RUTGERS Robert Wood Johnson Medical School

Optimized Hospital Radiologist Staffing in a Multisite Radiology Enterprise: A Data Driven Rational Approach to Efficiently Delivering Real Time Subspecialized Radiology

Lily Zou, MD
Murray Becker, MD PhD
Alberto Goldszal, PhD
Lisa Martinez, BA

24x7 Subspecialized Radiology
Balancing Quality with Efficiency

Quality:

24x7 Final Reports

Subspecialized Radiology

Efficiency:

Optimal Radiologist Staff

Matching Radiology Staff to Workload 24x7

▶ <u>Staff Too Small For Workload → Quality Suffers</u>

  ▶ Turn Around Time Increases

  ▶ Cannot Provide Subspecialized Interpretation

▶ <u>Staff Too Large for Workload→ Resources are Wasted</u>

  ▶ Does anyone really have this problem?

Three Study Goals:

▶ <u>#1: Assess the Workload 24 x 7</u>:

  ▶ How Many Studies are Being Performed?

  ▶ When are they Being Performed?

  ▶ What is the distribution of Studies by Modality?

▶ <u>#2: Assess Typical Radiologist Capacity</u>

  ▶ Studies/Shift by Specialty

▶ <u>#3: Devise Strategies to Optimize the Enterprise:</u>

  ▶ Match Radiologist Staff to Workload

Data Collection: The Enterprise

▶ 24x7 Hospital Inpatient Setting

▶ 5 Hospitals

  ▶ 1 Academic, Level 1 Trauma Center

  ▶ 4 Community hospitals

▶ Sub-Specialized Radiology:

  ▶ General Diagnostic; Body; IR; MSK; Neuro; Neuro-IR; Nuclear; Pediatrics; Women's Imaging

---

Studies from multiple hospitals are transmitted to a data center. The radiologist can read all sites off a single worklist
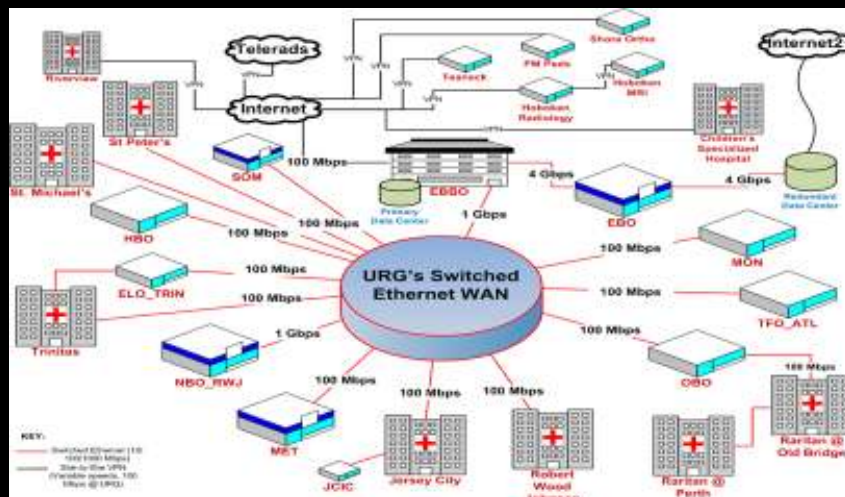
HL7 Order Data

- ▶ 285,981 Consecutive Studies Across the 5 Hospitals
- ▶ 180 Consecutive Days -7/1/11- 12/31/11

- ▶ Orders were Analyzed by
  - ▶ Stat Status
  - ▶ Study Completion Time
  - ▶ Study Site
  - ▶ Study Type
  - ▶ Study RVU

Study Type: Studies Were Assigned to a Subspecialty

- ▶ General Diagnostic: Radiography, Fluoroscopy
- ▶ Body Imaging: CT, MR, US
- ▶ Neuroradiology: CT and MR

- ▶ To make things simple/practical we excluded:
  - ▶ Breast Imaging; IR; Neuro-IR; Nuclear Medicine
  - ▶ Not Divided into Adult versus Pediatrics
  - ▶ MSK included in Body Imaging

Study Time: Studies were categorized by when they were performed.

▶ 3 Shifts

  ▶ First shift: 8 am-4 pm

  ▶ Second shift: 4 pm-12 am

 ▶ Third shift: 12 am-8 am

Sample Raw Data: Hospital #1

Average RVU per Shift by Radiologist Skillset All Studies			
	General Diagnostic	Body Imaging	Neuroradiology
1st shift	23.99	45.43	59.3
2nd shift	18.83	39.10	55.7
3rd shift	16.11	17.39	27.7

Sample Shift Distribution: Hospital #1
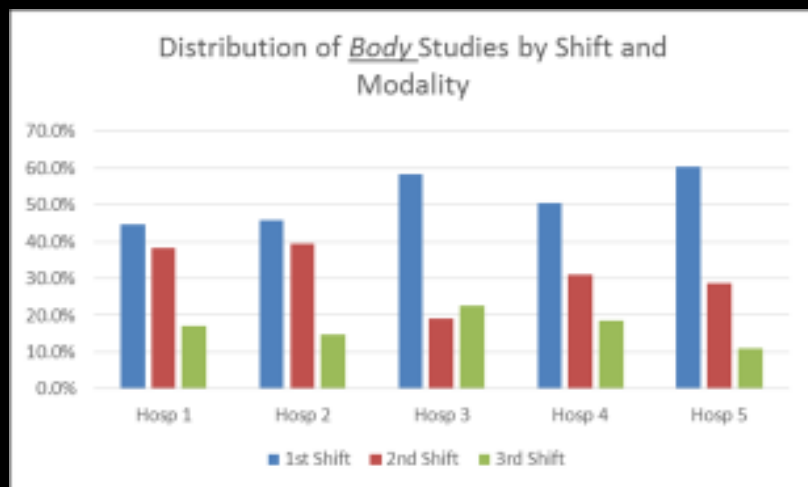
Distribution of Studies by Shift

	General Diagnostic	Body Imaging	Neuroradiology
1st shift	41%	46%	42%
2nd shift	32%	38%	39%
3rd shift	27%	16%	19%

Results: Distribution of *Dx* Studies by Shift

Distribution of *Dx* Studies by Shift and Modality
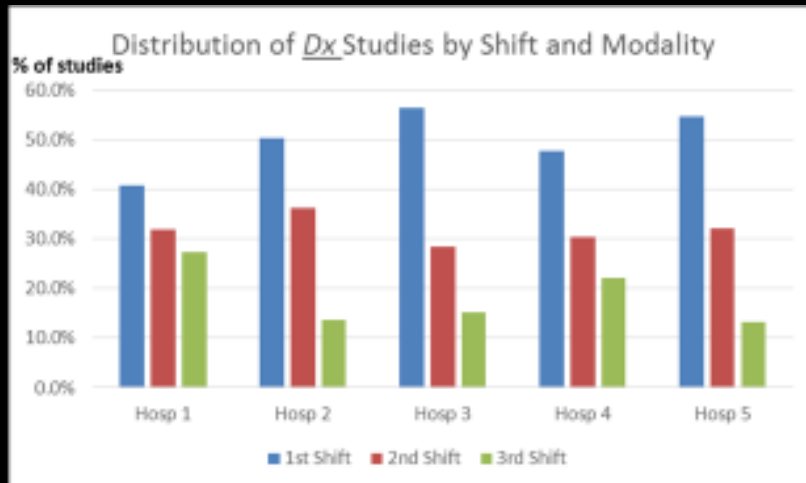
	1st Shift	2nd Shift	3rd Shift
Hosp 1	40.7%	31.9%	27.3%
Hosp 2	50.2%	36.2%	13.6%
Hosp 3	56.3%	28.4%	15.2%
Hosp 4	47.6%	30.4%	22.0%
Hosp 5	54.7%	32.0%	13.3%

Results: Distribution of _Body_ Studies by Shift

Distribution of _Body_ Studies by Shift and Modality

	1st Shift	2nd Shift	3rd Shift
Hosp 1	44.6%	38.4%	17.1%
Hosp 2	45.8%	39.4%	14.8%
Hosp 3	58.4%	19.0%	22.6%
Hosp 4	50.4%	31.1%	18.4%
Hosp 5	60.4%	28.6%	11.0%

Results: Distribution of _Neuro_ Studies by Shift

Distribution of _Neuro_ Studies by Shift and Modality
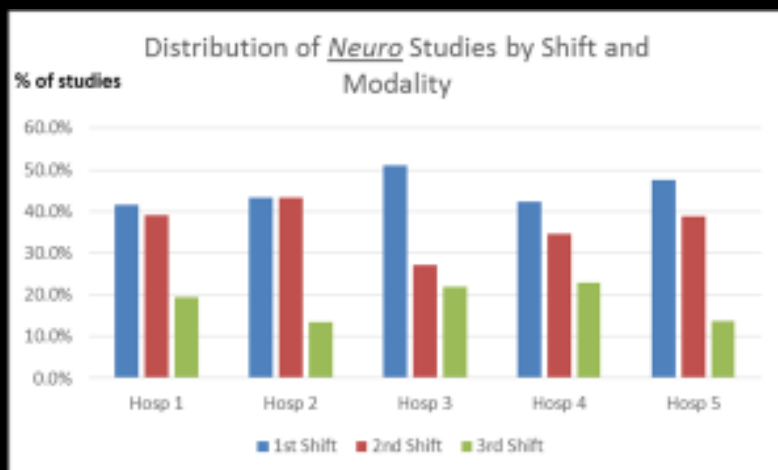
	1st Shift	2nd Shift	3rd Shift
Hosp 1	41.5%	39.0%	19.4%
Hosp 2	43.4%	43.2%	13.5%
Hosp 3	51.1%	27.0%	21.9%
Hosp 4	42.4%	34.7%	22.9%
Hosp 5	47.6%	38.7%	13.8%

Results: Stat Body Studies by Shift

% of studies Distribution of Stat Body studies by shift and site
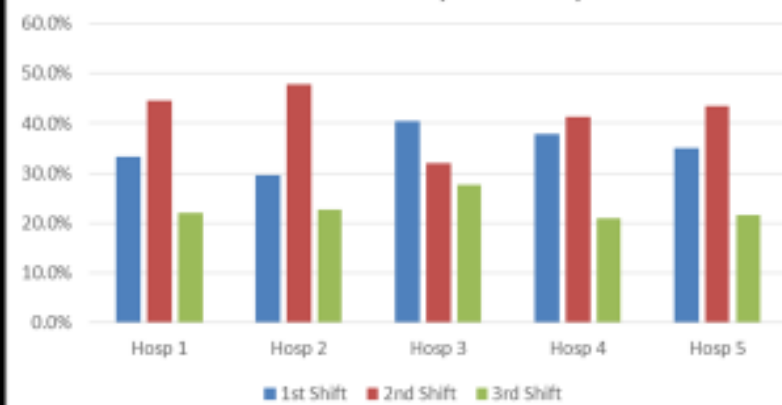
	1st Shift	2nd Shift	3rd Shift
Hosp 1	33.3%	44.6%	22.0%
Hosp 2	29.5%	47.8%	22.6%
Hosp 3	40.4%	31.9%	27.7%
Hosp 4	37.8%	41.3%	21.0%
Hosp 5	34.9%	43.6%	21.5%

- 2nd shift is busiest for stat cases!

- Same pattern for stat Diagnostic and Neuro

Study goal #1: Assessing workload

▶ Study Distribution is Similar through the 5 Hospital Sites

▶ Study Distribution is Similar through the 3 Skillsets

▶ All Studies: 1st shift is busiest

▶ All Studies: 2nd + 3rd shift about equal to 1st shift

▶ Stat Studies: 2nd shift is busiest

▶ Stat Studies: 2nd+3rd shift > 1st shift

Study Goal #2: Asssess Radiologist Capacity

Expected Radiologist Daily Production:

DX = 25 RVU/day
Body = 40 RVU/day
Neuro = 60 RVU/day

RVU per shift
Expected Radiologist Daily Production = # FTEs needed to cover each modality by shift

## How many FTEs does each hospital need per shift by modality?

Less than 1 = not enough volume to support a full time subspecialized radiologist

	DX	BODY	NEURO
Hosp 1: 1st Shift	0.96	1.14	0.99
Hosp 1: 2nd Shift	0.75	0.98	0.93
Hosp 1: 3rd Shift	0.64	0.43	0.46
Hosp 2: 1st Shift	0.53	0.73	0.36
Hosp 2: 2nd Shift	0.38	0.63	0.36
Hosp 2: 3rd Shift	0.14	0.24	0.11
Hosp 3: 1st Shift	0.66	0.95	0.52
Hosp 3: 2nd Shift	0.33	0.31	0.27
Hosp 3: 3rd Shift	0.18	0.37	0.22
Hosp 4: 1st Shift	0.62	0.93	0.56
Hosp 4: 2nd Shift	0.40	0.58	0.46
Hosp 4: 3rd Shift	0.29	0.34	0.30
Hosp 5: 1st Shift	0.81	0.92	0.37
Hosp 5: 2nd Shift	0.48	0.44	0.30
Hosp 5: 3rd Shift	0.20	0.17	0.11
Total: 1st Shift	3.58	4.68	2.79
Total: 2nd Shift	2.34	2.93	2.32
Total: 3rd Shift	1.45	1.55	1.20

Same Pattern All 5 Hospitals
Not Enough Studies to Subspecialize 24x7
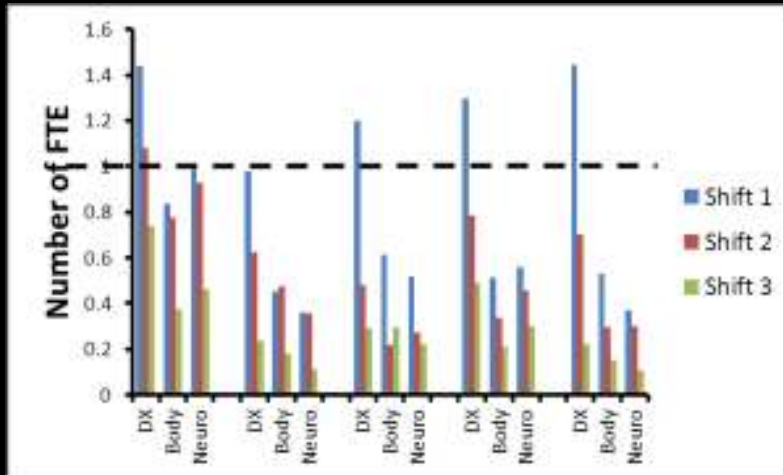
By Aggregating Studies at Multiple
Hospitals We Can Subspecialize 24x7!
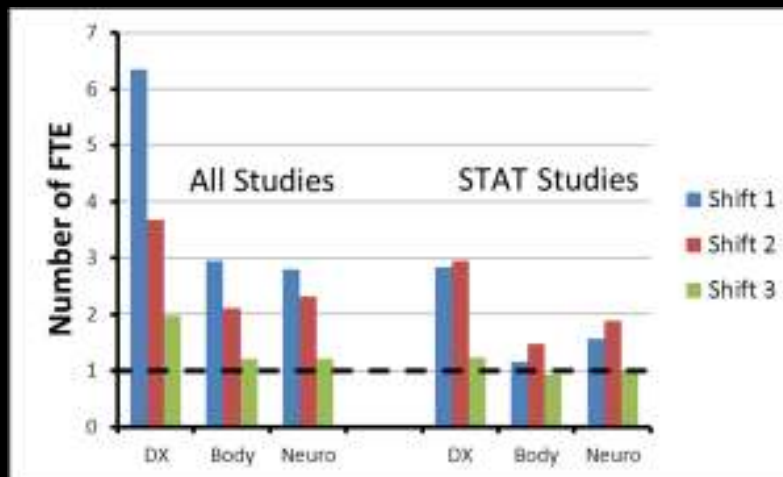
Study goal #2: Radiologist Utilization

- ▶ In this study, Individual Hospitals:
  - ▶ Do not have sufficient volume to support subspecialization 24x7.
  - ▶ This even applies to the academic hospital
- ▶ By aggregating the cases from multiple hospitals:
  - ▶ Volume is sufficient to support subspecialization 24x7

Study goal #3: Match Staffing to Workload Day-to-Day Variation in Volume

Example 2nd Shift Neuro:

Hosp 1:	55.70 +/-	14.12 RVU
Hosp 2:	21.41 +/-	7.73 RVU
Hosp 3:	16.37 +/-	6.37 RVU
Hosp 4:	27.42 +/-	9.60 RVU
Hosp 5:	18.08 +/-	6.21 RVU
Total:	138.97 +/-	25.05 RVU

How Do We Measure Variation?
Coefficient of Variation = SD/Mean

Example 2nd Shift Neuro:

Hosp 1:	55.70	+/-	14.12 RVU	CV = 25%
Hosp 2:	21.41	+/-	7.73 RVU	CV = 36%
Hosp 3:	16.37	+/-	6.37 RVU	CV = 39%
Hosp 4:	27.42	+/-	9.60 RVU	CV = 35%
Hosp 5:	18.08	+/-	6.21 RVU	CV = 34%
Total:	138.97	+/-	25.05 RVU	CV = 18%

Aggregating Studies "Smoothes" Out the Day-to-Day Variation
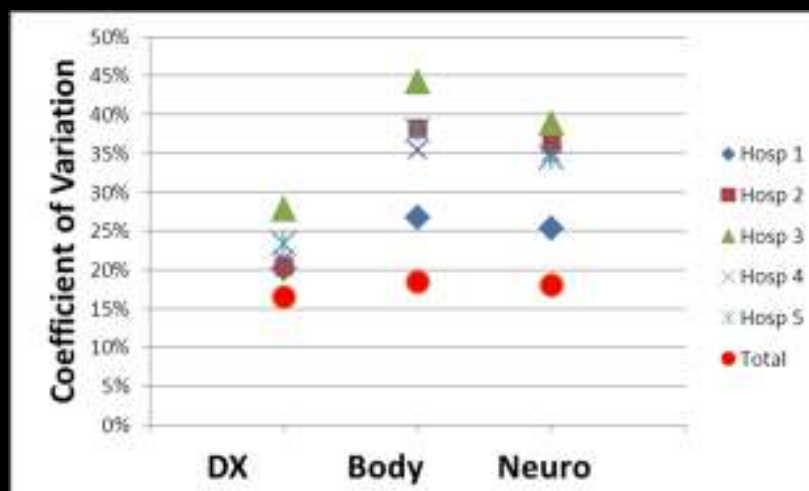
Implications for Radiologist Staffing #1

If you want to read the studies in real time:

At least half your radiologists need to work 2nd/3rd shift

Implications for Radiologist Staffing #2

Single Hospitals (Even Relatively Large):

May Not Have Adequate Volumes to Subspecialize 24x7…

But By Aggregating Studies From Multiple Hospitals 24x7 Subspecialization is Possible

Implications for Radiologist Staffing #3

Study Volume Varies Day-to-Day:

> Variation Adds an Element of Unpredictability
>
> Aggregation of Sites Decreases Overall Variability

Thank You

Questions?