YALE UNIVERSITY
SCHOOL OF MEDICINE
Quality Assurance and Improvement

Jamal Bokhari, M.D.
Professor of Radiology and Surgery
Program Director Radiology Residency
Section Chief Emergency Radiology
Yale University School of Medicine
New Haven, Connecticut
QA/QI—Goals and Objectives

- To recognize the distinction between QA and QI
- To understand the complexity of the processes
- To recognize that solutions while implemented at the grass roots have to involve leadership at all levels
- And most importantly to leave you with more questions and challenges than we began with.
Quality Assurance and Improvement

QA/QI

Error Prevention and Safety

Quality Improvement (Bettering Best Practices)
Quality Assurance and Improvement - Errors

Types of Errors

- Error Recognition
- Error Reporting
- Error Analysis
Quality Assurance and Improvement

Error Prevention and Safety

Error Analysis

System assessment

System Redesign

Implementation and Assessment
ERRORS

• PRINCIPLES
  • Murphy’s law
  • All errors are preventable given enough resources
  • Murphy’s Law trumps all resources
ERRORS

- PRINCIPLES Contd...
  - To err is human, to really foul up things requires computers and especially software upgrades
ERRORS

- PRINCIPLES Contd…
  - Most errors do not lead to ‘bad’ outcomes i.e. most errors are ‘minor’ (and thus easily hidden/ignored)
  - Most major errors are due to series of minor errors
PRINCIPLES Contd…

- Errors should be dealt with for their potential outcomes not true outcomes
- The culture should be to recognize, report and fix errors not to brush them under the rug
- And most importantly, coming up with system solutions to prevent future occurrences
ERRORS

PRINCIPLES Contd…

- All errors are learning opportunities
- Learning from others mistakes leads to knowledge
- Learning from ones mistakes leads to experience
- Learning from ones experience leads to wisdom

- Error reduction and prevention– QA/QI is a continuous process
TYPES OF ERRORS

- Ordering
- Protocolling
- Technical
- Reading
- Communication
- Specific/Unforeseen
- Combination/Chain Reaction
- Unique??
TYPES OF ERRORS

- Ordering
  - Too much, too many
  - Too little, too few
  - Wrong contrast
  - Wrong study
  - Wrong patient
  - Wrong history
TYPES OF ERRORS

- Protocolling (Screening for appropriateness)
  - Wrong type of study
    - Wrong or insufficient history
    - Non committal attitude
      - Seen as unnecessary or 'busy' work
  - Seen as unrewarding work
    - Negative financial impact
  - Insufficient experience
TYPES OF ERRORS

- Technical
  - Mechanical Failure
  - System Failure
    - Bilateral studies in same acc. # / folder
- Human
  - Identification
    - Wrong patient
    - Wrong body part
  - Use of wrong Hardware/software
  - Misuse of appropriate hardware/software
  - Poor technique
  - Poor positioning
TYPES OF ERRORS

- Reading
  - Failure of identification
    - Wrong patient
    - Wrong date
  - Failure of perception
    - Positive findings not seen
      - Target fixation
      - Satisfaction of search
    - Absence of findings/ structures not seen
  - Failure of comprehension
    - Undercalling
    - Overcalling
TYPES OF ERRORS

- Communication
  - Lack of verbal communication
    - Timely release of report
    - Finalized report of abnormal especially critical findings is not enough
      Lack of documentation of communication is = Lack of communication
  - Wrong caregiver
  - Ambiguous reports
TYPES OF ERRORS

- Communication – written report.
  - Ambiguous reports
    - Ambiguous language to denote lack of surety
    - Typos can be dangerous especially with voice recognition technology
      - No spelling mistakes only contextual ones
      - Macros
  - Main body of report vs Impressions
    - Alternative styles, Structured reports, Radiology lexicon
  - Disconnect between Radiology and other services regarding implication of terms eg ‘rule out’.
TYPES OF ERRORS

- Combination/Chain reaction
- Specific/ Unforeseen
- Unique ??
  - No such thing. Will repeat itself unless fixed.
ERROR ANALYSIS

- Recognizable ie cause of bad outcome
- Categorizable ie type of error
- Quantifiable ie severity of error
- Fixable ie what have we learned from it to do differently
Quality Assurance and Improvement - Errors

Error Prevention and Safety Suffers

- Volume
- Time pressure
- Busy
- Under resourced
“Busy Work”
Decreasing non interpretive activities

Ordering of studies and protocolling

- “Busy work” IE time spent:
  - Searching for ordering clinicians
  - Answering phone calls
  - Placating clinicians who feel challenged

- No vestment: Unpaid work “takes much less to read and get paid than discuss and not get paid”
“Busy Work”
Decreasing non interpretive activities

Ordering studies and protocolling

- First interaction with clinicians - promotes role as a consultant and combats commoditization
- Opportunity for information harvesting
- Opportunity to understand the thought process behind the order
- Opportunity for teaching and learning
- First link in the chain for a chain reaction
Ordering and Protocoling

- Do nothing IE perform studies as ordered
- Let techs do the screening and protocolling – transfer the busy work
- Radiologists (trainees and attendings) screen and protocol
- Dedicated trained staff eg RAs Screen and protocol
- Radiology order entry decision support
- Combination of order entry decision support and screening and protocolling
Errors in CT Ordering

- How big is the problem
  - Total errors average = 90/month-night shift only
  - Extrapolated to all 3 shifts/year = ~2880 errors/year
Initiative: CT Ordering and Protocoling

- Pilot conducted to gather necessary patient information for exams to be protocolled w/o phone calls
- Process created to handle cases that require additional information
- Communication to both ED & Radiology physicians regarding new process
  - Must enter exam order correctly
  - Review recent imaging
  - Provide complete & accurate history
  - Check pregnancy status & creatinine
  - Ensure accurate attending MD contact info
- Passive order entry support available to clinicians (Links to ACR guidelines)
Errors in Ordering and Protocolling
Order entry decision support

PMID: 23999241 [PubMed - as supplied by publisher]
Related citations

2. Gupta A, Raja AS, Khorasani R. 
PMID: 2386922 [PubMed - as supplied by publisher]
Related citations

3. Ip IK, Schneider L, Seltzer S, Smith A, Dudley J, Menard A, Khorasani R. 
PMID: 23786568 [PubMed - indexed for MEDLINE]
Related citations

4. Durand DJ, Feldman LS, Lewin JS, Brotman DJ. 
PMID: 23273974 [PubMed - indexed for MEDLINE]
Related citations

5. Zafar HM, Mills AM, Khorasani R, Langlotz CP. 
PMID: 23208649 [PubMed - indexed for MEDLINE]
Related citations

6. Duszak R Jr, Berlin JW. 
Related citations
Errors in CT Ordering

CT Ordering Errors

2012-2013
Errors in CT Ordering and Protocoling

CT Ordering errors

- Soft errors
- Wrong exam
- Radiation
- Cancelled (misordered)
- Double order
Error rates in ordering are very significant, 20-25 % of all ordered CT scans
Conclusions QA - Errors

- Be aware of your role as a consultant
- Beware of commoditization (Radiology report is not a laboratory value)
- Combating commoditization begins at home
- Seek long term not short term solutions
Commoditization of Radiology

April 2011, Volume 196, Number 4

Health Care Policy and Quality Opinion

Masters of Radiology Panel Discussion: The Commoditization of Radiology
Howard P. Forman1, David B. Larson2, Alan D. Kayes, Ella A. Kazerooni4, Alexander Norbash, John K. Crowe, Marcia C. Javit1 and Norman J. Beauchamp, Jr.8

Share
Commoditization of Radiology
Commoditization of Radiology
Commoditization of Radiology

The stranger reading your X-ray may be 8,000 miles away

That scan of your brain, bones or breasts you got last Tuesday? It might have been read by someone who isn’t a doctor and lives 12 time zones away. If, that is, anyone has bothered to read it at all.  

By Katherine Eban

Jennifer Drumm had the worst headache of her life. The pain was so severe that as she arrived at the Charles Cole Memorial Hospital in Coudersport, Pennsylvania, an emergency room doctor suspected she had a cerebral hemorrhage, which could quickly turn deadly. He ordered a CT (computed tomography) scan of Drumm’s brain.

“We count on scans to find cancer and more.”

“In the old days, the radiology suite was right next to the ER, so the radiologist would walk past the patient on his way to read the scan,” says Lauren Ellerman, a personal-injury attorney in Roanoke, Virginia, who has handled radiology cases. Today, that image of doctors conferring in front of a backlit X-ray is as outdated as Marcus Welby.
Conclusions QA

- Beware of commoditization (Radiology report is not a laboratory value)
- Combating commoditization begins at home
- Seek long term not short term solutions
- Increase Communication
- Resource appropriately
Resources

- Dedicated Triage Assistants
  - Med student moonlighting: 5 - 11pm
  - RA: 10pm – 7.30 am

- Increased resident education: Triaging/protocolling introductory lectures

- Dedicated Hotline

- Order Entry Support
  - Passive order entry support
  - Active/interactive decision support

- Weekly feedback of all errors to the ER
Beware of commoditization (Radiology report is not a laboratory value)

Combating commoditization begins at home

Seek long term not short term solutions

Increase Communication

Resource appropriately

Teamwork with ER clinicians is Key
Quality Assurance and Improvement

QA/QI

Error Prevention and Safety

Quality Improvement (Bettering Best Practices)
Quality Improvement

- Quality improvement (Bettering Best Practices)
  - Review Processes
    - Efficiency
      - TAT
    - Education
  - Research
    - New paradigms
    - Verification of current methods
Quality Improvement

Efficiency

TAT (Turn around Times)

Benchmarks –goals

O-C-R

Resources
## TAT - Benchmarks

### VHA Benchmarks - 2006

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<thead>
<tr>
<th>Measure</th>
<th>Median performance</th>
<th>Top performers</th>
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## Benchmarks

### UHC Metrics

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<th>Best quartile mean</th>
<th>Group mean</th>
<th>YNHH</th>
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### Benchmarks

**UHC – Best performers**

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#241 = Clarian, Indianapolis, IN  
#84 = Harborview Medical Center, Seattle, WA
## Benchmarks

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How metrics calculated at UHC:

CXR – Average and median time from order communicated to results received; Specifically the worksheet notes the results could be communicated via various modalities (phone/fax/EMR posting)
Quality Improvement
Efficiency

TAT (Turn around Times)

O - C - R
## Prioritization of Initiatives

<table>
<thead>
<tr>
<th>Rank</th>
<th>Initiative</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Overall process flow improvement / Process Maps</td>
<td>Visual presentation of entire value stream allows “opportunities” to become apparent</td>
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<tr>
<td>2</td>
<td>CT protocoling</td>
<td>Perceived as a significant issue and requiring intense scrutiny</td>
</tr>
<tr>
<td>3</td>
<td>Information Technology</td>
<td>Allowing seamless transfer of information should help streamline processes</td>
</tr>
<tr>
<td>4</td>
<td>Staffing to demand (providers and techs)</td>
<td>Matching resources to workload ensures maximum efficiency</td>
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</table>
Dr orders CT in SCM

Exam prints out at CA desk

Exam scheduled automatically in Imagecast

Radiologist protocols exam

Is this an Oral CT exam?

Y

Is this an Oral CT exam?

N

CT Tech enters pt. into Transport system

CT tech dispatches

Exam scheduled automatically in Imagecast

Imagecast

Regional nursing units

Is the patient ready?

Y

Undressed, jewelry off, ID band, etc.

Transporter enters delay code and waits

Nurse tells transporter to wait

“Short”

How long is the delay?

“How long is the delay?”

“Long”

Transporter reschedules job for a certain # min.

Transporter informs Rad. Tech or scheduler

“Very Long, or told to cancel”

Transporter cancels job

Transporter informs Rad. Tech or scheduler

Rad prelim/final report in Imagecast/Synapse

Rad dictates exam P.S.

Image in Synapse ready for review

Exam completed by tech

Pt. entered into Transport system for return

Exam done by tech

Transport Patient to DR

RN

MD

Transport

Radiology

Key

ED DR UPDATED CT PROCESS MAP
DR orders in SCM

Exam prints out at CA desk
Exam scheduled automatically in Imagecast
Exam is reviewed by Sonographer in Tech. worklist
Sonographers enters pt. into Transport system
Transport dispatches

Is patient Ready?

Transporter enters delay code and waits
N

Contact ED nurses to correct

How long is delay?

"Short"
Nurse tells Transporter to wait

"Long"
Transporter reschedules Job for a certain # min.
Transporter informs Rad. Tech or scheduler

"Very Long, or told to cancel"
Transporter cancels job

Sonographer calls Radiologist to Review
Does the Rad. need to scan pt.

Y
Sonographer holds patient until Rad is ready to scan

N
Radiologist scans patient.

Sonographer sends images to Synapse
Exam done by Sonographer
Exam is reviewed by Sonographer in Tech. worklist

Sonographer calls Radiologist to Review

Yes
Radiologist dictates exam P.S.
Rad prelim/ Final rpt in Imagecast/ Synapse

No
Image in Synapse ready for review
Exam completed by Sonographer

Pt. entered into Transport system for return

Rad prelim/ Final rpt in Imagecast/ Synapse

Sonographer enters pt. into Transport system
Transporter informs Rad. Tech or scheduler

Transporter informs Rad. Tech or scheduler
RN
MD
RN
Transport
Radiology
MD
Key
**UPDATED ED DR PROCESS MAP (ED PHASE)**

Patient Arrives by Ambulance

- Patient goes directly to bed
  - RN gathers Medical History
  - Orders protocolled lab and DR Exams

Patient waits in waiting Room

- PFAS registers patient at bedside
  - gathers Demographics
  - Band Patient
  - Adds Attending MD to SDK

Is patient critical? [Y/N]

- Y: Patient prepped before evaluation
- N: Patient waits in waiting Room

Pat. evaluates by provider/nurse

MD decides DR exam needed

- MD orders other tests
  - creatinine
  - Pregnancy
  - other

Results of creatinine and pregnancy tests available

DR Exam Order placed

- With complete information as needed by Radiology

Ensure right exam is ordered the first time

No need to consult with DR if required information provided

Standardize sequence of steps

PFAS registers patient

- gathers Demographics
- Band Patient
- Adds Attending MD to SDK

Patient evaluated by RN

Pat. evaluated by provider/nurse

MD decides DR exam needed

Solution

Opportunity

Key

- RN
- MD
- PFAS

Note: difficult to report critical results for patients in waiting room since there is no attending

Occasionally, US is ordered by MD after talking to RN

Cannot prep patient in public
Quality Improvement

Efficiency

TAT (Turn around Times)

O - C – R

Once the study is done the reading process is simple and smooth!!
What type of ED exam

- MSK
- Pedi WP2
- GI SP2
- US NP2
- Neuro WP2
- Pre-OP Bone CT
- OR CT
- Barium IVP, GU
- Non Trauma CT, CTA
- CR, Trauma CT-CTA, Petrous Bone
- Body
- MRI
- Nuc Med
- Nuc Med
- US

One Resident 2 @ 4pm
- Reads Exam; Places in correct mode for attending
- Reviews cases with attending
- Approves report in IDX as Preliminary

One Attending
- Reads Exam; Finalizes or places in correct mode to return to later
- Reviews Exam in correct mode with resident. Finalizes report in IDX

Depending on Attending, the Resident places exam in approve or correction mode
**What type of Exam?**

- Adult/Pedi
- MR-Neuro/Body-OnCall
- NM-On Call
- Neuro Non Trauma
- CTA/Petrous Bone-Next day
- MSK-Pre OP-Next Day

**Read by service-On Call or Next Day**

- Dr. Bokhari
  - Reads CR/CT/US exams, places them in correct mode
  - Reads multiple exams
  - Reviews multiple exams and tells resident what he finds
  - Make corrections and additions, Approves report
  - Report is available as Prelim in IDX

- 2nd YR & up Resident
  - Reads Multiple exams, places them in correct mode
  - Reviews other procedures ordered from same patient
  - Finalizes Report. Available as “F” in IDX

**ED Attending**
- ER-Pedi & Adult CR/CT except US-Pedi/Adult
- Pedi Fluoro – Depending on Attending
- Shoreline cases after 11pm on weekdays
- VA Exams – CXR-ER-CT on Request

**Staffing 9:30pm-8AM**
- 1-2rd/3rd resident
- 1-RA
- 1-3rd/4th yr resident til 2AM
- 1-Attending

*All other Rads follow the 8am-5pm reading process*
Emergency radiology is not viewed as a subspecialty within Departments or at best viewed as a subspecialty of convenience - after hours.
# ABR Core Exam Matrix

<table>
<thead>
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<th></th>
<th>Breast</th>
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<th>MSK</th>
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<th>Peds</th>
<th>Thorax</th>
<th>Repro / Endo</th>
<th>Urinary</th>
<th>Vascular</th>
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Reading Complexity Analysis

- Emergency radiology is not viewed as a subspecialty within Departments or at best viewed as a subspecialty of convenience - after hours
- No ABR recognition
- Under resourced and over monitored/regulated with the most stringent TAT requirements
  - Leading to stressful work environment with perpetual list anxiety, forcing ER Radiologist to parse out work
# Diagnostic Radiology ED Daily Operating Report

**23-Sep-12**

<table>
<thead>
<tr>
<th>Target</th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
<th>WTD Actual</th>
<th>MTD Actual</th>
<th>YTD Actual</th>
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## VOLUME (Total)

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<th>Mon 09/17/12</th>
<th>Tues 09/18/12</th>
<th>Wed 09/19/12</th>
<th>Thurs 09/20/12</th>
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## TURN AROUND TIME

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## EFFICIENCY

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## % ATTAINMENT

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TAT Surprises

Internal Conflict

◆ All multimodality studies excluded on behest of the Tech Managers
  ◆ This improved the O-C but negatively impacted C-R as traumas are the most expeditiously read.

◆ Studies completed before images processed and available, to make them available for evaluation on PACS.
  ◆ Again improving B-C but negatively impacting C-R
Verbal communication is often limited to the most important and urgent and thus fastest reads. While recorded in reports (and other systems such as Veriphy) these are still not databasable or easily discoverable and thus not counted.
Quality Improvement
Efficiency

ED imaging reporting

Median 2013 ED Turnaround Time (C-R) All Shifts
(Minutes):

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Target (mins)</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>June</th>
<th>July</th>
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Quality Improvement Efficiency

CT PERFORMANCE ERRORS

- Graph shows CT performance errors from January to August.
- Errors increase from January to August.
Quality Improvement
Efficiency

CT ERRORS

CT Errors
CT Vol x 100

January March April May June July August
It is totally plausible to expect that interpreting more cases per unit of time will negatively impact diagnostic accuracy.

Processes can be made efficient only to a point without inviting errors.

Conclusions QA/QI

- Continuous QA/QI is critical but more critical to do it right
- Improving one parameter (efficiency) at the cost of other (increased reading errors, teaching or morale) is failed QA
- Databases should be detailed and robust
- Data sharing with colleagues should be objective not critical or punitive
- All new initiatives should be adequately resourced
Challenges

Individuals: Be more interactive and communicative with clinical colleagues

Section: Take initiative to provide quality, efficient and safe patient care in close collaboration with your ER colleagues while taking responsibility of education at all levels

Departments: Have dedicated well resourced ER sections- 24/7
Challenges

ABR: Get ER Radiology accepted as a sub-specialty

ASER: Help in setting standards for safe workloads

Provide a platform for a forum in helping set up and improve ER sections and liaison with SCARD.

National: Consider Radiologists as consultants with billing options of time slots (as in some other nations)
Challenges

A valid methodology must be developed to measure safe work loads as a fundamental pillar of quality measure. Dr. Stuart Mirvis: editorial, Applied Radiology, May 2013, Vol 42, No 5.

Value = Quality + Efficiency + Safety + Education

Dr. Paul Chang: ASER 2013

Changes worth making are never easy.

Gary Danton, MD, PhD: Applied Radiology Vol. 39, 5 May 2010