



# Fatigue and Engagement: The Impact of Shift Work Schedules

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# Objectives

- Define the role shift work has in creating sleep debt resulting in worker fatigue
- Describe the impact fatigue has on nurse engagement at work
- Identify scheduling practices that diminish the likelihood of fatigue



# Shift Work...

- Work schedules that vary by:
  - Time of day
    - Permanent work shift (day, evening, night)
    - Rotation forward or backward (morning to night, night to morning)
  - Days of week
    - May be driven by fixed patterns
    - May be inconsistent variable distribution pattern of the shifts
    - Often include weekend shifts
  - On-Call Coverage



Chung, Wolf and Shapiro (2009)

# Shift Work in the Healthcare Industry...

- Nurses are often shift workers, irregular hours and around-the-clock.
- Variety of shift-lengths, day-of-week combinations and the rotation of time-of-day shifts (Natvik et al., 2011)
- 75% of nurses today work 12 hour shifts (Townsend & Anderson, 2013)
- Longer shift lengths result in
  - Shorter work weeks
    - Increase opportunities to work overtime hours
    - Increase opportunities to work second jobs



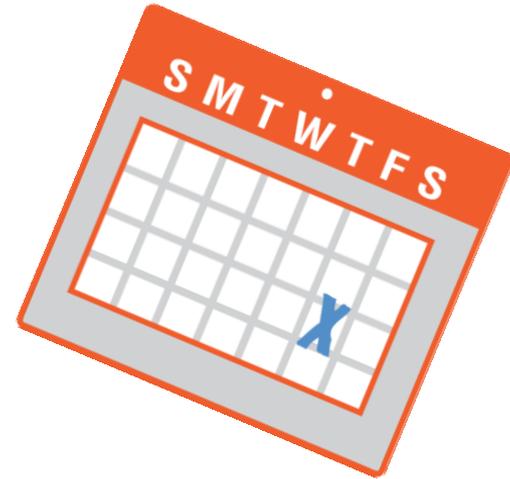
(Marucci-Wellman, Lin, Willetts, Brennan & Verma, 2014)

# Shift Work and Scheduling



# Scheduling approaches...

- Fixed Schedules
  - Patterns
- Variable Schedules
  - Manually created
  - Automated generation (rules-based software) with manual intervention
  - Self-Scheduling



# Common Fixed Schedule Patterns in Healthcare

- Metropolitan and Continental plans for 8 hour shifts

Team	Days 1-6	Hours	Shifts
Team 1		48.0	Day Shift (8 Hrs) 7:00 AM-3:00 PM
Team 2		48.0	Swing Shift (8 Hrs) 3:00 PM-11:00 PM
Team 3		48.0	Night Shift (8 Hrs) 11:00 PM-7:00 AM
Team 4		48.0	
Hours		192.0	192.0

Team	Days 1-7	Days 8-14	Days 15-21	Days 22-28	Hours	Shifts
Team 1					168.0	Day Shift (8 Hrs) 7:00 AM-3:00 PM
Team 2					168.0	Swing Shift (8 Hrs) 3:00 PM-11:00 PM
Team 3					168.0	Night Shift (8 Hrs) 11:00 PM-7:00 AM
Team 4					168.0	
Hours	168.0	168.0	168.0	168.0	672.0	

- Dupont, Pittman and Panama plans for 12 hour shifts

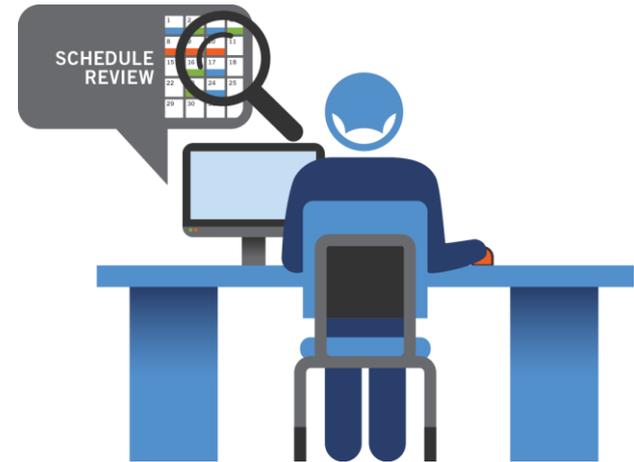
Team	Days 1-7	Days 8-14	Days 15-21	Days 22-28	Hours	Shifts
Team 1					168.0	Day 7:00 AM-7:00 PM
Team 2					168.0	Night 7:00 PM-7:00 AM
Team 3						
Team 4						
Total Hours	168.00	168.00	168.00			

Team	Days 1-14	Hours	Shifts
Team 1		84.00	Day 7:00 AM-7:00 PM
Team 2		84.00	Night 7:00 PM-7:00 AM
Team 3		84.00	
Team 4		84.00	
Total Hours	336.00	336.00	

Team	Days 1-14	Days 15-28	Days 29-42	Days 43-56	Hours	Shifts
Team 1					336.0	Day Shift (12 Hrs) 7:00 AM-7:00 PM
Team 2					336.0	Night Shift (12 Hrs) 7:00 PM-7:00 AM
Team 3					336.0	
Hours		336.0	336.0	336.0	1344.0	

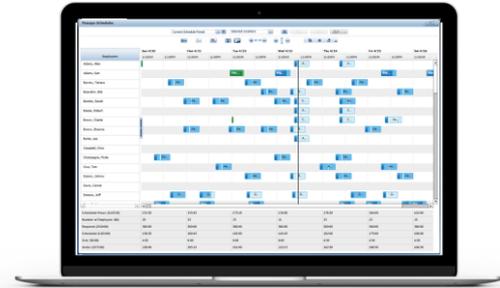
# Variable Scheduling...

- Manually created
- Automated generation with manual intervention
- Self-Scheduling
  - Benefits
    - Empowering nurses
    - Supports work/life balance
    - Decreases administrative burden on managers
    - Enhances communication
    - Creates a cooperative community



# Risks Associated with Variable Scheduling...

- Risks
  - Human error
  - Fairness
  - Poor attention to work/life balance
  - Lack of defined rules to drive automation of a “good” schedule
  - Lack of defined rules & processes to drive self-scheduling



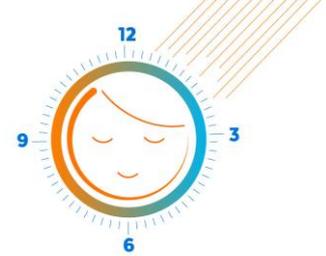
**There is a price to pay when work schedules are poorly constructed!**



# Impact of a poorly constructed work schedule



# The Impact of Shift Work Schedules..



- Root cause of tiredness or fatigue in a qualitative study of nurses

(Happell et al. 2013)

- Disrupts sleep patterns

- most frequently reported health problem among shift workers

(Natvik et al., 2011)

- Creates a conflict with circadian rhythms

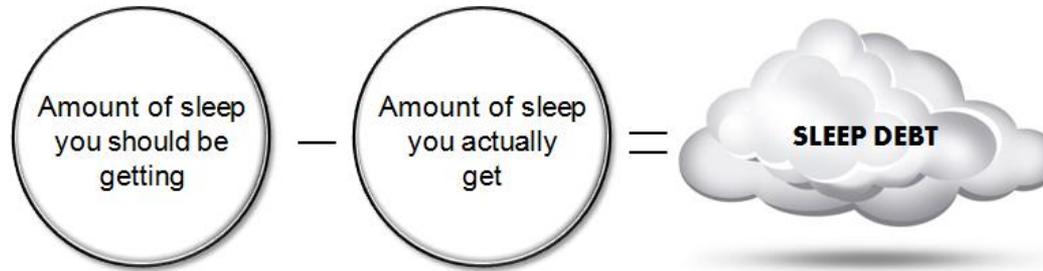
- interferes with the ability to obtain restorative sleep between shifts
- results in accumulating “sleep debt”

(Geiger-Brown et al, 2012)

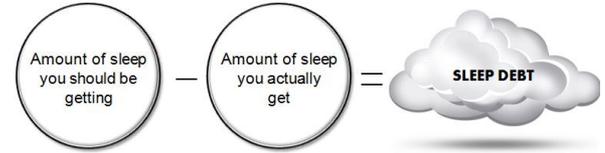


# The Impact of Shift Work Schedules...

- Consecutive shifts, regardless of time of day, incur significant sleep debt  
(Geiger-Brown et al, 2012)
- Inherent inability to maintain consistency can lead to “chronic” sleep debt  
(Witkoski & Dickson, 2010)



# Sleep and Sleep Debt...



- Sleep-debt or lack of sleep adversely impacts performance

(The National Sleep Foundation, 2014)

- Older workers doing shift work are prone to sleep disorders

(Letvak, 2005)

- Every minute of “commute” time equals 0.84 minutes of sleep loss

(Hirsch-Allen et al., 2014)



# “Shift Work Sleep Disorder” (SWSD)

- International Classification of Diseases v10
    - G47.26 Circadian Rhythm Sleep Disorder, Shift Work Type
      - a normal pattern of sleep and wake cycles that conflict with shift work
- (ICD10Data.com, 2014)
- Most at risk:
    - Permanent night shift schedules
    - Any schedule with a night shift rotation
  - Study of over 5,000 nurses found **37.6% fulfilled criteria for a diagnosis of SWSD** (Flo et al., 2012)



**Let's look at some data...**



# Quantify the Probability of Fatigue...

- Tool: “Fatigue Index Score Calculator: Health & Safety Executive”

**Fatigue Index Calculator**  
 Read the manual before using! Go to <http://www.hse.gov.uk/RESEARCH/rrpdf/rr446g.pdf>

Company: Sample Medical-Surgical Unit  
 Location: \_\_\_\_\_  
 Shift ID: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 Assessor: \_\_\_\_\_

Mode:  Fatigue  Defaults  Reset Index

Display schedule  
 Display charts

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Day	On Duty	Off Duty	Job type / breaks	Commuting Time	Duty Length	Rest Length	Average duty per day	Cumulative component	Duty timing component	Job type / Breaks component	Fatigue Index
1	7.00	19.00	Default	Default	12h	Fully Rested	12h	0.1	0.8	2.6	3.4
2	7.00	19.00	Default	Default	12h	12h	12h	1.8	0.8	2.6	5.1
3	19.00	7.00	Default	Default	12h	1d	9h	7.8	17.4	21.5	43.7
4	15.00	11.00	Default	Default	20h	8h	11h 12m	11.8	22.5	28.5	56.8

## Fatigue / Risk Assessment

**Commuting Time**  
 What is the typical commuting time of employees to OR from work (to the nearest 10 minutes):

About  hours  mins  
(Please specify the typical commuting time)

**Breaks**  
 How frequently (to the nearest 15 mins) are rest breaks typically provided OR taken?

Every  hours  mins  
(please specify the typical interval between breaks)

**Type of Job: Workload**  
 The workload and/or work pace of the job is typically:

hours  mins

Reese, 2016

# What did the data reveal?

- Source Data:
  - 379 shifts (12 hour) over a 4 week period
- Probability of Fatigue:
  - Day Shift
    - Highest score was 20.7% on the 4<sup>th</sup> consecutive 12 hour shift
  - Night Shift
    - Lowest score was 42.3% on the 1<sup>st</sup> shift after 2 days off
    - Highest score was 59.8% on the 5<sup>th</sup> consecutive 12 hour shift



# Shift Work Based Fatigue Leads to Burnout!

- Shift work and sleep disturbance are both antecedents to **stress**  
(Fountouki, Ourania, and Theofanidis, 2011)
- In nurses, the fatigue that results from stress is frequently referred to as **burnout** according to the seminal work of Duquette, Kerowc, Sandu and Beaudet (1994).



**Work Schedule Induced Fatigue**



**...and let's not forget the patient!**



# Fatigue's Impact on Care Delivery...



- The most alarming negative impact (of sleep debt, fatigue) is that of decrements in performance and decision regret

(Geiger-Brown & Trinkoff, 2010)
- A study of 546 registered nurses in the U.S. found that 30% reported decision regret.
  - Those reporting decision regret also reported increased amounts of fatigue.

(Scott, Arslanian-Engoren & Engoren, 2014)

# Fatigue's Impact on Care Delivery...



- Work schedules have been associated with patient mortality
  - Pneumonia related deaths were significantly higher when nurses reported:
    - long work hours
    - decreased amounts of time away from work

(Trinkoff et al., 2011)

- Fatigue associated with overtime work was associated with increased re-admission rates

(Bobay, Yakusheva & Weiss, 2011)

# Work Schedules Matter!



# Fatigue & Engagement

# Polar Opposites...



Engagement

- Energy
- Involvement
- Sense of Competence

Fatigue/Burnout

- Exhaustion
- Depersonalization
- Reduced Personal Accomplishment

# Work Schedule Induced Fatigue

- Adversely impacts engagement in three ways:
  - Withdrawal behaviors (Exhaustion)
  - Feeling of being taken for granted, unimportant, needs are of less significance, a sense of being “apart from” (Depersonalization)
  - Decreased self-confidence, questions competence, fear of errors (Reduced Personal Accomplishment)



# Resulting Behaviors...

- Absenteeism
  - Relationship between shift work and absenteeism (Bockermann & Laukkanen, 2010)
  - Physical fatigue was associated with absenteeism (Roelen et al., 2013)
- Turnover
  - Fatigue and exhaustion were among the top reasons for leaving an employer (Mackusick & Minick, 2010).
- Performance Decrements
  - Diminished attention to detail
  - Error prone



# Diminishing Work Schedule Induced Fatigue



# Recommendations...

- Clearly articulated rules!
- Consecutive 12 hour day shifts should not exceed four
- Consecutive 12 hour night shifts should not exceed three
- Create a culture of openness and encourage reporting excessive fatigue
- Night shift nurses should be closely monitored for signs of fatigue
- Commute time matters
- Know if your employees have a second job
- Know if your employees are working overtime in other departments/units

# Learn Today, Improve Tomorrow

- Shift work schedule creation is where quality caregiving begins.
- Recognize the three behaviors associated with disengagement
  - Exhaustion exhibited by withdrawal
  - Depersonalization exhibited by a “sense of being apart”
  - Reduction in feeling of personal accomplishment
- Re-evaluate your schedule creation approach and practices
  - Ensure there are clear guidelines for shift lengths
  - Ensure there are clear guidelines for number of consecutive shifts
  - Nurses on permanent night shift and those rotating to nights should be carefully monitored for fatigue



Questions?



## References

Bobay, K.L., Yakusheva, O., & Weiss, M. E. (2011). Outcomes and cost analysis of the impact of unit-level nurse staffing on post-discharge utilization. *Nursing Economic*, 29(2), 69-78, 87.

Brockermann, P. & Laukkanen, E. (2010). What makes you work while you are sick? *European Journal of Public Health*, 20, 43-46.

Chung, S. A., Wolf, T. K., & Shapiro, C. M. (2009). Sleep and health consequences of shift work in women. *Journal of Women's Health*, 18(7), 965-977.

Flo, E., Pallesen, E., Magerøy, N., Moen, B. E., Grønli1, J., Nordhus, I. H. & Bjorvatn1, B. (2012). Shift work disorder in nurses – assessment, prevalence and related health problems. *Plos One*, 7(4), Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3317447/pdf/pone.0033981.pdf>

Fountouki, A., Ourania, P., & Theofanidis, D. (2011). Nursing staff under heavy stress: Focus on Greece a critical review. *International Journal of Caring Sciences*, 4(1). Retrieved from [http://www.internationaljournalofcaringsciences.org/docs/Vol4\\_Issue1\\_03\\_Fountouki.pdf](http://www.internationaljournalofcaringsciences.org/docs/Vol4_Issue1_03_Fountouki.pdf)

Geiger-Brown, J., Rogers, V. E., Trinkoff, A. M., Kane, R. L., Bausell, R. B., & Scharf, S. M. (2012). Sleep, sleepiness, fatigue and performance of 12 hour shift nurses. *Chronobiology International*, 29(2), 211-219.

Geiger-Brown, J., & Trinkoff, A. M. (2010). Is it time to pull the plug on 12-hour shifts? Part 3: Harm reduction strategies if keeping 12-hour shifts. *Journal of Nursing Administration*, 40(9), 357-359.



Happell, B., Dwyer, T., Reid-Searl, K., Burke, K. J., Caperchione, C. M., & Gaskin, C. J. (2013). Nurses and stress: Recognizing causes and seeking solutions. *Journal of Nursing Management*, 21, 638-647.

Health and Safety Executive. (n.d.). RR446 - The development of a fatigue / risk index for shiftworkers. Retrieved from <http://www.hse.gov.uk/research/rrhtm/rr446.htm>

Hirsch Allen, A. J., Park, J. E., Adhami, N., Sirounis, D., Tholin, H., Dodek, P., Rogers, A. E., & Ayas, N. (2014). Impact of work schedules on sleep duration of critical care nurses. *American Journal of Critical Care*, 23(4), 290-295.

ICD10Data.com. (2014). Sleep disorders. Retrieved from <http://www.icd10data.com/ICD10CM/Codes/G00-G99/G40-G47/G47->

Letvak, S. (2005). Health and safety of older nurses. *Nursing Outlook*, 53(2), 66-72.

Mackusick, C. I., & Minick, P. (2010). Why are nurses leaving? Findings from an initial qualitative study on nurse attrition. *MEDSURG Nursing*, 19(6), 335-340.

Marucci-Wellman, H., Lin, T., Willetts, J., Brennan, M. & Verma, S. (2014). Differences in time use and activity patterns when adding a second job: Implications for health and safety in the United States. *American Journal of Public Health*, 104(8), 1488-1500.

Natvik, S., Bjorvatn, B., Moen, B. E., Mageroy, N., Sivertsen, B. & Pallesen, S. (2011). Personality factors related to shift work tolerance in two- and three-shift workers. *Applied Ergonomics*, 42, 719-724.



Roelen, C., van Rhenen, W., Groothoff, J. W., van der Klink, J. J., Bultmann, U. & Heymans, M. W. (2013). The development and validation of two prediction models to identify employees at risk of high sickness absence. *European Journal of Public Health*, 23(1), 128-133.

Scott, L., D., Arslanian-Engoren, C., & Engoren, M. (2014). Association of sleep and fatigue with decision regret among critical care nurses. *American Journal of Critical Care*, 23(1), 13-23. doi: 10.4037/ajcc2014191

Townsend, T., & Anderson, P. (2013). Are extended work hours worth the risk? *American Nurse Today*, 8(5). Retrieved from <http://www.americannursetoday.com/article.aspx?id=10272&fid=10226>

Trinkoff, A., Johantgen, M., Storr, C., Gurses, A., Liang, Y., & Han, K. (2011). Nurses' work schedule characteristics, nurse staffing and patient mortality. *Nursing Research*, 60(1), 1-8.

Witkoski, A. & Dickson, V. (2010). Hospital staff nurses work hours, meal periods and rest breaks. *AAOHN*, 58(11), 489-497.

