

TRAINING OF NON-CREDENTIALLED X-RAY OPERATORS IN RADIATION SAFETY

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The State of Washington, in common with approximately thirty other States in the United States, has no requirements for minimum training for operators of x-ray machines on human patients. In an attempt to correct the educational deficiency in non-credentialed operators, a training course has been developed by the State of Washington in cooperation with the Food and Drug Administration. Course topics, results of a post-class questionnaire, and changes in observations by State inspectors are discussed.

COURSE TOPICS

Subjects covered in the day-long course include Basic Radiation Perspectives, Radiation Production, Radiation Interaction with Matter, Biological Effects, Risks of Radiation Exposure, Radiation Protection, Image Quality, and Quality Assurance Techniques. In all cases, of course, the intent is to supply attendees with enough information so that they may be aware of the reasons for certain actions and concerns. The effect of changes of kVp upon resulting radiographs and upon scatter radiation indicate to students the need for kVp selection appropriate for a particular examination as well as the State requirement that no one be in the room during radiography unless that individual is necessary for the procedure.

Early attendee critiques requested answers to patients' questions concerning radiographic examinations. Therefore, a session entitled "Patients' Concerns" was added to the standard course.

POST-CLASS QUESTIONNAIRE

Originally, pre- and post-class written examinations were given to students attending the class. However, written examinations did not measure the behavior modification expected from the class. The intent was not to turn non-credentialed technologists into physicists; the course was to motivate attendees to change their working conditions in such a way so as to obtain better radiographs with less radiation exposure to themselves and their patients.

In 1986 and 1987, questionnaires were mailed to attendees of the nine separate courses held in 1985 and 1986, respectively, a total of 213 x-ray facilities throughout the State. Responses were received from 70 facilities. The questions were designed to identify technical, administrative, and engineering changes, and work performance changes observable by both management and staff. The questions also noted relationships between attendees and patients and fellow employees regarding concerns of radiation protection.

The following equipment changes were found to be a direct result of course attendance:

- 25% had replaced their screens;
- 20% had purchased thermometers, timers, and other darkroom supplies;
- 16% had upgraded major equipment or components (collimator, processors)
- 13% replaced the safelight;
- 10% began a commercial processor quality assurance contract;
- 7% obtained a commercial gonad shield;
- 7% bought patient-positioning aids;
- 7% replaced or bought lead aprons and/or gloves;
- 4% had introduced the use of a grid for chest examinations.

Regarding changes in operators' technical procedures:

- 30% had reduced exposure time;
- 18% began to follow an established film development guide;
- 18% began film badge monitoring;
- 16% performed a film fog test and made some corrections;
- 13% began processor sensitometry/densitometry testing;
- 10% began to refer to technique charts routinely.

In terms of observable changes in the quality of patient care:

- 50% reported "some" to "considerable" exposure time reduction;
- 36% improved collimation practice;
- 25% felt that occupational exposure was also reduced;
- 20% reported improving patient gonad shielding practices.

Regarding changes in radiographic quality:

- 70% experienced image enhancement;
- 50% reported "some" or "marked" reduction in film retakes;
- 20% indicated improved patient positioning.

INSPECTIONAL OBSERVATIONS

Routine post-course inspections were made of 49 facilities with operators that attended the course and compared to observations at 59 facilities without operator attendance. The 49 inspected facilities in the study group were not selected simply because of course attendance; these were facilities which were already due to be inspected according to the State's routine priority scheduling. The 59 control facilities were randomly selected to match the same proportion of types of facility (dental, medical, chiropractic, etc.) and geographic locations as those in the study group.

For dental facilities, those without training showed an average decrease of patient exposure of 6% (320 to 300 mR) between inspections performed in 1983-84 and those performed in 1986. Facilities with training showed a 14% average drop (280 to 240 mR) during the same period of time. Washington State NEXT data for bitewing examinations in 1984-85 was 284 mR. Seemingly, facilities willing to send technologists to the course already are motivated toward lower patient exposures, and attendance at the course induces further exposure reduction.

For PA chest examinations, facilities without training reduced patient exposure by 23% average (22 to 17 mR) within the same time period. Facilities with training decreased patient exposure by 37% (19 to 12 mR). Again, facilities motivated to training seemingly began at a lower patient exposure and decreased the patient exposure even more after the training.

Similar data occur with studies of other examinations.

Data was also collected to compare facilities' noncompliance rates as a function of operator training. During the same period of time, 57.3% of all Washington State facilities were found to be in compliance with State regulations. Those facilities which sent operators to the course had a pre-training compliant inspection rate of 61% which increased to 74% during the first inspection after the training course.

The types of noncompliance also change with training. Pre-training inspections noted that most noncompliances were associated with lack of adequate collimation, inadequate gonad shielding, and improper exposure switch placement. Post-training noncompliances showed the highest rate in improper exposure switch placement and inadequate film processing, with other non-compliances at a much lower rate.

CONCLUSIONS

Definite improvements in State inspection compliance rates, patient and occupational exposures, and actions taken to improve radiographic quality can be achieved from even a single-day training activity. The improvements noted appear to be greater than those accomplished with programs exclusively emphasizing inspection and enforcement.