

# Impact of Simulator Teaching on Junior Radiology Resident Preparedness for Independent Call

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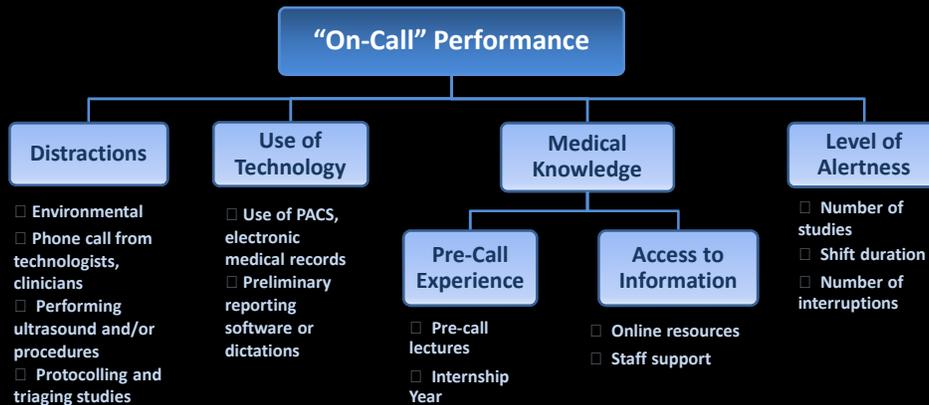
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## Introduction

- The demands on the radiology resident have changed dramatically over the last ten years<sup>1</sup>
  - The volume of “after hours” scans has steadily increased to meet the demands of the Emergency Department
  - In addition, there has been a trend towards more complex imaging as the initial imaging modality of choice, such as computer tomography (CT)<sup>2</sup>
- With the advancement in radiologic image acquisition, there is an increasing number of reconstructions available for evaluation
  - For example, the polytrauma CT scan at our institution contains 5000 images<sup>3</sup>
  - At trauma centres, often several polytrauma scans are read “after hours”
- To add to the “after hours” workload, some centres require residents to perform and interpret ultrasounds requested for Emergency Department patients
- The possibly life threatening conditions, for which clinicians depend on radiology to help guide management (e.g. suspected aortic dissection, ectopic pregnancy, testicular/ovarian torsion etc.), add to the challenges faced by on call residents

## “On-Call” Performance

- There are many factors affecting “on call” performance:



- All of these factors determine the comfort level of the resident

## Traditional Call Preparation

- Call preparation has traditionally included:
  - Didactic lectures
    - At our institution, there are lectures offered by senior residents and attending staff
  - Case-based modules<sup>4</sup>
  - Self-study<sup>5</sup>
  - Mandatory subspecialty rotations
    - At our institution, first year residents are recommended to complete dedicated rotations in neuroradiology, chest and abdominal imaging, as well as at least one ultrasound rotation
  - “Shadow” or “Buddy Call” with senior residents
    - 6-8 “Shadow” shifts are required, split between the two hospitals we cover
  - Exams<sup>6</sup>
    - Canadian National OSCE exam offered to all first year residents across Canada (questions set by program directors)
- However, these call preparation methods do not equip radiology residents with everything that they need to excel during a busy night on call

## Simulator-Based Training

- Simulation-based training is used in a variety of medical and surgical residencies to provide residents with technical and critical thinking skills required for independent practice<sup>8</sup>
  - Examples include simulated lines and tubes sessions for Intensive Care Residents and Fellows, intubation and advanced airway skills for Anesthesia Residents, simulated “Code Blue” situations for interdisciplinary resident teams
- There is a positive correlation between the fidelity of the simulator-based training and likelihood of transfer to practice<sup>9</sup>
  - The fidelity, or the degree in which the experience replicates reality, can be divided into these categories:<sup>8</sup>



## Simulator-Based Training in Radiology

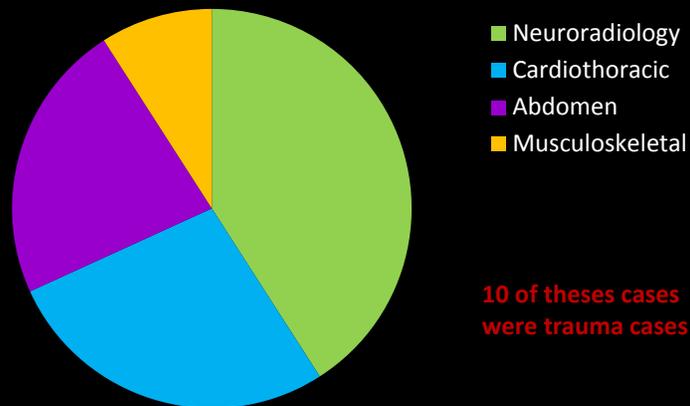
- There are many applications for simulator-based training in radiology:<sup>9</sup>
  - Management of contrast reactions
  - Procedures, such as biopsies and line placement
  - Communication of critical results
- Simulation has been used in the emergency radiology setting to improve workload management and to prepare learners for call<sup>10</sup>
  - Subjectively residents reported value in the simulator experience
- In one published study, simulated cases have been used as a “test” to determine if junior residents are safe to take independent call<sup>11</sup>
  - Residents who did not meet the established passing mark were required to complete remedial cases
- At our institution, simulation has not yet been used as part of the preparation for the on call responsibilities of junior residents
- **The purpose of this study was to objectively and subjectively assess the impact of simulator-based training on first year radiology preparedness for independent call**

## Methods

- This was a prospective cohort study which was conducted from August 2013 to March 2014
- All 9 first year radiology residents at a Canadian Diagnostic Radiology Residency Training Program participated in a 4 hour mock call shift
- They were presented with 17 standardized computed-based simulated cases consisting of 24 studies
  - Cases were viewed on a fully enabled PACS system common to both hospitals where residents take call
  - Previous images were available for comparison
- Cases were selected by the Radiology Resident Program Director and Chief Radiology Resident
  - Selected with acute and pertinent pathological findings in the “on call” or emergency radiology setting
  - Reference was made to the core curriculum published by American Society of Emergency Radiology<sup>12</sup>
  - Most included studies were positive for pathology
    - 1 CT scan of the head and 1 chest x-ray were normal

## Distribution of Cases

- There were 24 studies
  - 21 were CT scans
  - 3 were plain films



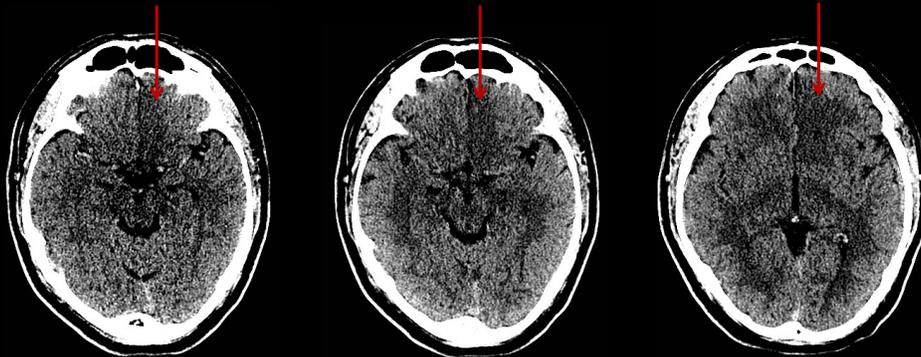
## Methods

- Residents were asked to describe the:
  - Study type
  - Protocol used
  - Pathological findings
  - Impression, including the differential diagnosis
  - Management plan
    - Appropriate immediate action and referral
- Resident responses were typed to mimic the “on call resident preliminary report” at our institution
- Responses were scored by a chief resident and medical student using a standardized grading system

Question	Marking Scheme
1	0/2 Incorrect modality and protocol
	1/2 One of two is incorrect
	2/2 Correct modality and protocol
2	0/1 Incorrect body part
	1/1 Correct body part
3	0/2 Incorrect contrast and phase
	1/2 One of two is incorrect
	2/2 Both contrast and phase correct
4	?/? One point for each correct finding
5	0/? Differential doesn't include ____ or differential is not ____
	?/? Differential includes ____
6	0/1 Does not recommend ____ or does not indicate discussing with staff
	0.5/1 Does not recommend ____ but indicates discussing with staff
	1/1 Recommends ____
<b>Total</b>	<b>/ ?</b>

## Sample Case 1

- 38 year old male found down



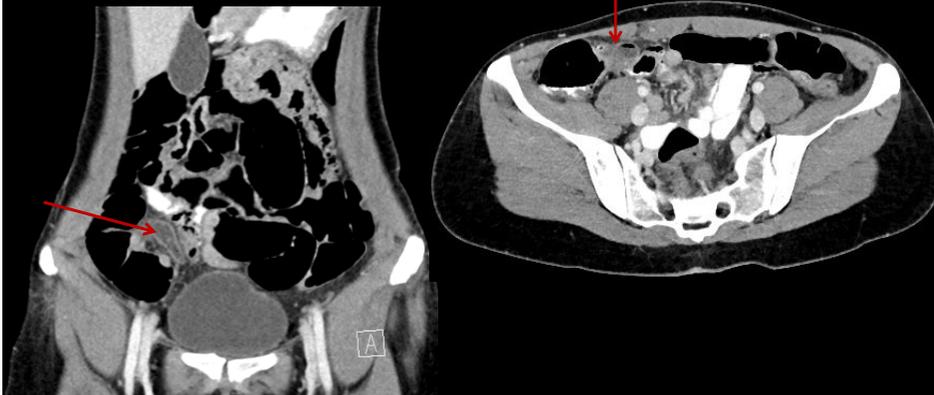
- Left anterior communicating artery stroke

## Sample Case 1 – Grading

Question	Key Points	Points
1	<u>Modality:</u> CT (1) <u>Protocol:</u> Non-contrast CT head (1)	/2
2	Head (1)	/1
3	<u>Non-Contrast</u> (1) <u>Phase:</u> Non-contrast, none	/1
4	<u>Findings:</u> Left anterior communicating artery (ACA) stroke: 1. loss of grey white differentiation along left parafalcine area 2. No hemorrhage or mass effect 3. Low attenuation in the left caudate head and anterior left lentiform nucleus	/3
5	<u>Impression:</u> Acute left ACA ischemic stroke	/1
6	<u>Recommends:</u> 1. Report findings by phone 2. Neurology consultation 3. CT angiogram from aortic arch to vertex	/2
	<b>Total</b>	<b>/10</b>

## Sample Case 2

- 48 year old woman with right lower quadrant pain



- Acute appendicitis with perforation and small abscess

## Sample Case 2 – Grading

Question	Key Points	Score
1	<u>Modality:</u> CT (1) <u>Protocol:</u> CT Abdo/Pelvis with oral and IV (1)	/2
2	Abdomen and Pelvis	/1
3	<u>IV and oral contrast</u> (1) <u>Phase:</u> Portal Venous (1)	/2
4	<u>Findings:</u> <ul style="list-style-type: none"> <li>Appendix mildly distended at 6mm, presence of submucosal enhancement and 7mm appendicolith</li> <li>Enhancing fluid collection with air fluid level adjacent to appendix</li> <li>Trace amount of free intraperitoneal fluid</li> </ul>	/2
5	<u>Impression:</u> Acute appendicitis with abscess	/1
6	<u>Recommends:</u> <ol style="list-style-type: none"> <li>Report findings by phone</li> <li>Recommend general surgery consult</li> </ol>	/1
	<b>TOTAL</b>	<b>/9</b>

## Methods

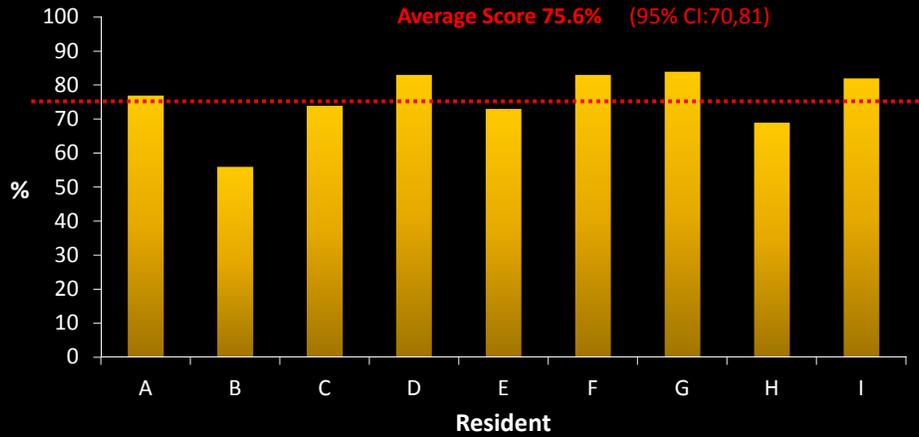
- Resident self-reported preparedness was evaluated at three time points:
  - Before participating in the simulated call shift
  - After 3 months of taking independent call
  - After 9 months of taking independent call

- Survey responses were recorded using a 5 point Likert scale:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

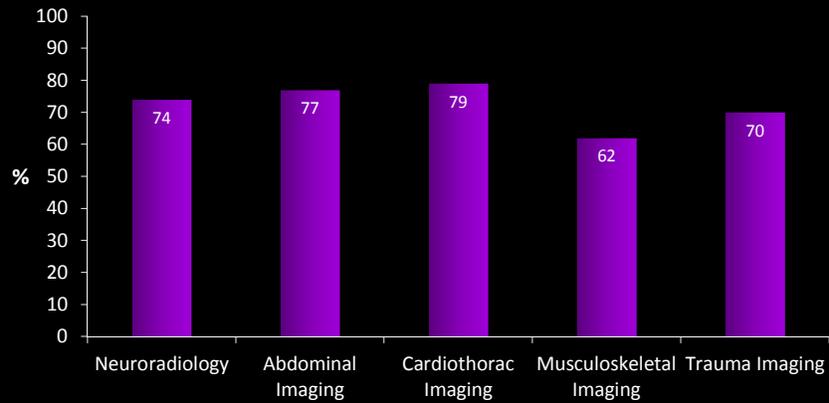
- Survey questions were designed to include these areas:
  - Overall comfort level
  - Knowledge of “on call” pathology
    - Subdivided into findings, impression, and appropriate recommendations
  - Use of technology including PACS workstation and preliminary reporting system
  - Use of time (e.g. I was able to complete all the call cases in the allotted time)
- Survey responses were statistically analyzed using ANOVA test
  - One residents who participated in the simulator experience did not continue in the program and therefore this individual’s responses to the pre-simulator were not included for analysis

## Results – Individual Resident Scores

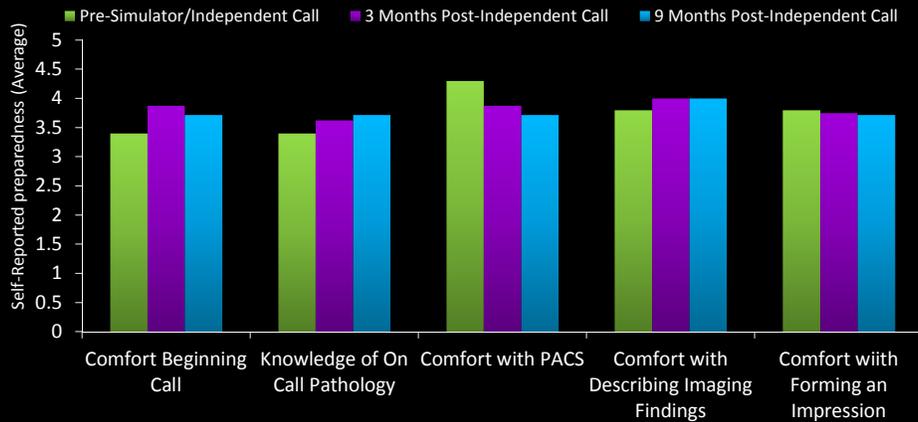


## Results – Scores By Subspecialty

- There was no significant difference in performance across subspecialties:

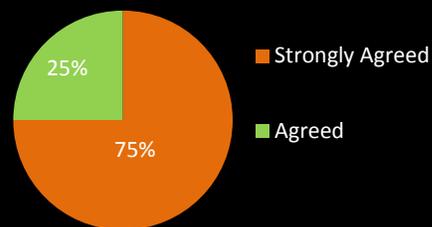


## Results – Survey Responses

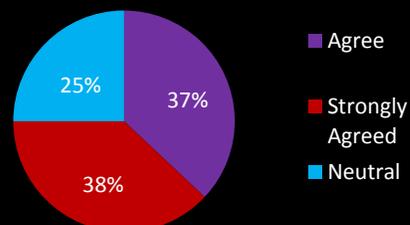


## Results – After Taking Independent Call

- All residents felt that the cases simulated real cases that they would encounter on call

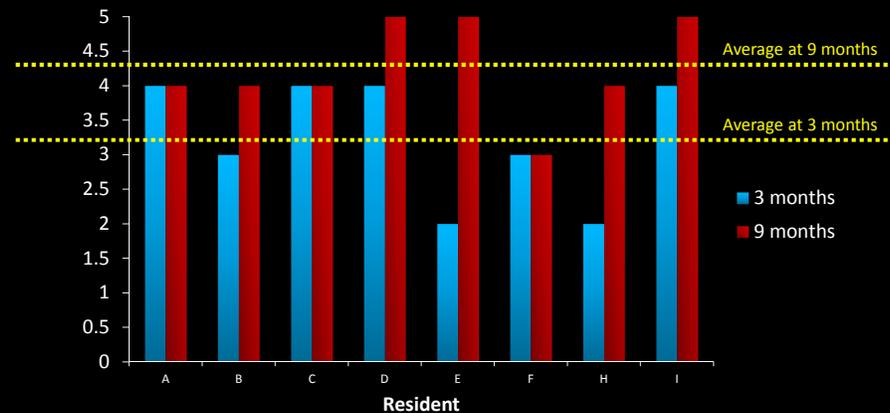


- Residents had mixed impressions of the effectiveness of the simulated cases to teach radiology findings



## Results – After Taking Independent Call

- At 9 months post-simulator experience, residents **agreed** that their overall comfort with “on- call” responsibilities was increased as a result of the simulated cases

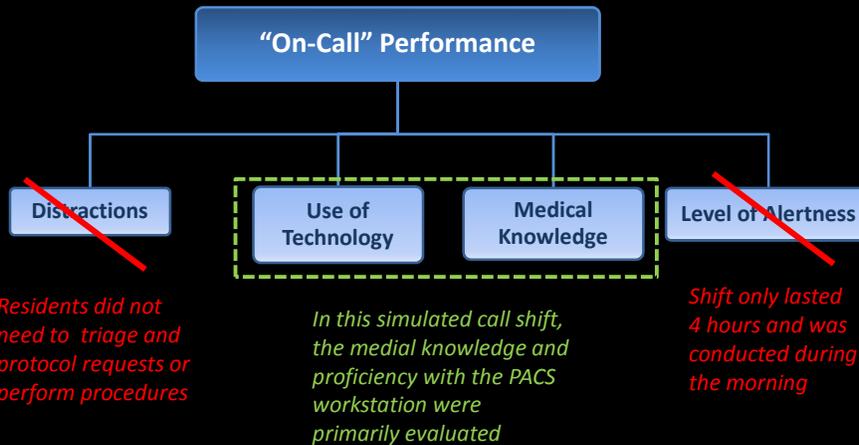


## Limitations

- Small cohort of participating residents
  - The simulated call experience was only offered for one year, and included 8 residents
  - Future years will also participate
- No standardized pre-call curriculum
  - Variability regarding individual studying and exposure
  - Recommended but not mandatory pre-call rotations
- At our institution, residents cover two different hospitals with variable complexity of cases and variable “after hours” staff coverage
  - Tertiary care hospital with staff coverage until 10 pm
    - Preliminary reads by residents from 5 pm to 8 am; however, studies performed between 5-10 pm are dictated out within 1 hour by staff and the resident is notified immediately if there is a discrepancy
  - Quaternary Level 1 trauma centre with 24/7 staff coverage
    - Preliminary reports are issued by residents for all inpatients and scans ordered by specialists
    - All cases ordered by emergency physicians are reviewed and dictated immediately
- It is unclear how staff coverage influences junior resident preparedness for call

## Limitations

- Not all variables affecting “on call” performance were evaluated in this simulated call shift:



## Conclusions

- With an increase in utilization of “after hours” imaging there is increased demand on residents to interpret studies quickly and accurately
- Patients are often very sick and there is increased pressure on radiology from referring clinicians to help direct patient care
- Although more and more institutions have 24/7 staff coverage for Emergency Department patients, many of the “after hours” imaging is still the responsibility of residents (e.g. when covering smaller centers and inpatients)
- Traditional, primarily didactic call preparation does not adequately prepare residents for all the factors that affect “on call” performance
  - Primarily assesses medical knowledge
- Residents reported that the stimulated call module was an effective educational tool and helped prepare them for beginning independent call
- More data, however, is required to better understand the factors that affect “on call” junior resident performance, which will be assessed in futures studies

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