

# Occupational Health Hazards of Working in the Interventional Laboratory



## A Multisite Case Control Study of Physicians and Allied Staff

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### ABSTRACT

**BACKGROUND** The occupational hazards of working in the interventional laboratory have been inadequately studied for physicians and remain unaddressed for nonphysician personnel.

**OBJECTIVES** This study sought to determine whether the prevalence of work-related musculoskeletal pain, cancer, and other medical conditions is higher among physicians and allied staff who work in interventional laboratories compared with employees who do not.

**METHODS** Mayo Clinic employees who work in affiliated hospitals with interventional cardiology or interventional radiology laboratories took an electronic survey. Results were stratified on the basis of self-reported occupational exposure to procedures that involve radiation.

**RESULTS** There were 1,543 employees (mean age  $43 \pm 11.3$  years, 33% male) who responded to the survey (response rate of 57%), and 1,042 (67.5%) reported being involved with procedures utilizing radiation. These employees reported experiencing work-related pain more often than the control group before (54.7% vs. 44.7%;  $p < 0.001$ ) and after adjustment for age, sex, body mass index, pre-existing musculoskeletal conditions, years in profession, and job description (odds ratio: 1.67; 95% confidence interval: 1.32 to 2.11;  $p < 0.001$ ). Musculoskeletal pain varied significantly by job description, with the highest incidence reported by technicians (62%) and nurses (60%) followed by attending physicians (44%) and trainees (19%;  $p < 0.001$ ). There was no difference in cancer prevalence between groups (9% vs. 9%;  $p = 0.96$ ).

**CONCLUSIONS** Musculoskeletal pain is more common among healthcare workers who participate in interventional procedures and is highest in nonphysician employees. The diagnosis of cancer in employees who participate in procedures that utilize radiation was not elevated when compared to controls within the same departments, although any conclusion regarding causality is limited by the cross-sectional nature of the study, as well as the low overall prevalence of malignancy in our study group. (J Am Coll Cardiol 2015;65:820-6) © 2015 by the American College of Cardiology Foundation.

Fluoroscopically guided interventional procedures performed by cardiologists and radiologists have become increasingly complex as they are applied to new and higher risk patient populations (1-4). These changes can lead to increased procedural times and volumes, which result in additional radiation exposure and more time wearing a protective lead apron (5).

The occupational hazards of working in the interventional laboratory have been incompletely studied for physicians in the modern era, and no study has examined the effect on the nonphysician members of the interventional team. Studies performed over a decade ago on physicians have shown a high prevalence of orthopedic problems (6-9). Findings regarding radiation exposure to healthcare employees

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and the risk of developing cancer have been less consistent (10-15). A major limitation of many of these studies is a bias related to poor response rates on surveys that usually lacked age-matched controls and the exclusion of nonphysician allied health staff.

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Mayo Clinic consists of a large multistate network of physicians and allied health staff who participate in a wide array of interventional procedures that require wearing lead aprons and exposure to radiation. An enterprise-wide survey among all members of the interventional teams comparing results with employees from the same departments not involved in these procedures would circumvent most limitations of the prior studies by providing adequate response rates, a control group, and workplace details that may detect variables associated with work-related hazards. With that background, the aims of the present study were to determine if the prevalence of work-related musculoskeletal pain, cancer, and other medical conditions is higher among the various healthcare employees who work in interventional labs compared with similar employees who do not.

**METHODS**

**RESEARCH SUBJECTS.** The Mayo Clinic consists of 3 major patient care facilities (Rochester, Minnesota; Scottsdale, Arizona; Jacksonville, Florida), as well as the Mayo Clinic Health System facilities in Minnesota (Mankato) and Wisconsin (La Crosse and Eau Claire), which also have interventional facilities. Clinical employees working at these sites within the departments of cardiology and radiology were identified through Human Resources electronic databases. The Mayo Clinic Institutional Review Board approved the study, and medical records were not accessed as a part of this investigation.

**SURVEY TOOL.** With the assistance of the Mayo Clinic Survey Center, an electronic email survey was developed and administered. The survey generates self-reported baseline demographic information (age, sex, weight, and height), baseline work-related information (e.g., exposure to procedures involving radiation, use of protective equipment including the lead apron), and basic personal medical information related to employment in an interventional laboratory (history of musculoskeletal pain, medical evaluation/treatment for musculoskeletal pain, cancer, cataracts, etc.). The Pain Rating Index (PRI) and Present Pain Intensity (PPI) scores were used to assess current pain levels (16). The PRI is a numerical pain scale that ranges between 0 (no pain) and 20 (severe

pain). The PPI is a descriptive pain scale using words to describe the severity of pain (none, mild, discomforting, distressing, horrible, and excruciating). The electronic survey was sent out on September 25, 2013, and was open for 6 weeks. Reminder emails were sent out weekly to nonresponders.

**STATISTICAL METHODS.** Employees who affirmatively responded to survey questions regarding participation in procedures involving radiation were assumed to work in interventional laboratories and comprised the study group. Employees who did not respond affirmatively to these questions comprised the control group. Continuous variables are summarized as mean ± SD or median (25th, 75th percentile). Discrete variables are presented as frequency (group percentage). Missing values were excluded from the denominator for calculating percentages. Differences between groups were compared using Student’s *t* test for near symmetric continuous variables, the rank sum test for skewed continuous and ordinal variables, and Pearson’s chi-square test for categorical variables. Logistic regression models (with and without covariate adjustment) were used to estimate the association between occupational exposure to radiation and potential health risks, such as work-

**ABBREVIATIONS  
AND ACRONYMS**

**PPI** = Present Pain Intensity  
**PRI** = Pain Rating Index

**TABLE 1 Baseline Characteristics**

	Involvement in Procedures With Radiation Exposure (n = 1, 042)	Control Group (n = 499)	p Value
Age, yrs	42.7 ± 11.3	43.5 ± 11.3	0.20
Male	370 (36)	133 (27)	<0.001
Body mass index, kg/m <sup>2</sup>	26.2 ± 4.8	25.8 ± 5.3	0.18
Pre-existing musculoskeletal condition	99 (10)	36 (7)	0.45
Department			<0.001
Cardiology	268 (26)	283 (57)	
Radiology	774 (74)	216 (43)	
Years in current profession*			0.81
0-5	224 (22)	106 (21)	
6-10	212 (21)	107 (22)	
11-15	161 (16)	84 (17)	
16-20	119 (12)	61 (12)	
20+	314 (30)	137 (28)	
Position			<0.001
Physician	160 (15)	45 (9)	
Residents/fellows	68 (7)	5 (1)	
Registered nurse	207 (20)	76 (15)	
Technician/technologist	548 (53)	288 (58)	
Other	59 (6)	85 (17)	

Values are mean ± SD or n (%). \*Sixteen respondents did not answer this question and are not included in denominators for percentage calculations.

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