

Occupational Exposure to Diagnostic Radiology in Workers without Training in Radiation Safety

Enrique Gaona*, Jesús G. Franco Enríquez**

*DEHA, **DAS, Universidad Autónoma Metropolitana-Xochimilco
Calz. del Hueso 1100, 04960 México, D.F. México.

Abstract. The physicians, technicians, nurses, and others involved in radiation areas constitute the largest group of workers occupationally exposed to man-made sources of radiation. Personnel radiation exposure must be monitored for safety and regulatory considerations, this assessment may need to be made over a period of one month or several months. The purpose of this study was to carry out an exploratory survey of occupational exposures associated with diagnostic radiology. The personnel dosimeters used in this study were thermoluminescent dosimeters (TLDs). The reported number of monitored workers was 110 of different departments of radiology of the Mexican Republic without education in radiation safety, included general fluoroscopic/radiographic imaging, computed tomography and mammography procedures. Physicians and X-ray technologist in diagnostic radiology receive an average annual effective dose of 2.9 mSv with range from 0.18 to 5.64 mSv. The average level of occupational exposures is generally similar to the global average level of natural radiation exposure. The annual global *per capita* effective dose due to natural radiation sources is 2.4 mSv (UNSCEAR 2000 Report). There is not significant difference between average occupational exposures and natural radiation exposure for $p < 0.05$.

INTRODUCTION

It is incumbent upon all individual who use in diagnostic X-ray procedures to maximize its clinical utility while minimizing the radiation dose to staff. Individual doses from diagnostic radiology procedures vary with a variety of factors and the radiation programs in diagnostic radiology depend on the education of staff about radiation safety principles and the risk associated with radiation exposure to ensure that radiation exposures are kept as low as reasonably achievable (ALARA), taking societal and economic factors into consideration.

The purpose of this study was to carry out an exploratory survey of occupational exposures associated with diagnostic radiology of staff without training in radiological protection.

Radiography is by far the most widely used X-ray imaging technique in the Mexican Republic. During radiography with fixed installations, the radiographer would normally be expected to stand in a control booth that is typically shielded as a secondary barrier against X-ray tube leakage and scattered radiation from the room and patient. Depending on room size and barrier thickness, the dose to a radiographer in the control booth area is of few μSv for a single film.

Everyone is exposed to natural radiation. The natural sources of radiation are cosmic rays and naturally occurring radioactive substances existing in the Earth itself and inside the human body. The annual global *per capita* effective dose due to natural radiation sources is 2.4 mSv [1].

MATERIALS AND METHODS

In this exploratory survey the elements in the study were the workers (staff) without training in radiological protection of different radiology departments of the Mexican Republic included general-purpose radiography, computed tomography, mammography and fluoroscopy procedures (the interventional procedures were not included).

The personnel dosimeters used in this study were thermoluminescent dosimeters (TLDs) which are excellent personnel and environmental dosimeters. The number of monitored workers reported was 110 of different departments of radiology and the period of monitoring was every two months during one year. The dosimetry service used is supervised by the Mexican Nuclear Regulatory Commission.

RESULTS AND DISCUSSION

Figure 1 shows the frequency distribution of effective dose from the survey of occupational radiation exposures of workers that participated in the sampling of all measurements.

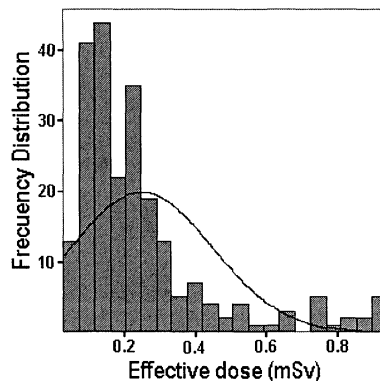


FIGURE 1. Frequency distribution of effective dose to staff by period.

Data on occupational doses to staff from diagnostic radiology are given in the table 1. The effective dose mean was 0.249 mSv/period (two months) but this average is somewhat lower than might be expected because it includes personnel who received very small occupational exposures and the annual doses are from 0.18 mSv to 5.64 mSv and median annual effective dose of 2.9 mSv. The average level of occupational exposures is generally similar to the global average level of natural radiation exposure.

TABLE 1. Statistics of staff radiation dose					
Statistics	Minimum	Maximum	Mean	Standard Deviation	Standard Error
mSv	0.03	0.94	0.2490	0.19928	0.320

Figure 2 shows the results of radiation dose to staff by period and there is not significant difference in the average effective dose by period of monitoring for $p < 0.05$ (except one).

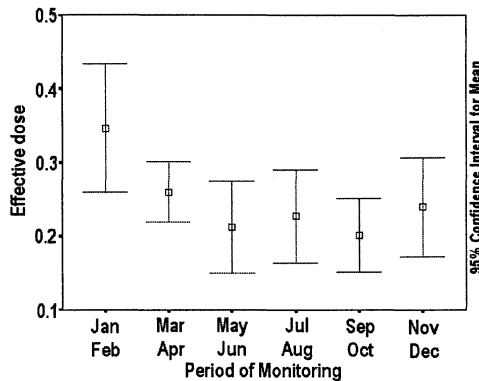


FIGURE 2. Comparison of mean effective dose by period of monitoring with 95% confidence interval.

The annual global *per capita* effective dose due to natural radiation sources is 2.4 mSv. However, the range of individual doses is wide. In any large population about 65% would be expected to have annual effective doses between 1 mSv and 3 mSv [1].

RESULTS AND DISCUSSION

The average level of occupational exposures is generally similar to the global average level of natural radiation exposure for staff without training in radiological protection and there is not significant difference in the average effective dose by period.

REFERENCES

1. UNCEAR, *Sources and Effects of Ionizing Radiation*, UNSCEAR 2000 Report, Vol. I, Annex B, United Nations Scientific Committee on the Effects of Atomic Radiation, Vienna, 2001, pp 29-59.

Copyright of AIP Conference Proceedings is the property of American Institute of Physics and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.