

# Patterns and trends of population radiation exposure and projected the risk of exposure-induced death from gamma camera examinations in Yazd Province

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## Abstract

**Introduction:** The use of nuclear medicine examinations as imaging modalities has recently increased. This study aimed to assess the radiation dose delivered to patients from common diagnostic nuclear medicine examinations and estimate the risk of exposure-induced death (REID). In addition, the frequency of nuclear medicine procedures were evaluated from 2015-2018.

**Materials and methods:** The data were collected from adult patients who had undergone cardiac, skeletal, renal, lacrimal, and thyroid imaging. For each patient, the effective dose was calculated using dose conversion factors, and REID was estimated using PCXMC. The frequency of examinations between 2015 and 2018 was obtained from the hospital information system (HIS).

**Results:** The highest estimated effective dose was attributed to the scans of myocardial stress ( $8.09 \pm 1.28$  mSv), myocardial rest ( $5.59 \pm 1.27$  mSv), and thyroid imaging ( $3.93 \pm 0.55$  mSv). In addition, cardiac stress examination had the highest REID values for solid cancers ( $212.5 \pm 67.5$ ) and bone scans had the highest REID values for leukemia ( $11.5 \pm 2.5$ ). A large increase in the number of myocardial perfusion scans was a significant contributor to an increase in collective effective dose from 23.37 man-Sv in 2015 to 49.47 man-Sv in 2018, a compound annual growth rate (CAGR) of 26%.

**Conclusion:** Although the annual frequency and per capita effective dose of nuclear medicine procedures in Yazd Province increased continuously, they were comparably lower than those reported for other countries. Despite this, the cancer risks of nuclear medicine scans at the individual level are negligible (around 0.01% excess fatal cancer risk), yet the increasing tendency for these examinations could be of concern.

**Keywords:** Cancer risk estimation; Gamma camera examination; Radiation exposure.

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