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Sedentary Behavior in the Workplace: A Potential Occupational Hazard for Radiologists

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In this study, we sought to quantify the sedentary worklife of the radiologist, a potential health risk. Radiologists of all training levels at our academic institution were surveyed to estimate the levels of at-work and out-of-work sitting. Fitbit One activity monitors were used to measure the at-work activity levels of radiology, pediatric, and internal medicine (IM) residents. Correlation between awareness and utilization of dynamic (sitting or standing, walking, or biking) picture archiving and communication system (PACS) workstations among radiology residents was assessed. Among surveyed radiologists ($n = 89$), 78% estimated sitting for at least 6 hours per workday. Estimated workplace sitting accounted for most of the total sitting for 81% of respondents. As measured by activity monitors, radiology residents ($n = 27$) took fewer steps per day (2683 vs 4602 vs 4967) and per hour (294 vs 419 vs 444) and experienced more sedentary time per hour (40.3 vs 36.2 vs 34.9 min/h) than IM ($n = 15$) and pediatric ($n = 9$) residents. Activity experienced during reading room–based work and interventional work was compared by studying 4 additional radiology residents during both types of rotations. Reading-room activity was low, whereas activity on interventional rotations surpassed average levels for the pediatric and IM residents in our study. Radiology residents' ($n = 28$) awareness and utilization of dynamic PACS workstations varied among reading rooms, but were generally low—75% reported never or rarely using them. Resident utilization correlated with awareness of dynamic workstations available at our institution ($R^2 = 0.64$; $P = 0.013$). In conclusion, radiology residents in our study led more sedentary worklives compared with residents from other specialties and took minimal advantage of available tools to mitigate this. Potential health risks of inactivity justify individual and departmental efforts to limit workplace inactivity among radiologists.

Introduction

Physical activity is a highly promoted component of a healthy lifestyle. World Health Organization and US Department of Health and Human Services guidelines cite reduced cardiovascular disease, obesity, cancer, and mortality, among other benefits, when recommending regular moderate-intensity exercise for all individuals.[1,2] An average person spends, at most, 30 minutes, or 3%, of his or her waking time engaged in the levels of physical activity that meet guidelines for a healthy lifestyle and this percentage has steadily decreased over the last several decades. Emerging data suggest that the activity profile of the remaining 97% of the day has a separate influence on health[3]—that is, being "active" may not be enough.

Sedentary behavior, defined as the lack of physical activity, is an increasingly recognized risk factor adversely affecting many of the same health outcomes addressed by exercise recommendations.[4] Strikingly, these risks appear to be independent of one's level of physical activity.[5] Modern life provides ample opportunity for inactivity. Television use continues to rise and the proliferation of mobile devices has eased access to screen-based entertainment. Occupations are increasingly office-based and highly dependent on computers and, as most adults spend many of their waking hours at their jobs, workplace-activity levels have a large influence on an individual's activity profile. Indeed, evidence suggests that most of one's sedentary hours are accumulated while working.[6]

Physicians, as a group, report relatively high fitness levels outside work, which along with other choices such as avoiding smoking and drinking only moderately, suggests that they are healthier than their peers in other professions.[7,8] However, physicians also work more than the average nonphysician (59.6 h/wk vs 38.0 h/wk in the United States),[9,10] resulting in disproportionate exposure to the risks of occupational inactivity. Although the activity profiles of radiologists have not been studied, their darkrooms and desk-bound workstations, rather than clinics, operating rooms, and bedsides, may pose an even greater risk.

Workplace activity among doctors has received little attention in the literature. To our knowledge, there are only 2 investigational studies examining the activity by doctors at work (general surgeons and internal medicine [IM] physicians).[11,12] No studies have specifically examined radiologists, although there are a number of commentaries on the subject highlighting the interest and concern within the specialty.[13-16]

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Given the relatively sedentary workplace resulting from the radiologists' job requirements, we hypothesize that workplace activity among radiologists is markedly less than that among their peers in other specialties. To test this, we measured workplace activity levels among resident physicians from radiology, pediatric, and IM departments. We also assessed radiology residents' awareness and use of the tools available at our institution to limit workplace inactivity in the reading room.

We aim to quantify the sedentary worklife of radiology residents to better define a radiologist's potential health risk and, secondarily, motivate individuals, as well as radiology leadership, to intervene.

Methods

Subjects and Surveys

This survey and observation-based departmental quality improvement project was deemed exempt from Institutional Review Board approval.

To assess workplace-activity attitudes and estimate behaviors among radiologists, a voluntary, anonymous electronic survey (based on a survey by Chau et al[17]) using the SurveyMonkey online survey tool (SurveyMonkey Inc., Palo Alta, CA, www.surveymonkey.com/) was distributed to all resident, fellow, and attending radiologists at our institution, a large, urban, and multisite academic medical center. The survey is provided as an appendix.

To measure workplace activity, radiology residents performing clinical duties across subspecialties at each of our teaching hospitals were contacted by email and invited to participate. Activity monitors, described later, were distributed to interested residents as they became available. To recruit residents from pediatric and IM departments, resident rosters were obtained from program coordinators and 20 residents were randomly chosen from each program to be invited by email correspondence. If a resident declined to participate or could not be reached, the next resident on the roster in alphabetical order was invited. Our target resident subject number was 30 from radiology, 15 from IM, and 15 from pediatrics, based on a power calculation ($\beta < 0.2$) and feasibility of distributing activity monitors.

Dynamic radiology workstations–defined as workstations designed to allow standing, walking or running, biking, or other nonsedentary activity while working–were available in multiple reading rooms at the affiliated hospitals within our institution. To estimate knowledge and utilization of these dynamic workstations in mitigating workplace inactivity, a separate voluntary, nonanonymous paper survey was distributed to all radiology residents at our institution. We asked residents to (1) recall whether each reading room at our institution, regardless of whether the resident had rotated there, was equipped with at least one of these dynamic workstations and (2) to estimate their own frequency of using a workstation with these capabilities.

Activity Monitoring

Fitbit One wireless activity monitors (Fitbit Inc., San Francisco, CA) were used to track workplace activity. Participants were instructed to wear the monitor, according to manufacturer's recommendations,[18] at all times while working, and to keep a log of workday start and stop times. All workplace activity during a consecutive 1-week period was recorded and analyzed. Assuming residents from all specialties can choose their means of transportation to and from work, commuting activity levels were not measured. If the participant lost or forgot to wear his or her monitor such that fewer than 4 workdays were recorded, a new week of monitoring was initiated.

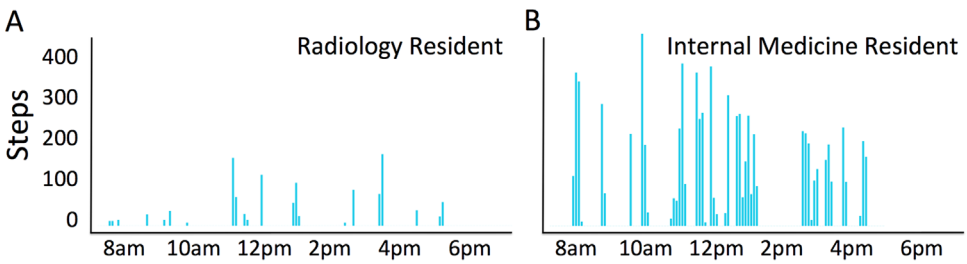
We initially distributed activity monitors to radiology residents rotating on many different subspecialties and our comparison with IM and pediatrics includes data from predominantly diagnostic rotations. To test our hypothesis that procedural duties increase workplace activity levels, we monitored 4 additional radiology residents on 2 different rotations—a reading room–based diagnostic rotation and an interventional procedures rotation. A total of 2 authors, both radiology residents, communicated with all potential and eventual study participants and arranged activity monitor distribution and retrieval.

Data Analysis

Data from activity monitors were uploaded to a Fitbit online account. For each workday, total steps per day and a daily activity graph depicting recorded steps per 5-minute interval (Fig. 1 for examples) were obtained from Fitbit.com. ImageJ software (version 1.47v, National Institutes of Health, Bethesda, MD) was used to extract numerical data from graphical data. Total steps per workday and per hour and total sedentary time per workday and per hour were recorded for each participant. Averaged data from 1 week were used for comparisons.

Statistical Analysis

Statistical analyses were performed using R (version 3.1.2; R Foundation for Statistical Computing, Vienna, Austria). Analysis of variance was used to compare radiology, pediatric, and IM resident



1153	Total steps
118	Steps/hour
7.76	Sedentary hours
47.9	Sedentary min/hr

8206	Total steps
958	Steps/hour
4.35	Sedentary hours
30.5	Sedentary min/hr

Fig. 1. Fitbit One daily activity graphs. Examples of Fitbit One data as presented on Fitbit.com from a single workday of a (A) radiology and (B) internal medicine resident. Each bar represents the number of steps registered in a 5-minute interval. Intervals with no registered steps are considered "sedentary." Data presented in Figs. 2 and 3 were generated from numerical data extracted from daily activity graphs using ImageJ software. (Color version of figure is available online.)