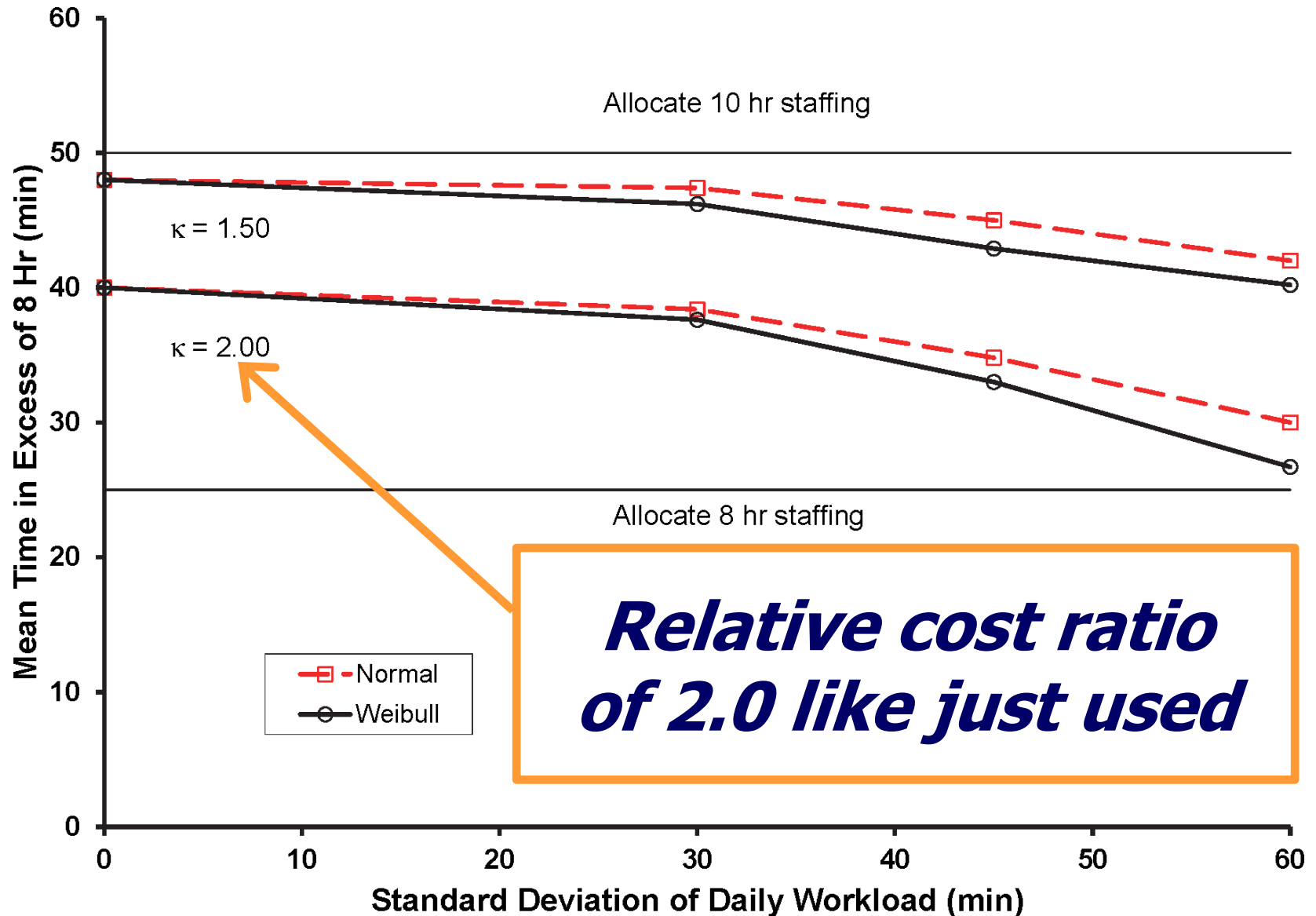
Dexter F et al. Am J Vet Res 2024



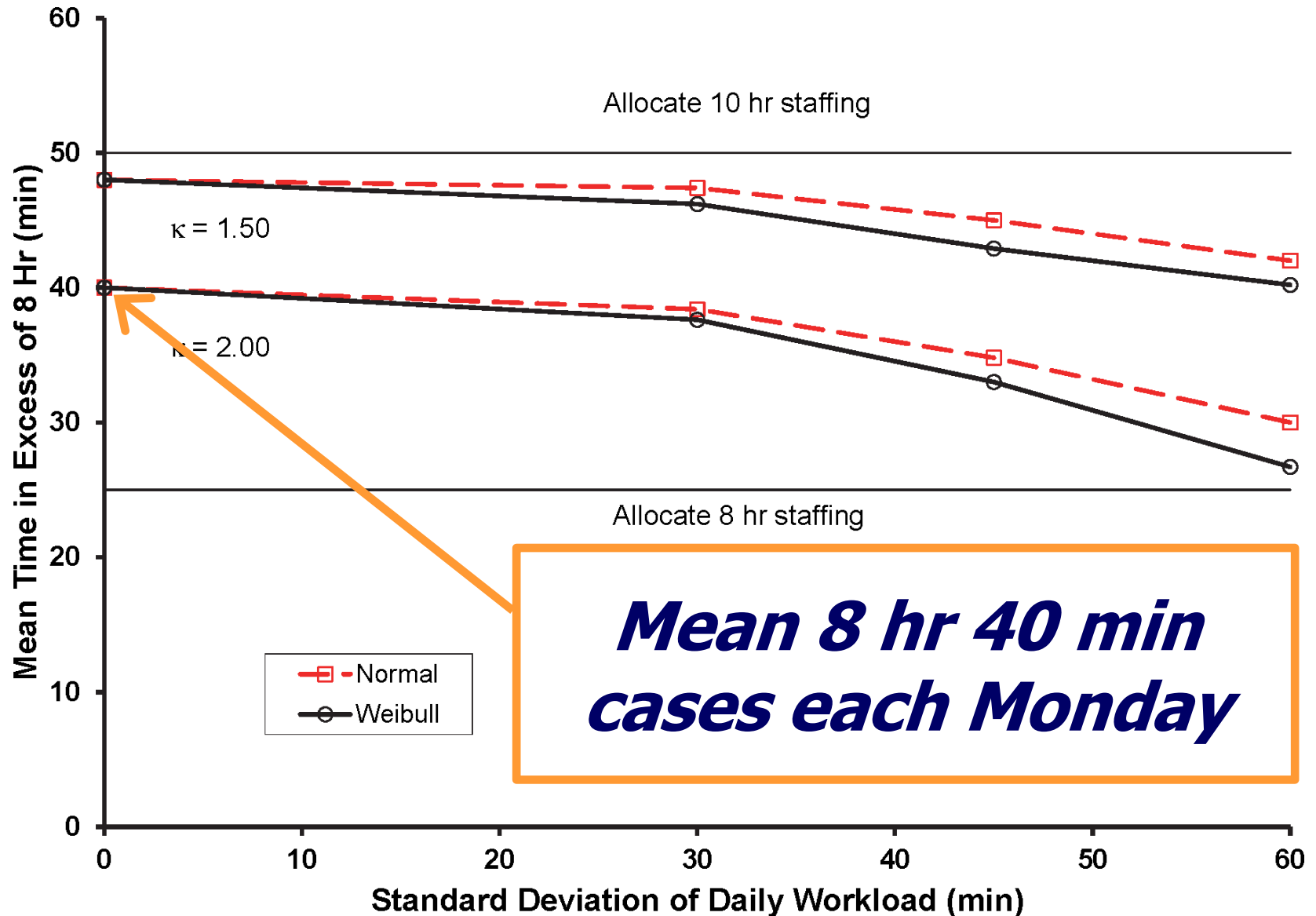
# Allocated Times for Single ORs From Pandit & Dexter 2009



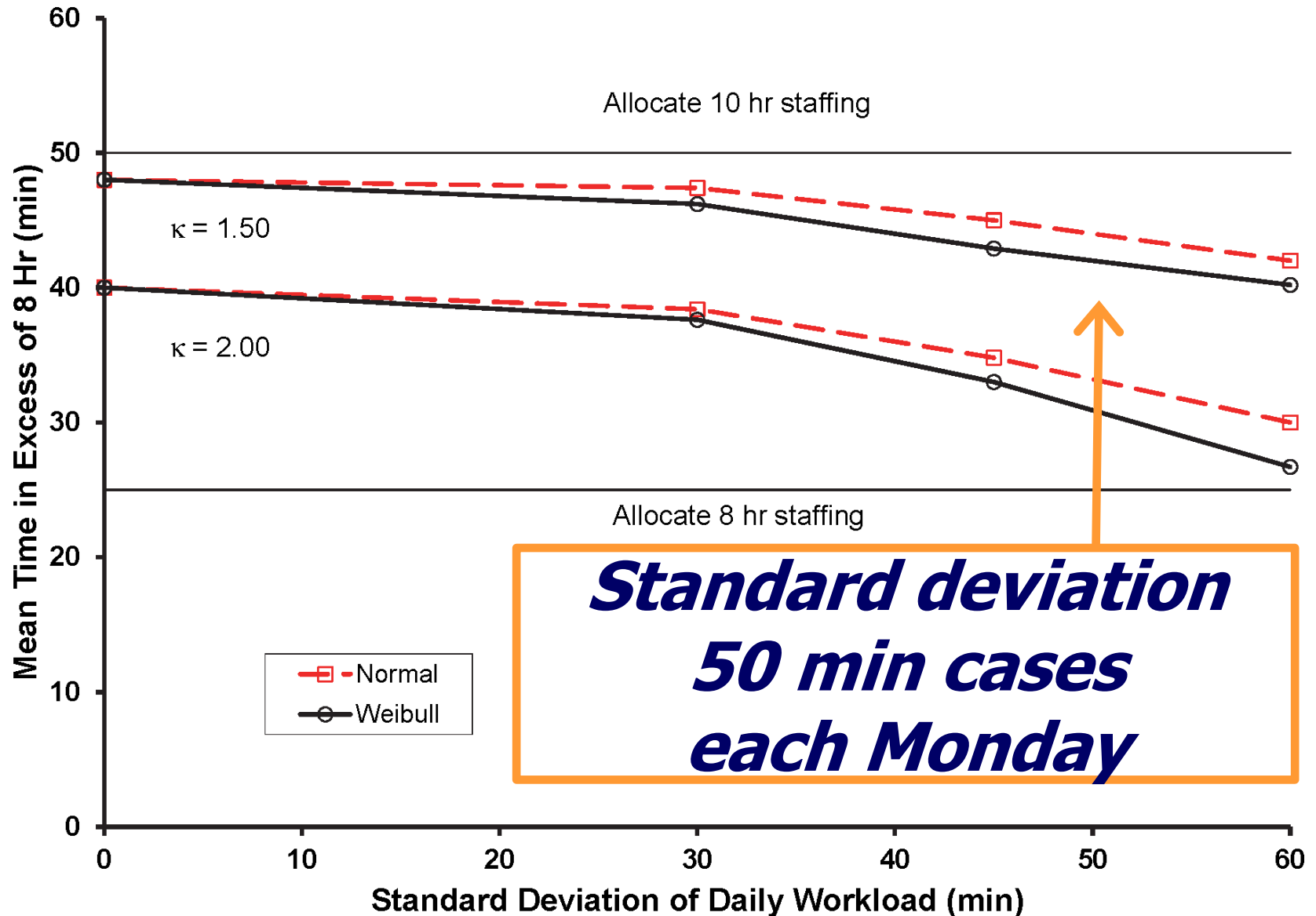
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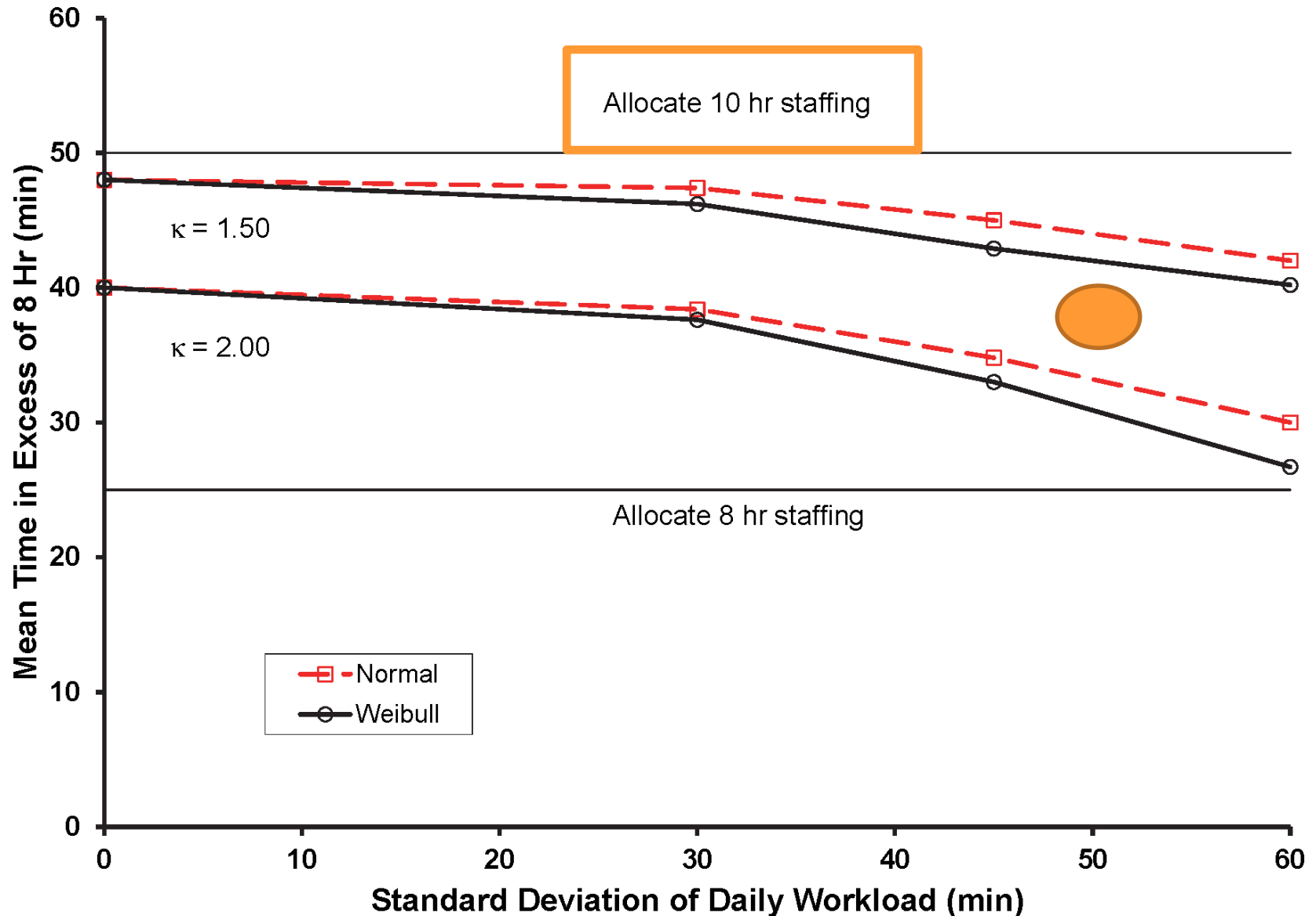


# Allocated Times for Single ORs From Pandit & Dexter 2009





# Allocated Times for Single ORs From Pandit & Dexter 2009



# Reducing Variability

- Vertical axis relates to mean
  - Commonly used to report adjusted utilization
- Horizontal axis relates to standard deviation



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- Since objective is to reduce ***variability*** in work hours, focus includes both mean and the standard deviation, principally the latter



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- Vertical axis relates to mean
  - Commonly used to report adjusted utilization
- Horizontal axis relates to standard deviation
- Since objective is to reduce ***variability*** in work hours, focus includes both mean and the standard deviation, principally the latter
- For monitoring reduction in variability and recognizing when and how it has been achieved, please see the previous talk online



# Topics of Talk on Reducing Variability

- Review of principles in calculating allocated OR time for use in reducing over-utilized time
- Making good staff scheduling decisions to facilitate assignments the day before surgery
- Decision-making 1-2 days before surgery to reduce over-utilized time
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# Increased Variability End of Day If Neglect Staff Scheduling

- Scenario for anesthesiologists using teams
  - Orthopedics' OR allocations are 4 ORs Mon, 3 ORs Tue-Thu, and 2 ORs on Fri

Lubarsky DA, Reves JG. J Am Coll Surg 2005





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  - Staff scheduling must then be by team and must include different numbers of allocated ORs for each day of the week

Dexter F et al. Anesth Analg 2010



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    - To start multiple peripheral nerve blocks in preoperative area on-time, staff scheduling also needs to include anesthesiologists' arrival times

Chelly JE et al. J Clin Anesth 2010



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    - To start multiple peripheral nerve blocks in preoperative area on-time, staff scheduling also needs to include anesthesiologists' arrival times
- If plan for 3 ORs daily, anesthesia assignment office falsely appears to perform poorly each Monday

# Application to Staff Scheduling and to Staff Assignment

- Service has multiple specialties, 10 hr staffing
- Resident physicians scheduling is one of the specialties, with policy that when no cases for the specialty they are not assigned other cases
  - On 1/3<sup>rd</sup> of workdays there are no cases of the specialty, and when  $\geq 1$ , mean 5.4 hr of cases

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  - On 1/3<sup>rd</sup> of workdays there are no cases of the specialty, and when  $\geq 1$ , mean 5.4 hr of cases
- Need to schedule nurse anesthetist for the 1/3<sup>rd</sup> of days' first case starts and for the afternoons: low observed productivity



# Lunch Breaks

- Most prolonged turnovers occur middle of day

Dexter F et al. Anesthesiology 2005





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- After first cases of day, period of day with the largest numbers of anesthesia providers needed is also middle of day because of lunch breaks (at hospitals with ORs lasting >8 hours)

Epstein RH, Dexter F. Anesthesiology 2012



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- Plan staff scheduling to have providers for all ORs during middle of day, no gap for breaks

Marjamaa RA et al. Health Care Manag Sci 2009

Smallman B et al. Anesth Analg 2013



# Lunch Breaks

- Most prolonged turnovers occur middle of day
- After first cases of day, period of day with the largest numbers of anesthesia providers needed is also middle of day because of lunch breaks (at hospitals with ORs lasting >8 hours)
- Plan staff scheduling to have providers for all ORs during middle of day, no gap for breaks
- Use displays with evidence-based dynamic assignment of providers to ORs for breaks

Epstein RH, Dexter F. Anaesth Intensive Care 2012

Titler SS et al. Cureus 2021 and Breastfeed Med 2021

# Topics of Talk on Reducing Variability

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- Review of bin packing principles

Dexter F et al. Anesth Analg 2016



# Working Fast Can Increase OR Efficiency

- OR nurses, nurse anesthetists, and anesthesiologists are full-time employees
- Allocated time is from 8 AM to 3:30 PM
- There are estimated to be 8.5 hr of cases
- Turnover and extubation times are brief
- OR finishes at 3:30 PM, instead of 4:30 PM
- Has OR efficiency been increased?





# Working Fast Can Increase OR Efficiency

- OR nurses, nurse anesthetists, and anesthesiologists are full-time employees
- As approach the day of surgery, the cost of an hour of under-utilized OR time becomes 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

Dexter F et al. Anesthesiology 2004





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***Constant***



# 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***

- Decisions made in the scheduling office to maximize OR efficiency are those that minimize the hours of over-utilized OR time



# Working Fast Can Increase OR Efficiency

- Scenario
  - Allocated time was from 8 AM to 3:30 PM, which is 7.5 hr
  - Reducing turnover and extubation times resulted in cases finished in 7.5 hr instead of in the expected 8.5 hr
    - Finished at 3:30 PM instead of at 4:30 PM
    - Had 0 hours of over-utilized time instead of 1 hour of over-utilized time



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    - Finished at 3:30 PM instead of at 4:30 PM
    - Had 0 hours of over-utilized time instead of 1 hour of over-utilized time
- Increased efficiency of use of OR time by preventing 1 hr of over-utilized OR time

# Working Fast Can Increase OR Efficiency

- OR nurses, nurse anesthetists, and anesthesiologists are full-time employees
- Allocated time is from 8 AM to ~~3:30~~ **6** PM
- There are estimated to be 8.5 hr of cases
- Turnover and extubation times are brief
- OR finishes at 3:30 PM, instead of 4:30 PM
- Has OR efficiency been increased?





# Working Fast Can Increase OR Efficiency

- Scenario
  - Allocated time is from 8 AM to ~~3:30~~ **6** PM
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McIntosh C et al. Anesth Analg 2006

Dexter F et al. Anesth Analg 2016

Dexter F, Epstein RH. Periop Care Oper Room Manag 2024



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- Allocated time is from 8 AM to ~~3:30~~ **6** PM
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- No increase in OR efficiency

Good OR management operational decision-making is highly sensitive to the OR allocations, which is why those values used in scheduling office need to be calculated appropriately

# Case Scheduling to Maximize OR Efficiency

- Allocated time for Ophthalmology Associates is 7:15 AM to 3:30 PM in OR 1 and OR 2
- 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 3 PM in OR 1
- Schedule the case into OR 1?



# Scenario – 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

Dexter F et al. Anesth Analg 2012

Shi P et al. Anesth Analg 2016



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# 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 with over-utilized OR time when another allocated OR is empty
  - Choose a different workday





# 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



# 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

**Must** get OR allocation right to PREVENT this scenario. Every case scheduling conflict is failure of OR allocation until proven otherwise.



# Starting Late the Afternoon of Day Before Surgery, Target ORs

- At facilities where anesthesiologists supervise multiple ORs, they must effectively use staggered starts ( $\cong 20$  min) of first cases of day, since otherwise they cannot be present at all critical portions of cases
  - Otherwise 1:2 MD:CRNA, lapses  $> 30\%$  of days
  - Otherwise 1:3 MD:CRNA, lapses  $> 96\%$  of days

Epstein RH, Dexter F. Anesth Analg 2012



# Starting Late the Afternoon of Day Before Surgery, Target ORs

- Let the surgeons know so that those with the later starts are not waiting in the ORs

Koenig T et al. Anaesthesia 2011



# Starting Late the Afternoon of Day Before Surgery, Target ORs

- Let the surgeons know so that those with the later starts are not waiting in the ORs
- Yes, preferentially focusing on ORs with over-utilized time, since ordered priorities are first performing all the cases safely and second reducing expected over-utilized time

Dexter F et al. Anesthesiology 2004

Dexter F et al. Anesth Analg 2007



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- Yes, preferentially focusing on ORs with over-utilized time, since ordered priorities are first performing all the cases safely and second reducing expected over-utilized time
- Important to understand since fixation on first case starts is due to cognitive bias that starting late results in all cases being tardy



# Anesthesia Staff Assignment

- Some surgeons have significantly briefer turnover times when assigned to specific anesthesiologists
- For those surgeons, when possible, make assignment decisions to reduce turnover times
- Overall benefit is 6.8% reduction in median turnover times (95% CI 6.3% to 7.1%)

Doll D et al. Anesth Analg 2017





# Anesthesia Staff Assignment

- End surgery to tracheal extubation ( $\geq 15$  min) delays start next case, rated poorly by anesthesiologists, and important to surgeons

Apfelbaum JL et al. Anesth Analg 1993

Vitez TS, Macario A. J Clin Anesth 1998

Masursky D et al. Anesth Analg 2012

Dexter F, Epstein RH. Anesth Analg 2013



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# Anesthesia Staff Assignment

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- Odds ratio 2.10 ( $P = 0.025$ ) for the 57% of cases when nurse anesthetist or resident physician worked with neurosurgeon < 5 previous cases

Apfelbaum JL et al. Anesth Analg 1993

Vitez TS, Macario A. J Clin Anesth 1998

Masursky D et al. Anesth Analg 2012

Dexter F, Epstein RH. Anesth Analg 2013

Epstein RH et al. J Clin Anesth 2020



# Anesthesia Staff Assignment

- Odds ratio 4.4 ( $P = 0.005$ ) for the cases when the anesthesiologist worked with neurotologist < 5 previous cases
- Odds ratio 2.10 ( $P = 0.025$ ) for the 57% of cases when nurse anesthetist or resident physician worked with neurosurgeon < 5 previous cases

Xia J et al. Otol Neurotol 2022

Epstein RH et al. J Clin Anesth 2020



# Anesthesia Staff Assignment

- Odds ratio 4.4 ( $P = 0.005$ ) for the cases when the anesthesiologist worked with neurotologist < 5 previous cases
- Odds ratio 2.10 ( $P = 0.025$ ) for the 57% of cases when nurse anesthetist or resident physician worked with neurosurgeon < 5 previous cases
- Threshold is <5 previous cases over 3 years, which at hospital was for 74% of cases, causing 23% prolonged extubations

# Anesthesia Staff Assignment

- Anesthesia-controlled times, anesthesiologist & nurse anesthetist vs. & resident physician
  - (OR entrance until preparation can start) + (end of procedure [dressing on] until OR exit)
  - 2.5 min (SE 0.2) quicker,  $P < 0.001$
- Turnover times, anesthesiologist & nurse anesthetist vs. & 1<sup>st</sup> year anesthesia resident
  - 2.6 min (SE 1.1) quicker,  $P = 0.016$

Dexter F et al. Anesth Analg 1995

Urman RD et al. Ochsner J 2012

Hoffman CR et al. BMC Med Educ 2018



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Urman RD et al. Ochsner J 2012

Hoffman CR et al. BMC Med Educ 2018





# Nurse Staff Assignment

- For each targeted OR
  - Assign senior nurse with expertise in the surgical specialty as lead
    - In addition to surgical technician and circulating nurse
  - Assign 2 dedicated PACU beds to the OR
- Significantly reduce non-operative time

Mascarella MA et al. Surgery 2016



# Managerial Behavior

- When monitoring managers' performance, good criterion is use by their facility of either:
  - Displays providing recommendations
  - Displays providing information and checklists for how to use the information

Dexter F et al. Anesth Analg 2007

Stepaniak PS, Dexter F. Anesth Analg 2013



# Managerial Behavior

- When monitoring managers' performance, good criterion is use by their facility of either:
  - Displays providing recommendations
  - Displays providing information and checklists for how to use the information
- Use anesthesia group – facility agreement to codify the performance criteria

Dexter F, Epstein RH. Anesth Analg 2008

Dexter F, Epstein RH. Anesth Analg 2015



# Caution: Do Not ↓ Variability and Yet Net ↓ Productivity

- Productivity =  
$$\frac{(\text{clinical care provided} / \$ \text{ per regular hour})}{(\text{allocated hours} + \{ \text{ratio} > 1 \} \times \text{over-utilized hours})}$$



# Caution: Do Not ↓ Variability and Yet Net ↓ Productivity

- Productivity =  
$$\frac{(\text{clinical care provided} / \$ \text{ per regular hour})}{(\text{allocated hours} + \{ \text{ratio} > 1 \} \times \text{over-utilized hours})}$$
- Would have nearly zero over-utilized time if every surgeon had 2 ORs every day



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- Productivity =  
$$\frac{(\text{clinical care provided} / \$ \text{ per regular hour})}{(\text{allocated hours} + \{ \text{ratio} > 1 \} \times \text{over-utilized hours})}$$
- Would have nearly zero over-utilized time if every surgeon had 2 ORs every day
  - But productivity would be extremely low





# Caution: Do Not ↓ Variability and Yet Net ↓ Productivity

- Reduced productivity from 3 versus 2 anesthesia providers assigned to 2 ORs
- Increased productivity from 4 versus 3 anesthesia teams assigned to 3 ORs
- Increased productivity from 5 versus 4 anesthesia & nursing teams assigned to 4 ORs

Williams BA et al. Am J Anesthesiol 1998

Hanss R et al. Anesthesiology 2005

Torkki PM et al. Anesthesiology 2005



# Caution: Do Not ↓ Variability and Yet Net ↓ Productivity

- Reduced productivity from 3 versus 2 anesthesia providers assigned to 2 ORs
- Increased productivity from 4 versus 3 anesthesia teams assigned to 3 ORs
- Increased productivity from 5 versus 4 anesthesia & nursing teams assigned to 4 ORs

Williams BA et al. Am J Anesthesiol 1998

Hanss R et al. Anesthesiology 2005

Torkki PM et al. Anesthesiology 2005



# Caution: Do Not ↓ Variability and Yet Net ↓ Productivity

- Reduced productivity from 3 versus 2 anesthesia providers assigned to 2 ORs
- Increased productivity from 4 versus 3 anesthesia teams assigned to 3 ORs
- Increased productivity from 5 versus 4 anesthesia & nursing teams assigned to 4 ORs

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- Results insensitive to specific workflow

Marjamaa RA et al. Health Care Manag Sci 2009



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- Increased productivity from 5 versus 4 anesthesia & nursing teams assigned to 4 ORs
- Results insensitive to specific workflow
- Facilitate by coordinating dates surgeons operate (“blocks”) to best use the shared OR(s)





# Topics of Talk on Reducing Variability

- Review of principles in calculating allocated OR time for use in reducing over-utilized time
- Making good staff scheduling decisions to facilitate assignments the day before surgery
- Decision-making 1-2 days before surgery to reduce over-utilized time
- Review of bin packing principles





# Bin Packing Surgical Cases

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Dexter F et al. Anesthesiology 1999

Dexter F, Traub RD. Anesth Analg 2002

Dexter F et al. Anesthesiology 2004

Shi P et al. Anesth Analg 2016



# Bin Packing Surgical Cases

- Allocated time from 7 AM to 5 PM
- Time remaining in ORs at 2 PM
  - 3 hours in add-on OR [ available immediately ]
  - 2 hours in OR 2 [ available in 1 hr ]
  - 1 hour in OR 3 [ available in 2 hr ]
  - 0 hours in all other ORs
- Three add-on cases listed in sequence of submission: 0.7 hr, 2.9 hr, 1.8 hr
- All can safely wait a few hours
- Perform cases in what sequence?

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# Bin Packing Surgical Cases

- Sort the cases based on estimated duration from longest to shortest
  - Consider the cases in this descending order
  - Longest add-on case is assigned first
- Assign each case to OR meeting two criteria
  - Has no restrictions on equipment or personnel preventing the case from being put into the OR
  - Sufficient extra time available for the new case



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*Safety*



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why?





# Reason for Add-on Surgical Case Scheduling Result

- Sort the cases based on estimated duration from longest to shortest
  - Consider the cases in this descending order
  - Longest add-on case is assigned first
- Assign each case to OR meeting two criteria
  - Has no restrictions on equipment or personnel preventing the case from being put into the OR
  - Sufficient extra time available for the new case

why?



# Reason for Add-on Surgical Case Scheduling Result

- On average, only 1/5 ORs with scheduled cases will have time available for add-on case
- Average time remaining in these ORs each day will be around 1.3 hr, with large SD 1.6 hr
- Average OR time of add-on cases including their turnover times around 3.4 hr (SD 1.7 hr)
  - Long, since add-on case scheduling applies to cases at hospitals, rarely outpatient facilities

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  - Long, since add-on case scheduling applies to cases at hospitals, rarely outpatient facilities
- Because 0 or 1 add-on cases per OR not designated for add-on cases



# Bin Packing Surgical Cases

- Sort the cases based on estimated duration from longest to shortest
  - Consider the cases in this descending order
  - Longest add-on case is assigned first
- Assign each case to OR meeting two criteria
  - Has no restrictions on equipment or personnel preventing the case from being put into the OR
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# Bin Packing Surgical Cases

- Sort the cases based on estimated duration from longest to shortest
  - Consider the cases in this descending order
  - Longest add-on case is assigned first
- Assign each case to OR by meeting two criteria
  - Has no restrictions on equipment or personnel preventing the case from being put into the OR
  - Sufficient extra time available for the new case

Why?





# Reason for Add-on Surgical Case Scheduling Result

- Sort the cases based on estimated duration from longest to shortest
    - Consider the cases in this descending order
    - Longest add-on case is assigned first
  - Assign each case to OR meeting two criteria
    - Has no restrictions on equipment or personnel preventing the case from being put into the OR
    - Sufficient extra time available for the new case
- Reduces the hours of over-utilized OR time!





# Topics of Talk on Reducing Variability

- Review of principles in calculating allocated OR time for use in reducing over-utilized time
- Making good staff scheduling decisions to facilitate assignments the day before surgery
- Decision-making 1-2 days before surgery to reduce over-utilized time
- Review of bin packing principles



# Question and Answer #1

- OR time is allocated at a surgical suite either for 8 hours or 10 hours
- A service on Tuesdays has a mean of 8 hr 40 min with a standard deviation of 50 min
- Allocate 8 hr or 10 hr and why?



# Question and Answer #1

- OR time is allocated at a surgical suite either for 8 hours or 10 hours
- A service on Tuesdays has a mean of 8 hr 40 min with a standard deviation of 50 min
- Allocate 8 hr or 10 hr and why?
- 10 hr maximizes efficiency of use of OR time



# Question and Answer #2

- A studied surgical suite had some allocated ORs for 8 hours and other 10 hours, based on minimizing the inefficiency of use of OR time
- Anesthesiologists supervise CRNAs, some ORs 1:2 and some 1:3
- What are the two times of day that the largest numbers of anesthesia providers are needed?



# Question and Answer #2

- A studied surgical suite had some allocated ORs for 8 hours and other 10 hours, based on minimizing the inefficiency of use of OR time
- Anesthesiologists supervise CRNAs, some ORs 1:2 and some 1:3
- What are the two times of day that the largest numbers of anesthesia providers are needed?
  - First case starts and lunch breaks
    - Middle of the day, when there are also the largest numbers of turnovers



# Question and Answer #3

- A studied surgical suite had some allocated ORs for 8 hours and other 10 hours, based on minimizing the inefficiency of use of OR time
- Anesthesiologists supervise CRNAs, some ORs 1:2 and some 1:3
- What is the consequence of 1 too few CRNAs at either of these 2 times of day when need the largest numbers of anesthesia providers?





# Question and Answer #3

- A studied surgical suite had some allocated ORs for 8 hours and other 10 hours, based on minimizing the inefficiency of use of OR time
- Anesthesiologists supervise CRNAs, some ORs 1:2 and some 1:3
- What is the consequence of 1 too few CRNAs at either of these 2 times of day when need the largest numbers of anesthesia providers?
  - Increased over-utilized OR time, since all cases should still be completed



# Question and Answer #4

- A studied surgical suite had some allocated ORs for 8 hours and other 10 hours, based on minimizing the inefficiency of use of OR time
- Anesthesiologists supervise CRNAs, some ORs 1:2 and some 1:3
- When planning first case of day starts, how decide what ORs to stagger to start first? Last?

# Question and Answer #4

- A studied surgical suite had some allocated ORs for 8 hours and other 10 hours, based on minimizing the inefficiency of use of OR time
- Anesthesiologists supervise CRNAs, some ORs 1:2 and some 1:3
- When planning first case of day starts, how decide what ORs to stagger to start first? Last?
  - Start first OR(s) with over-utilized time
  - Start last OR(s) with most under-utilized time

# Additional Information on Operating Room Management

- [www.FranklinDexter.net/education.htm](http://www.FranklinDexter.net/education.htm)
  - Full course (e.g., medical directors and analysts)
  - Lectures on day of surgery decision making, case duration prediction, allocating OR time, increasing anesthesia productivity, financial analysis, and strategic decision-making
- [www.FranklinDexter.net](http://www.FranklinDexter.net)
  - Comprehensive bibliography of peer reviewed articles in operating room and anesthesia group management
    - Sign-up for notifications of new articles