

# Use of an Online Education Platform to Enhance Patients' Knowledge About Radiation in Diagnostic Imaging

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## Abstract

**Purpose:** The aim of this study was to compare the impact of a digital interactive education platform and standard paper-based education on patients' knowledge regarding ionizing radiation.

**Methods:** Beginning in January 2015, patients at a tertiary cancer center scheduled for diagnostic imaging procedures were randomized to receive information about ionizing radiation delivered through a web-based interactive education platform (interactive education group), the same information in document format (document education group), or no specialized education (control group). Patients who completed at least some education and control group patients were invited to complete a knowledge assessment; interactive education patients were invited to provide feedback about satisfaction with their experience.

**Results:** A total of 2,226 patients participated. Surveys were completed by 302 of 745 patients (40.5%) participating in interactive education, 488 of 993 (49.1%) participating in document education, and 363 of 488 (74.4%) in the control group. Patients in the interactive education group were significantly more likely to say that they knew the definition of ionizing radiation, outperformed the other groups in identifying which imaging examinations used ionizing radiation, were significantly more likely to identify from a list which imaging modality had the highest radiation dose, and tended to perform better when asked about the tissue effects of radiation in diagnostic imaging, although this difference was not significant. In the interactive education group, 84% of patients were satisfied with the experience, and 79% said that they would recommend the program.

**Conclusions:** Complex information on a highly technical subject with personal implications for patients may be conveyed more effectively using electronic platforms, and this approach is well accepted.

**Key Words:** Ionizing radiation, patient education, patient safety

*J Am Coll Radiol* 2017;14:386-392. Copyright © 2016 American College of Radiology

## INTRODUCTION

Imaging studies that use ionizing radiation are widely used in oncology to diagnose disease, assess treatment response, and monitor for recurrence. Little has been published about patients' understanding of ionizing radiation, but a recent study by our group [1] conducted at a tertiary cancer center revealed that many patients did

not understand ionizing radiation or its potential risks. Although the scientific understanding of stochastic risks of exposure to ionizing radiation (eg, cancer) is rapidly evolving and hotly debated [2], the tissue effects caused by high doses of radiation (eg, skin burns, hair loss, infertility) are not disputed. Interestingly, data from our recent study demonstrate that patients understood

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Dr Steele received grant funding from HealthLoop (Mountain View, California), which supported a research assistant and graduate student. A percentage of the grant went to The University of Texas MD Anderson Cancer Center to cover indirect costs. All other authors have no conflicts of interest related to the material discussed in this article.

neither the stochastic risks nor the tissue effects [1] related to ionizing radiation exposure.

Concern about risks from exposure to ionizing radiation in health care goes back to within 6 months of Roentgen's discovery of the x-ray [3]. Recently, public concern over lay reports of latent pediatric CT-associated cancer cases [4], news of radiation overdoses [5,6], and epidemiologic projections of lifetime cancer risk associated with CT [7,8] have prompted reconsideration of data, practices, and risks associated with ionizing radiation and increased educational initiatives not only by radiology professionals [9,10] but also by the US government [11] to promote the safe use of medical imaging. However, when performed appropriately, imaging studies that use ionizing radiation very rarely cause tissue effects, and radiologists often use diagnostic algorithms that help avoid unnecessary examinations that may result in unnecessary patient exposure.

Patient health literacy about the risks of ionizing radiation is critically important to drive productive shared decision making between patients and providers about which imaging studies patients should undergo. Patient participation in such decision making is an example of patient engagement, which has been called the "blockbuster drug of the 21st century" [12]. However, low health literacy, low education levels, and low technology literacy remain barriers to successful patient engagement and therefore barriers to better patient outcomes [13].

In an effort to improve patient education on the use of ionizing radiation in medical imaging, the Division of Diagnostic Imaging at The University of Texas MD Anderson Cancer Center partnered with a company that creates software for delivering patient education and facilitating provider-patient communication. The purpose of this study was to compare the impact of a web-based digital interactive education platform and standard paper-based education materials on patients' knowledge of ionizing radiation in medical imaging.

## METHODS

### Web-Based Interactive Education Platform

A web-based digital interactive education platform developed by HealthLoop (Mountain View, California) was used to present educational content and facilitate automated communication between study patients and their health care team. The Division of Diagnostic Imaging collaborated with HealthLoop to produce a series of five brief videos that introduced the learner to the diagnostic imaging department and common imaging studies. The videos were scripted and narrated by a faculty radiologist

(J.R.S.) and a diagnostic medical physicist (A.K.J.). The videos provided a virtual tour of the radiology department and details about ultrasonography, CT, MRI, interventional radiology, and radiography. For example, in the video about CT, the faculty radiologist and medical physicist discussed CT while standing next to the CT scanner, demonstrated typical patient positioning, and showed examples of the images produced. Within the digital platform, learners could not only watch the five videos but also contact their imaging care team through a secure messaging system, and the care team could respond to patients through the same system. Through automated e-mails generated by the platform and addressed from the physician, patients randomly assigned to use the platform were invited daily to engage for each of the 5 days before their scheduled diagnostic imaging examinations. Every day, patients would check in using a link provided in the e-mail, watch a new video, and be offered the opportunity to provide feedback or contact the health care team.

### Participant Selection, Randomization, and Study Design

From January 2015 through July 2015, patients were randomly selected from the radiology schedule 1 week before their scheduled imaging studies and invited via email to participate in the study. Participants were assigned randomly to one of three study groups: the interactive education group, which was invited to watch all five videos; the document education group, which received identical information presented in a read-only, nonprintable PDF document, designed so that patients would not be able to refer to the information when completing the post-intervention knowledge assessment questionnaire; or the control group, which received no educational intervention. The study team included physicians, nurses, a study coordinator, a statistician, a program manager, and administrative staff members and was led by physicians (principal investigator, J.R.S.; co-principal investigator, S.P.).

Study participants in groups 1 and 2 who at least accessed the educational materials provided and those in the control group were invited to complete a knowledge assessment questionnaire that our group previously published [1]. The questionnaire included questions about the definition of ionizing radiation, types of imaging studies that use ionizing radiation, doses of ionizing radiation from various types of imaging studies, and potential risks of exposure to ionizing radiation. Participants assigned to the interactive education group who completed the knowledge assessment were also invited to complete a feedback survey about their experience with the platform.

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