

Compliance with Personnel and Patient Safety Practices

Investigators:

Janet Reagan, Ph.D.

Anita Marie Slechta, MS, BSRT, RT(R)(M) FASRT

California State University
Northridge



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New Study . . . Since the worksite is the most important factor what in the work site promotes good practice??

- For our subsequent California study
 - Matched categories to ARRT categories when possible
 - Focus only on practice, Excluded knowledge
 - Eliminated CE as an independent variable (though it is a future area of research)
 - Increase focus on personnel safety and patient safety practice

Purpose of the study:

Radiation Protection practices in the Medical Imaging Department are designed to reduce personnel and patient dose. This study is designed to evaluate whether:

- 1) initial education,
- 2) years worked as a Radiologic Technologist,
- 3) highest level of education, or
- 4) primary place of employment are related to radiation protection practices.

Questionnaire Development

Survey covered radiation safety practices. The questions covered:		
Respondent Characteristics	7 questions	
Patient Safety	15 questions	8 out of 15 - poor practice
Personnel Safety	11 questions	9 out of 11 - poor practice

Categories of imaging areas included :		
Portables	3 items	Personnel
Fluoroscopy	6 items	5 personnel 1 patient
CT	3 items	Patient
General Radiography	8 items	3 personnel 11 patient

Sample Size and Response Rate

	CA STUDY	NATIONAL STUDY
Population	7301	160,000+
Sample	1500	2000
Return Rate	32%	24%
Usable Responses	431	454

California Study/National Study

CA Study (respondents)	CA-ARRT Population (randomly sampled for this study)	National Study*	ARRT Population*
n= 431	n = 7301	n = 451	n = 198,244
58.9 % female 41.1% male	53.69 % female 46.1% male	82% Female 18% Male	74 % female 26% male

*previously presented national study on radiation protection practices

Years of Practice as an ARRT/CRT		
CA Study	CA-ARRT Population (randomly sampled for this study)	National Study*
≤ 5 yrs ----- 21.3%	≤ 5 yrs ---- 29.2%	15.84 yrs average
6-15 yrs -- 31.8%	6-10 yrs ---- 18.7%	
16 - 25 yrs -20.6%	11-20 yrs ----25.3%	
≥ 26 yrs ----- 25.5%	> 20 yrs -----26%	

*previously presented national study on radiation protection practices

Primary Place of Employment				
	California Study (2005)	California Population	National Study (2003) *	ARRT Population *
Hospital	64 %	73.4%	65%	65.6 %
Clinic	20.9%	17.1%	15.4% combined	14.4 %
Private Office	4.2%	7.2%		13.9 %
Other (including Imaging Centers)	10.9%	2.4%	19.8%	5.9 %

Initial Radiologic Technology Education		
Type of Initial Education	California Study (05)	National Study(03)
Hospital-based/Certificate Program	28.8 %	42.5 %
Associate Degree	61.7 %	45.4 %
Bachelor Degree in Radiologic Sciences	3.0 %	5.1 %
Military Program	6.3 %	3.8 %
Other	.2 %	3.8 %

Highest Level of Education			
Type of Education	California Study (05) n = 431	California Population n = 7301	ARRT Population n = 218,591
Certificate Program (High School + RT)	19.5 %	23.6 %	35.9%
Associate Degree	59.6 %	61.4 %	46.1%
Bachelor Degree	18.3 %	12.9 %	14.8%
Masters Degree	1.2 %	0.8 %	2.3%
Other	1.2 %	0.9 %	0.9 %

- ### Independent Variables
- Years Worked as a Radiologic Technologist
 - Primary Place of Employment / worksite
 - Hospital 1-99 beds
 - Hospital 100 - 299 beds
 - Hospital ≥ 300 beds
 - Outpatient facility / clinic
 - Imaging Center
 - Private Office
 - Other
 - Initial Radiologic Education
 - Hospital-based/Certificate Program
 - Associate Degree
 - Bachelor Degree in Radiologic Sciences
 - Military Program
 - Other
 - Highest Level of education
 - Certificate Program (High School + RT)
 - Associate Degree
 - Bachelor Degree
 - Masters Degree
 - Other

- ### Dependent Variables
- Compliance with Radiation Safety Practice
- Score for Personnel Safety - 11 questions
 - Score for Patient Safety - 15 questions

Study Design

Independent Variables	Dependent Variables	
	Personnel Safety Practice	Patient Safety Practice
Initial Radiologic Science Education		
Highest Level of Education		
Years as Radiologic Technologist		
Primary Worksite		

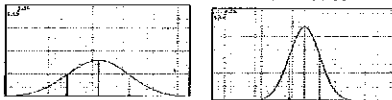
Results:

Compliance with Radiation Safety Practice

STUDY	Mean % Score	S.D.
CA Study		
Personnel Safety Practices (n=317)	70.49	17.64
Patient Safety Practice (n = 420)	77.10	13.09
National Study		
Personnel and Patient Safety Practice (n = 385)	72.18	23.5

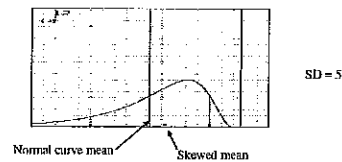
**Patient Safety 37 points maximum score for best practice
**Personnel safety 23 points maximum for best practice

Distribution review..



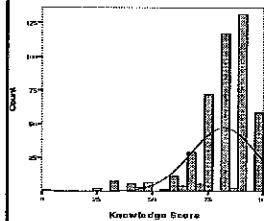
- Both curves have the same mean, but different standard deviations (S.D.)
- One SD identifies the limits for 68% of the population around the mean...
- The *smaller* the SD the more peaked the curve is and the more of the population is close to or at the mean. (Kurtosis is a measure of the curves peakedness)
- The higher the SD the flatter the curve and the greater the variation there is in the population

Distribution review continued..

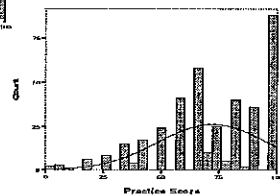


“Skewedness”... when the mean is above or below a normal curves mean (50)

Distribution of General Radiology Knowledge Score



Distribution of General Radiology Practice Score



Results:

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**Patient Safety 37 points maximum score for best practice
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Flat distribution for personnel safety practices.. Great variability around the mean

- An average of 70.49% with a S.D. of 17.64 means **68% of the respondents** scored from 52.8 to 88.13
- A lot of variation around the mean , which means there are a lot below 70%
.....Poor radiation safety practice

Distribution of patient safety practice somewhat less variability around the mean

- An average of 77.10% with a S.D. of 13.09 **shows that 68 % of the respondents scored from 64.01% to 90.19%**

But even if there was a small S.D. around the mean would you want good practice only 70 to 77% of the time?

The following slides are of the Analytical Statistical information compiled from the study

Statistical tools...Tests of Association

- **Spearman's rho coefficient---**
 - Used for non-normal distribution and ranked data that do not satisfy normality assumption.
 - Used with scores that have been ranked.
 - An adaptation of the Pearson Product Moment Correlation for use with ordinal data, and it is more sensitive to outliers than the Pearson Product Moment Correlation
 - Possible ranges from -1.0 to +1.0.
- **Kendall's tau (τ)**
 - Used for ordinal data (Being of a specified position in a numbered series). Takes into account tied pairs, and therefore, does not overestimate the strength of the association between two variables.
- **Correlation versus association--**a correlation coefficient is an indicator of the degree of association. In fact we often refer to Pearson Product Moment as a measure of association.

Study Analysis

Independent Variables	Dependent	Variables
	Personnel Safety Practice	Patient Safety Practice
Initial Radiologic Science Education	Spearman rho = -.025 Kendal tau = -.021	Spearman rho = .053 Kendal tau = .042
Highest Level of Education	Spearman rho = -.038 Kendal tau = -.030	Spearman rho = -.006 Kendal tau = -.002
Years as Radiologic Technologist	Spearman rho = -.130* Kendal tau = -.088*	Spearman rho = -.05 Kendal tau = -.077
Primary Worksite	Spearman rho = .114* Kendal tau = .084*	Spearman rho = .100* Kendal tau = .073*

*Significant at $p \leq .05$

**Spearman rho .114 is a weak correlation but $p \leq .05$ means we have confidence in this finding and it is not likely due to chance.

Summary Correlation:
Those RT's who protect their patients also protect themselves!

- Correlation between
 - Patient Safety Practices mean % Score, and the
 - Personnel Safety Practice Mean % Score
- Spearman rho .251**
- Kendal tau .172**

**Significant at p < .01 level (two tailed)

Review of performance of best practice on individual items

Personnel Radiation Safety Practice

Question #	n	Always	Sometimes	Never
6. When performing portable exams how often do you wear a lead apron if you cannot stand 6' from the patient?	319	60.2% (% response to each answer) *Total 60.2% best practice	29.8%	10.0%
7. When setting up a C-arm procedure and when room size and patient bed allows, how often do you place the x-ray tube above the II tube for the procedure?	248	27.4% *Total 27.4% best practice	45.2%	27.4%

* Best practice

Personnel Radiation Safety Practice

8. How often do you hold patients during portable radiography?				
California Study n=284	%	National Study n=318	%	Comparable %
At least once a week	17.6	Daily	4.7	27.0
		Once a week	22.3	
At least once a month	28.2	Once a month	24.5	24.5
		Once a year	26.7	48.4 *
Once a year or less *	54.2	Never	21.7	

* Best practice

Personnel Radiation Safety Practice

9. Where do you typically stand during an <i>Upper GI</i> Fluoroscopic procedure if you are not using a remote control fluoro room?			
California Study n=285	%	National Study n=264	%
<i>By the patient's head</i>	5.6		10.6
<i>Behind the doctor</i>	75.1		70.4
<i>In the control room</i>	15.4		11.7
<i>At the foot of the table</i>	3.9		2.6
<i>Other</i>	NA		4.5

* Best practice

Personnel Radiation Safety Practice

10. Where do you typically stand during a <i>Lower GI</i> Fluoroscopic procedure if you are not using a remote control fluoro room?			
California Study n=284	%	National Study n=263	%
<i>By the patient's head</i>	.4		3.4
<i>Behind the doctor</i>	68.7		61.7
<i>In the control room</i>	11.6		7.6
<i>At the foot of the table</i>	19.4		22.4
<i>Other</i>	NA		5.3

* Best practice

Personnel Radiation Safety Practice

11. Where do you wear your personal monitoring device?	
California Study n = 315	%
At waist level outside apron	0.3
At collar level outside apron	88.3
At collar level inside apron	9.5
Other	1.9

* Best practice

Personnel Radiation Safety Practice

12. During a fluoroscopic procedure, how often do you wear a thyroid shield?			
California Study n=301	%	National Study n=270	%
<i>Always</i>	49.8		34.1
<i>Sometimes</i>	33.6		37.4
<i>Never</i>	16.6		28.5

* Best practice

Personnel Radiation Safety Practice

13. How often do you hold patients during fluoroscopic procedures?	
California Study n=273	%
At Least Once a Week	6.6
At Least Once a Month	26.0
Once a Year or Less	67.4

* Best practice

Personnel Radiation Safety Practice

California Study Only	n	At Least Once a Week	At Least Once a Month	Once a Year or Less
20. How often do you hold <u>adult</u> patients during routine radiography?	360	10.3	22.5	67.2
21. How often do you hold <u>pediatric</u> patients during routine radiography?	356	15.4	32.3	52.2
22. How often do you hold patients during <u>trauma</u> radiography?	286	8.4	30.4	61.2

* Best practice

Patient Radiation Safety Practice

14. During Fluoroscopy with an under-the-table X-ray tube, where do you place the image intensifier?			
California Study n=212	%	National Study n=131	%
As far away from the patient as possible	6.8		15.3
As close to the patient as possible	91.9		80.9
The distance, position does not matter	0.0		3.8

* Best practice

Patient Radiation Safety Practice

15. Do you use gonadal shielding on a woman of child-bearing age during a CT of the chest?			
California Study n=170	%	National Study n=136	%
<i>Always</i>	45.9		40.4
<i>Sometimes</i>	27.6		36.8
<i>Never</i>	26.5		22.8

* Best practice

Patient Radiation Safety Practice

16. Where do you place gonadal shielding during a CT exam of the chest?

California Study n=168	%	National Study n=142	%
On top of the patient	11.3		9.2
Around the entire pelvis	67.3		70.4
Under the patient	0.6		2.1
No gonadal shielding is necessary	20.8		18.3

* Best practice

Patient Radiation Safety Practice

17. How often do you alter the manufacturer's recommended technique (mA & kVp) for a chest or abdomen CT when you are imaging a pediatric patient?

California Study n=152	%
Always	47.4
Sometimes	37.5
Never	13.2

* Best practice

Patient Radiation Safety Practice

18. Have you compared radiation from the sun to radiation from diagnostic X-rays when talking to patients who are nervous about the dose for their diagnostic procedure?

California Study n=426	%	National Study n=413	%
Always	20		9.9
Sometimes	62		50.1
Never	18.1		40

A title different phrasing in National study

* Best practice

Patient Radiation Safety Practice

19. For which of the following patients would you use gonadal shielding for a foot X-ray??

California Study n=431	% Yes
2-day old baby	95.4
15 year old male	94.9
85 year old male	18.3
50 year old male	52.2
33 year old male	86.3
24 year old female	95.1
7 year old female	96.3

* Best practice

Patient Radiation Safety Practice

24. How have you attempted to decrease your patient's dose in the last year?

California Study n=431	%
Decrease the mAs	65.9
Use lead shielding	85.2
Increase kVp	62.9
Unable to manipulate dose	3.7

* Best practice

Patient Radiation Safety Practice

Question #	n	Always	Sometimes	Never
25. How often do you ask females that are in their reproductive years if they are pregnant before diagnostic exams	427	95.6%	4.2%	0.2%
		*Total 95.6% best practice		
26. How often do you use gonadal shielding on a 3-year-old boy who needs a chest X-ray?	395	92.4%	6.3%	1.3%
		*Total 92.4% best practice		

* Best practice

Patient Radiation Safety Practice

How often do you use gonadal shielding on a _____ who needs a _____ X-ray?

California Study	n	Always	Sometimes	Never
27. 16-Year –old male/ L-Spine	395	92.4	6.3	1.3
28. 37- Year –old male/ knee	408	62.3	26	11.8
29. 21- Year –old female/ finger	407	84.3	11.1	4.7
30. 10 -Year –old male/ pelvis	400	39.8	28.5	31.8
31. 19- Year –old male/ esophagram	322	61.8	18.6	19.6

* Best practice

Summary of "poor" Personnel Radiation Safety practice which we defined as **less than 85% best practice**

Question # (3 out of 11 poor)	% best practice
6 (portable/ apron)	60.2 %
7 (C-arm/ft position)	27.4 %
8 (hold portable)	54.2 %
10 (stand for BE)	80.3 %
12 (wear thyroid shield)	49.8 %
13 (hold/ fluor)	67.4 %
20 (hold/ radiography)	67.2 %
21 (hold/ pediatrics)	52.2 %
22 (hold/ trauma)	61.2 %

Summary of "poor" Patient Radiation Safety Practice which we defined as **less than 85% best practice**

Question # (8 out of 15 poor)	% best practice answer
15 (gonad shield CT female)	45.9%
16 (where gonad shield CT female)	67.3%
17 (vary CT technique pecks)	47.4%
18 (compare sunlight to x-ray)	18.1%
24 (decrease dose with technique-mAs & kVp)	65.9% & 62.9%
28 (shield 37 yr old male knee)	62.3%
30 (shield 10 yr old male pelvis)	39.8%
31 (shield 19 yr old male esophagram)	61.8%

Limitations of the study....

Study flaws:

- Return rate 32%
- Self response data
- Interpretation of best practice may differ among participants and experts in the field. (e.g., CT shielding for pregnant women is controversial)

Concerns about performance.....

How do we improve performance?

- Initial Education.. Explore ways of taking the results and plugging it in to a new focus for initial education
- Continuing education?? 98 % had met this requirement in the national study. Need more studies to understand what types of continuing education is effective (content, methods, frequency). Especially important for people who are in the field for a long time.
- Other factors that contribute to these poor practices:
 - Worksite factors— Safety practice appears to be higher in large to medium hospitals... Find out what is different in those settings
 - Staff—more staff
 - Equipment availability
 - Administrative enforcement
 - New Equipment and training available on a more frequent basis
- What factors do you think contribute to poor practice?? Please give us the benefit of your knowledge because the next study is to find out what about these work places make them institutions of best practice versus poor practice.

Question asked of educators at the California Educator's Conference after the Second Study: What could account for the difference between knowledge of safety practices and compliance with safety practices?

- Influence of physicians
 - Unnecessary to shield
 - Preference for particular practice
- Influence of senior radiologic technology staff
 - Comfort with status quo
 - May encourage newly trained technology staff to "do as I do".
 - Long term technologist may not believe the need for safety procedures
 - Long term technologists do not have the patience to let student use current safety compliance
 - Inevitable.
 - Long term technologists may not be familiar with new safety procedures.
 - Belief that if one colleague will there is no need for shielding.
- Technologists
 - Appears to be a shortage
 - Turnover makes it difficult to keep compliance level high. Registry radiologists may not be as compliant
- Facility/Equipment
 - Lacking safety equipment. Lack of shielding re lack of appropriate shields
 - Use of "post-confirmation", so technologist can't see
 - Need to use aprons with shields attached to increase thyroid shielding
- Time pressure
 - More efficient to hold patient than to go looking for equipment
 - Large patient load and pressure to complete procedure quickly.
- Administration
 - Need active involvement and support for compliance
 - Day time RT's are trained on new equipment versus partweekend personnel get "second-hand" training.

Of the 214 individuals:

- Number of All Continuing Education(CE) sessions reported by the 214 participants = 2647 unique CE sessions
- 185 CE sessions = 7% of the total 2647 CE addressed Radiation Safety practice
- 129 of the participants (60%) participated in CE activities addressing Radiation Safety Practices = An average of 1.43 Safety Practice CE sessions per RT.
- ~2.07 hours in 1.43 sessions of a 24 month period per participating RT out of the 24 hours of required CE
- ⇒ 40% are not taking CE in Radiation Safety practice

Mode of CE for all 214 individuals or for RP CE

Mode of CE session	Number	%
Online	74	40
Directed Readings	74	40
Multiple Format	9	4.9
CD ROM	2	1.
Home Study	2	1.1
Webinar	1	1
Other	13	7
No Information	10	5.4
Total	185	~100.5

Thank you

