

Patient Perceptions of Computed Tomographic Imaging and Their Understanding of Radiation Risk and Exposure

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Study objective: We describe patient perceptions of computed tomography (CT) and their understanding of radiation exposure and risk.

Methods: This was a cross-sectional study of acute abdominal pain patients aged 18 years or older. Confidence in medical evaluations with increasing levels of laboratory testing and imaging was rated on a 100-point visual analog scale. Knowledge of radiation exposure was ascertained when participants compared the radiation dose of one abdomen-pelvis CT with 2-view chest radiography. To assess cancer risk knowledge, participants rated their agreement with these factual statements: “Approximately 2 to 3 abdominal CTs give the same radiation exposure as experienced by Hiroshima survivors” and “2 to 3 abdominal CTs over a person’s lifetime can increase cancer risk.” Previous CT was also assessed.

Results: There were 1,168 participants, 67% women and mean age 40.7 years (SD 15.9 years). Median confidence in a medical evaluation without ancillary testing was 20 (95% confidence interval [CI] 16 to 25) compared with 90 (95% CI 88 to 91) when laboratory testing and CT were included. More than 70% of participants underestimated the radiation dose of CT relative to chest radiography, and cancer risk comprehension was poor. Median agreement with the Hiroshima statement was 13 (95% CI 10 to 16) and 45 (95% CI 40 to 45) with the increased lifetime cancer risk statement. Seven hundred ninety-five patients reported receiving a previous CT. Of 365 patients who reported no previous CT, 142 (39%) had one documented in our electronic medical record.

Conclusion: Patients are more confident when CT imaging is part of their medical evaluation but have a poor understanding of the concomitant radiation exposure and risk and underestimate their previous imaging experience. [Ann Emerg Med. 2011;58:1-7.]

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0196-0644/\$-see front matter

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doi:10.1016/j.annemergmed.2010.10.018

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INTRODUCTION

Background

Use of computed tomography (CT) has increased dramatically since its inception in 1970, with the number of annual scans increasing from approximately 2 million in 1980 to an estimated 72 million in 2007.¹⁻⁴ In contrast to magnetic resonance imaging (MRI), CT can be performed within minutes, is widely available, and allows health care providers continual access to patients for monitoring and medical management. Unlike ultrasonography or radiography, CT provides greater level of detail and allows simultaneous imaging of organs, vessels, musculature, and bone. This feature is particularly advantageous in patients with abdominal pain where the cause of the pain may be unclear because of a

depressed mental status, trauma, or concurrent medical conditions, such as diabetes or immunosuppression, which may mask or alter pain sensation and thresholds.^{5,6} Additional support for the liberal use of abdomen-pelvis CT is that it has been demonstrated to increase emergency physician certainty of diagnosis, decrease the need for emergency surgery from 13% to 5%, and avert up to 24% of proposed hospital admissions.^{6,7} Despite these benefits, however, there is growing concern that CT is being overused, and it is estimated that 1.5% to 2.0% of all cancers in the United States may now be attributable to the radiation from CT examinations.^{2,4}

Importance

In 2010, the controversy surrounding CT overuse led the Food and Drug Administration (FDA) to unveil an initiative to

Editor's Capsule Summary

What is already known on this topic

Emergency department (ED) use of computed tomography (CT) has rapidly increased, resulting in substantial radiation exposure to patients.

What question this study addressed

The authors surveyed 1,168 ED patients with abdominal pain to assess their confidence in medical evaluations that ranged from history and physical only, to history and physical, laboratory testing, and CT imaging, and their understanding of radiation exposure and radiation-related cancer risk.

What this study adds to our knowledge

Patients reported far greater confidence in evaluations that included CT but substantially underestimated the amount of radiation involved and the risks of that radiation.

How is this relevant to clinical practice

These results reinforce the need for increased public education about the appropriate use of CT imaging and the risks inherent in such imaging.

reduce unnecessary radiation exposure from medical imaging through collaboration with other federal agencies and health care professional groups.⁸ It also proposed the development and dissemination of a patient medical imaging history card, whereby patients would track their own medical imaging history and share it with their physicians.⁸ A major limitation of this initiative is that little effort is being expended on assessing patients' knowledge and perceptions of radiation risk and exposure. Patient expectations are also not addressed in the FDA initiative, and this omission is compounded by a dearth of literature on the topic.^{8,9} If patient expectations for imaging are high or if their understanding of radiation risk is poor, then efforts to reduce unnecessary radiation exposure from such imaging may pose an even greater challenge for health care providers.

Goals of This Investigation

The goals of this investigation were 3-fold. The first was to assess patients' confidence levels with medical evaluations that ranged from a physician-conducted history and physical examination (minimal technology) to one that included a history and physical examination, blood work, and an abdomen-pelvis CT (maximum technology). Second, we attempted to assess patients' understanding of relative radiation exposure by asking them to compare the amount of radiation exposure from one abdomen-pelvis CT to increasing numbers

of 2-view chest radiographs (standard posterior-anterior and lateral chest series). Third, we attempted to measure patients' understanding of cancer risk caused by CT imaging, using level of agreement with 2 factual statements.

MATERIALS AND METHODS

Study Design

We performed a cross-sectional study of adult patients aged 18 years and older who presented to the emergency department (ED) for the evaluation of acute, nontraumatic abdominal pain and assessed their expectations and confidence with increasing diagnostic levels of medical evaluation and their understanding of radiation risk and exposure from abdomen-pelvis CT. The Institutional Review Board at Cooper University Hospital reviewed and approved the study. Written informed consent was obtained from all participants.

Setting

The study was conducted from March 2008 to May 2009 at an urban, tertiary referral university hospital ED, with an annual ED census of 56,000 visits during the study period.

Selection of Participants

The recruitment of abdominal pain patients enabled us to capture a sample of patients whose presenting chief complaints would lead to a broad range of medical and diagnostic evaluations. Patients were eligible for inclusion if they were aged 18 years or older and presented with nontraumatic abdominal pain lasting 72 hours or less. Patients were excluded if they were pregnant, sustained abdominal trauma or underwent abdominal surgery within the previous 7 days, or were unable to complete the questionnaire. If there was a concern about a patient's mental status or cognitive state, research associates were instructed to discuss enrollment with the attending physician before enrolling the patient. Patients were enrolled only once, and completion of CT was not required for inclusion. The questionnaire was in English, and Spanish-speaking patients were encouraged to participate if they could understand and answer the survey items comfortably. Spanish-speaking-only subjects were not enrolled.

Methods of Measurement

We developed and pilot-tested a brief questionnaire designed to assess patients' confidence with a series of medical evaluation scenarios representing increasing levels of diagnostic evaluation. We also included items assessing patient knowledge and awareness of radiation risk and exposure that were based on previously published data.² Content items were field tested among a small sample of ED patients (n=30) and refined for clarity by the investigators. At the request of ED faculty, who expressed concerns that administration of the questionnaire would increase patient anxiety, investigators also prospectively noted whether administration of the pilot questionnaire resulted

in a reluctance by patients to undergo further medical imaging, specifically, CT. This did not occur.

The final questionnaire was composed of 2 parts. The first portion obtained patient demographics, socioeconomic factors, and education level, as well as triage classification and triage pain score (an 11-point Likert-type scale from no pain [0] to severe pain [10]). Medical management of patients, including whether patients underwent ancillary testing such as blood work, sonography, and CT, was determined through retrospective review of the medical record. The second portion of the questionnaire asked participants to rate their confidence in the accuracy of a medical evaluation of their abdominal pain if it included (1) a physician-conducted medical history and physical examination only; (2) a physician-conducted medical history and physical examination and blood work; (3) a physician-conducted medical history and physical examination, blood work, and an ultrasonographic examination; and (4) a physician-conducted medical history and physical examination, blood work, and an abdomen-pelvis CT. These scenarios were presented in succession. A 100-mm visual analog scale was used for the confidence scale, with 0=no confidence and 100=complete confidence. Knowledge of radiation exposure and risk were obtained by 3 items. Participants were asked to rate how much radiation an abdomen-pelvis CT has compared with a 2-view chest radiograph series ("X-ray"). Previous literature estimates the radiation dose for an abdomen-pelvis CT to be equivalent to 100 to 250 2-view chest series.^{2,10-12} For the purpose of this investigation, we used the conservative estimate of 1 abdomen-pelvis CT=100 2-view chest radiographs. Finally, participants were asked to rate their level of agreement by using a 100-mm visual analog scale, with 0=no agreement and 100=complete agreement, with the following 2 statements: "About 2 to 3 abdominal CTs give the same radiation exposure that survivors of the Hiroshima nuclear bombing received" and "Receiving 2 to 3 abdominal CTs over a person's lifetime can increase the chance of cancer." Both of these statements are true and well supported by the literature.^{2,11}

In addition to the above items, participants were also asked whether they had ever received a CT scan. We searched the electronic medical record of each participant and tallied the numbers of CTs completed in the 5 years preceding their enrollment. A copy of the data collection form is available in Appendix E1 (available online at <http://www.annemergmed.com>).

Data Collection and Processing and Primary Data Analysis

Trained research assistants, present in the ED 20 hours daily (from 9 AM to 5 AM the following day) 7 days a week, identified and enrolled eligible patients. Because the period from 5 AM to 9 AM is typically a very low-volume period in our ED, we did not pursue enrollment during this time. Potential subjects were approached immediately after the initial physician encounter and before any imaging was conducted. Printed questionnaires were administered by the research associates, and if subjects wished to complete these on their own, they did so in the presence of the research

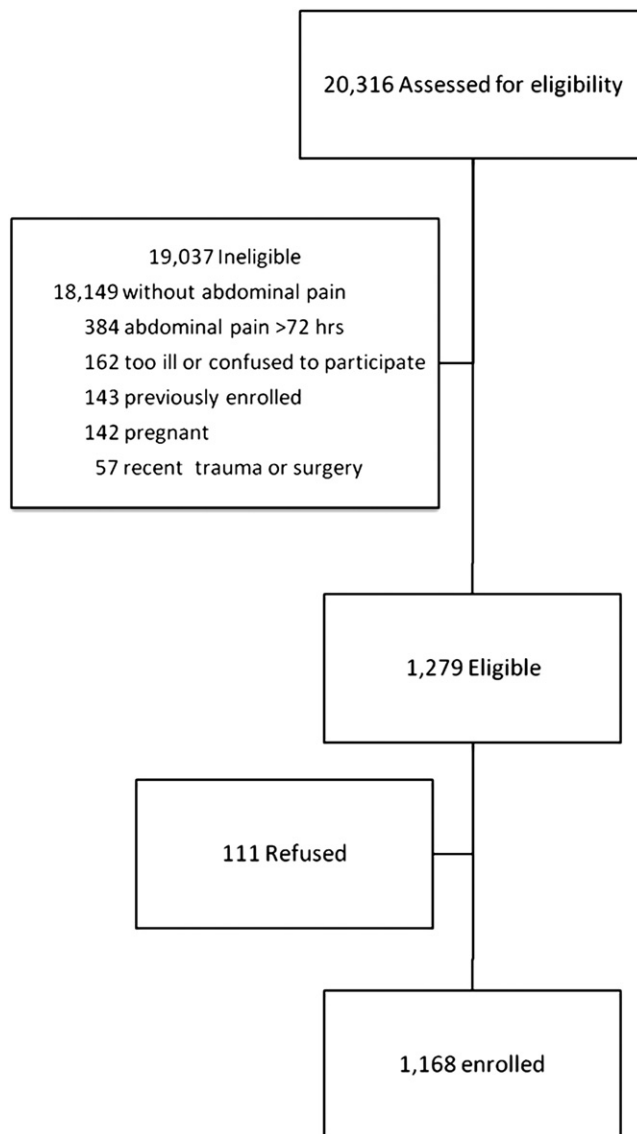


Figure 1. Screening and enrollment.

associate. This was done so that if the subject had any questions, they could be immediately answered.

Data are presented with summary statistics, means and medians with 95% confidence intervals (CIs) for continuous data and proportions for categorical data.

RESULTS

Characteristics of Study Subjects

Of the 1,279 patients who were screened and eligible according to abdominal pain characteristics and cognitive ability to complete the questionnaire, 111 refused, leaving 1,168 (91%) participants (Figure 1). The majority of patients were women (67%) and white (57%). Most completed at least a high school level education and more than one quarter had an annual income of less than \$20,000. Table 1 provides additional socioeconomic and presenting characteristics of participants.

Table 1. Participant characteristics.

Characteristic	n=1,168
Female, No. (%)	786 (67)
Age, y, mean (SD)	40.7 (15.9)
Race	
White	666 (57)
Black	469 (40)
Asian or other	33 (3)
Hispanic	320 (27)
Triage classification*	
2	111 (10)
3	897 (77)
4	143 (12)
5	9 (1)
Pain score, mean (SD)	7.7 (2.5)
Disposition	
Discharged	835 (72)
Admitted	321 (28)
Left against medical advice	12 (1)
Education level	
Did not complete high school	273 (23)
Completed high school or vocational school	463 (40)
Some college	221 (19)
College graduate	134 (12)
Refused to answer	77 (7)
Annual household income, \$	
<20,000	304 (26)
20,001–40,000	187 (16)
40,001–60,000	84 (7)
60,001–80,000	64 (6)
>80,000	112 (10)
Don't know/confidential	417 (36)
Insurance status	
Private/health maintenance organization	422 (36)
Medicare	128 (11)
Medicaid	305 (26)
Charity care	150 (13)
Self-pay	163 (14)

*Eight patients did not have a triage level recorded.

Patient confidence in the accuracy of progressive levels of medical evaluation is presented in Table 2. Confidence was lowest for a medical evaluation that was limited to a physician-conducted history and physical examination. The addition of laboratory testing and imaging resulted in a nearly 4-fold increase in confidence, with the highest confidence level in patients who were presented with the option of CT.

Patient knowledge about radiation exposure is presented in Figure 2. When asked to compare the amount of radiation from an abdomen-pelvis CT to a 2-view chest radiograph series, more than 70% of participants underestimated the relative amount. Of the 121 participants who did not complete this item, 50 expressed confusion with this question's options because they thought that CT delivered *less radiation* than a 2-view chest radiograph series. When participants were asked about their level of agreement with the 2 radiation exposure and risk statements, patients had a low level of agreement with the statement "2 to 3 abdominal CTs give the same radiation exposure that survivors of Hiroshima received" (median level of

agreement 13 [95% CI 10 to 16]). Only 61 (5%) participants noted a level of agreement greater than or equal to 90, and 114 (10%) noted a level of agreement greater than or equal to 70 (Figure 3). There was a higher median level of agreement with the second statement, "2 to 3 abdominal CTs over a person's lifetime can increase the chances of cancer" (median level of agreement 45 [95% CI 40 to 45]). As with the first statement, only a minority of participants, 156 (13%), demonstrated a very high level of agreement (≥ 90 on the visual analog scale), and only 258 (23%) noted a moderately high level of agreement (≥ 70 on the visual analog scale) (Figure 4).

To assess participants' recollection of previous CT exposure, we asked patients to note whether they had ever received a CT scan. Seven hundred ninety-five (68%) patients stated that they had received a CT scan. Of these, 581 had a CT scan documented in our electronic medical record. Eight participants declined to answer because they were unsure, and 365 (31%) stated that they had never received a CT scan. Of the 365 patients who reported no previous CT scan, 142 (39%) had received a CT scan that had been completed within the past 5 years, documented in our electronic medical record. For those who had a study documented in our system and reported a previous CT scan, the mean number of scans in the previous 5 years was 5.4 (95% CI 4.9 to 5.9), with a range of 1 to 57 scans. For those who denied a previous CT scan but had at least 1 documented in their electronic medical record, the mean number of scans was 2.4 (95% CI 2.1 to 2.6 scans) during the past 5 years (range 1 to 16 scans). Figure 5 depicts the number of scans during the past 5 years for participants according to data obtained from our electronic medical records.

LIMITATIONS

There are several limitations to this investigation. First, this study was conducted at a single site with a convenience sample of nontraumatic, nonpregnant abdominal pain patients. Thus, our results may not be generalizable to other settings or to other populations. We attempted to mitigate any bias caused by convenience sampling by conducting enrollments for 20 hours a day, 7 days each week. Because our study was conducted at an inner-city ED, we had large proportions of patients who did not attain college degrees, and approximately 25% of the sample lived near or at poverty levels. Thus, our results may not be applicable to community EDs in suburban areas, but our findings are likely representative of those that would be obtained in other urban settings. Second, some participants did not respond to all items. Specifically, when asked about the relative radiation exposure of abdomen-pelvis CT compared with a 2-view chest radiograph series, at least 41% of the nonrespondents left this item blank because there was no option for CT radiation exposure to be less than that of chest radiographs. In an attempt to avoid confusion with questionnaire items, we conducted a pilot study of our questionnaire. This did lead to revision of several items to improve their clarity and the quality of participants' responses, including the replacement of the phrase "abdomen-pelvis CT" with "abdominal CT" because

Table 2. Patient confidence with physician evaluation.

Evaluation Type	Confidence Level*			No. (%) Who Had This Completed†
	Median Visual Analog Scale Score	Interquartile range	95% CI	
History and physical examination only	20	1, 72	16–25	77 (7)
History and physical examination and blood work	84	50, 100	80–85	271 (23)
History and physical examination, blood work, and an ultrasonographic examination	85	55, 100	84–87	22 (2)
History and physical examination, blood work, and CT	90	60, 100	88–91	436 (37)

*Confidence levels with respect to medical evaluations were obtained from all participants.

†This column indicates the number of subjects who underwent the stated diagnostic evaluation. The total for this column does not equal the entire sample (n=1,168) because some patients may have undergone alternative evaluations. For example, participants who had a medical history and physical examination, a urinalysis, and a CT (for a nephrolithiasis diagnostic evaluation) would not be included in this column.

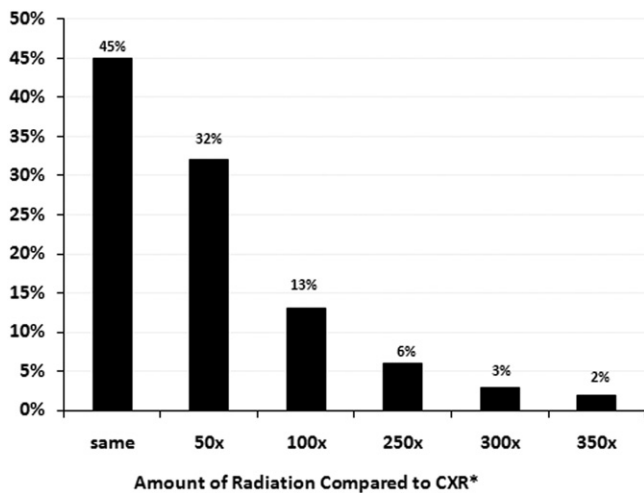


Figure 2. Patients’ understanding of relative radiation caused by CT versus chest radiography. *Of the 121 subjects who did not complete this item, 50 noted on the questionnaire that they thought the amount of radiation caused by CT was less than that from a 2-view chest series. CXR, Chest radiograph.

some patients thought the former referred to 2 separate imaging studies. The difficulty with this one item, with respect to a patient’s estimation that the radiation dose for an abdomen-pelvis CT would be lower than a chest radiograph series, was not made evident during our initial testing. Third, although we endeavored to enroll patients before any imaging was completed, we were not able to control whether patients were told that they would undergo an imaging procedure. It is possible that, for patients who were aware of their impending imaging, this affected their confidence ratings for the medical evaluation scenarios. Finally, our results pertaining to patients’ previous experiences with CT likely underestimated the number of patients who claimed that they had never received a CT scan when in fact they did. This underestimate is due to the limitations of our electronic medical record, which recorded data only from 2002 to the time of our investigation, and the likelihood that participants may have undergone CT at other institutions or outpatient sites.

Figure 3. Level of agreement with the statement “2 to 3 abdominal CTs give the same radiation exposure that survivors of Hiroshima received.” VAS, Visual analog scale.

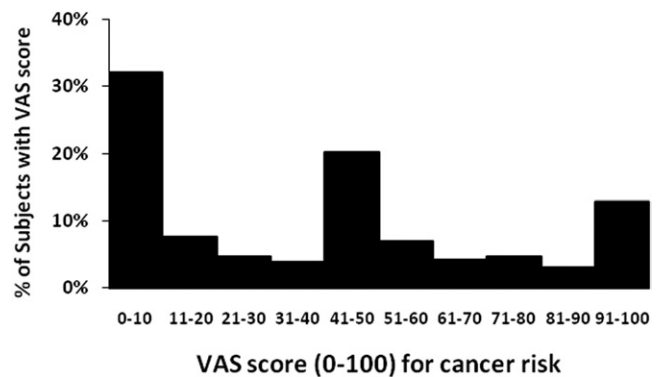


Figure 4. Level of agreement with the statement “2 to 3 abdominal CTs over a person’s lifetime can increase the chances of cancer.”

DISCUSSION

Our findings demonstrate that patients who present to the ED with acute, nontraumatic abdominal pain have higher levels of confidence with evaluations that include laboratory testing and imaging. We also determined that patients underestimate the amount of radiation exposure of an abdomen-pelvis CT scan, and we identified a minority of patients who had no recollection of their previous CT scans. Given the increasing concerns about unnecessary radiation exposure from medical

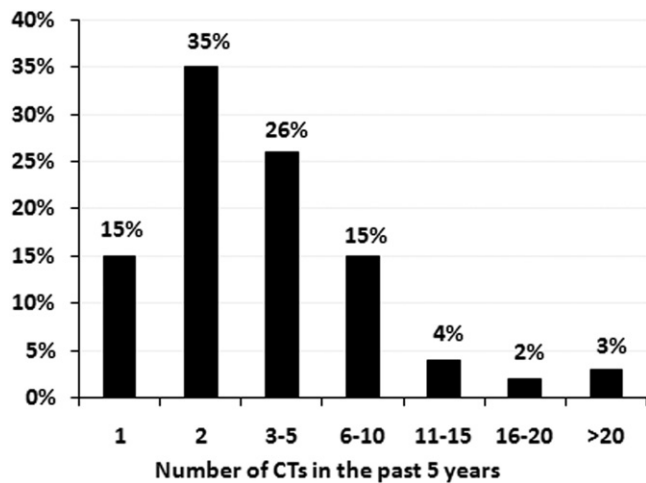


Figure 5. Number of CTs per patient in the past 5 years.

imaging, our findings suggest that efforts to reduce unnecessary medical imaging will need to not only address health care provider practices but also include patient education and awareness.

The majority of patients in our sample expressed a low level of confidence with medical evaluations that were limited to a physician-conducted history and physical examination. According to our assessment of patient confidence with 4 medical scenarios, abdominal pain patients expect some type of laboratory or radiologic testing, as evidenced by a nearly 4-fold increase in patient confidence level with just the addition of blood work to a physician-conducted history and physical examination and the highest level of confidence when the medical evaluation includes a CT scan. We also determined that patient understanding of radiation exposure caused by CT was poor. When patients were asked to compare the relative amount of radiation obtained from an abdomen-pelvis CT scan, the percentage who underestimated the amount (approximately 75% of our sample) was an improvement over the findings obtained in a previous study by Lee et al.¹⁰ In this latter investigation, 67 patients were asked to provide radiation exposure estimates, and all (100%) underestimated the exposure level.¹⁰ With respect to radiation risk, our sample had low median agreement with the Hiroshima statement and moderate median agreement with the cancer risk statement. Future cancer risk was also assessed by Lee et al,¹⁰ but in a slightly different fashion. Patients were asked whether they believed that the lifetime risk of cancer was increased by CT scan. In this investigation, only a minority, 2 of 76 (3%), concurred.¹⁰

More than 80% of patients either admitted to having received a CT scan or, for those who denied receiving a CT scan, had one documented in our electronic medical record. Although it is possible that some patients may have reported receiving a CT scan when in fact they had never received one, our data suggest otherwise: Using only our medical records, we were still able to corroborate CTs for 73% of patients who

stated that they had received a scan. We also identified an additional 142 patients who had a CT scan documented in our system (within 5 years of enrollment) when they denied having had a CT scan. We did not attempt to determine the basis for this discrepancy, but possible causative factors are poor patient recollection, altered mental status at imaging (eg, intoxication, head injury caused by trauma), lack of recognition of the type of previous testing, and confusion when multiple imaging studies occurred during the same visit. The number of previous studies conducted on our sample was also of concern to us, with the number of CTs ranging from 1 to 57 (1 to 33 in the subset who had no history of cancer) and a mean of 5.4 scans during the past 5 years for those who had a CT scan documented in our electronic medical record. Our findings were much higher than those obtained in a recent retrospective cohort.¹³ In this investigation, patients who underwent any type of CT during 2007, with the exception of interventional CT procedures, were included in the sample and the previous 22 years' worth of electronic medical records were reviewed. Here, 33% of patients underwent more than 5 CT examinations, 5% underwent more than 22, and 1% underwent more than 38 during this period.¹³

Extrapolating the number of CTs during 22 years, using our data, 53% of our sample would have had more than 5 CT scans, 15% would have had more than 22, and 3% would have had more than 32 scans during a 22-year period. This assumes that the baseline rate of CT per patient does not change, which is likely an underestimate, although perhaps not as much as one might expect. Although the estimated number of CT scans performed annually in the United States has continued to increase during the past 30 years, the highest rate of increase occurred between 1993 and 1997, and by 2000, we had reached the inflection point of this curve.² Irrespective of whether CT rates were to level off or continue to increase, our data suggest a high use of previous CT imaging in our abdominal pain patient population.

The concerns about overuse of medical imaging are well justified. A recent study by Korley et al¹⁴ demonstrated that the use of advanced medical imaging in the ED for injury-related conditions increased from 6% to 15% from 1998 to 2007, with CT composing more than 99% of all studies. This dramatic increase, however, was not accompanied by a concomitant increase in the prevalence of life-threatening conditions. One could argue that increased use of medical imaging may have avoided unnecessary hospital admissions, yet this did not occur. Both hospitalization rates and admission rates to ICUs were unchanged from 1998 to 2007, and, although not a primary objective of this investigation, visits during which CT or MRI was obtained lasted 126 minutes longer than those for which CT or MRI was not obtained.¹⁴ These findings suggest that medical imaging may indeed be overused.

According to Brenner and Hall,² it is estimated that 1.5% to 2% of all cancers in the United States may be attributable to the radiation from CT studies. Smith-Bindman et al¹¹ estimated that 1 in every 270 40-year-old women undergoing a CT

coronary angiogram will develop cancer from the procedure. Berrington de González et al⁴ projected 29,000 excess cancers as a result of the CT scans conducted in 2007.⁴ These cancers are expected to appear in the next 20 to 30 years, with an associated 50% mortality rate. Strategies for decreasing the risks associated with CT imaging include increasing efforts to educate physicians, improving radiation protocols to enable technicians to select the lowest-dose scanning techniques without compromising resolution, and increasing patient awareness of their own radiation exposure by using aids such as FDA medical imaging history cards.^{2,8,11,15-18} According to our findings, we maintain that the current mandated patient awareness efforts are not sufficient. Increased awareness cannot translate to increased health literacy if patients do not understand what their exposures mean.

In conclusion, we determined that patients' confidence levels in their medical evaluation increased with increasing use of technology, with the inclusion of CT yielding the highest degree of patient confidence in a medical evaluation. We also determined that patients underestimate the relative amount of radiation exposure of an abdomen-pelvis CT compared with a 2-view chest radiograph series, as well as underestimate the risk of cancer caused by CT imaging. Finally, in our review of previous CT imaging, using our electronic medical records, we demonstrated that patients not only underestimate their previous CT exposure but also have relatively high rates of CT scans compared with rates previously reported in the literature.^{13,16} We suggest that future efforts to curtail unnecessary medical imaging consider these findings and use them to guide investigations aimed at determining patient understanding of radiation risk and exposure in other patient populations. These future findings, in conjunction with ours, should guide patient education and awareness efforts.

The authors acknowledge Barry Milcarek, PhD, for his assistance with this article and his statistical expertise.

Supervising editor: David T. Overton, MD, MBA

Author contributions: BMB, EHC, AMM, and MCF were responsible for study design and data collection. LG, NMT and MKJ assisted with data collection. BMB conducted the statistical analyses. All authors contributed to data interpretation and article preparation. BMB takes responsibility for the paper as a whole.

Funding and support: By *Annals* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see www.icmje.org). The authors have stated that no such relationships exist.

Publication dates: Received for publication July 19, 2010. Revision received October 11, 2010, and October 20, 2010. Accepted for publication October 25, 2010. Available online December 13, 2010.

Presented at the Society for Academic Emergency Medicine annual meeting, May 2009, New Orleans, LA.

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APPENDIX E1. Patients' perceptions of CT scanning in the ED.**Patients' Perceptions of CT Scanning in the ED**

Subject Number _____

Inclusion Criteria:

- Age \geq 18 years Y
 Awake, alert and oriented Y
 Consent signed Y

Demographics

- Sex Male₁ Female₂
 Age _____ years
 Race Non Hispanic White₁ Hispanic White₂ Non Hispanic Black₃ Hispanic Black₄ Asian₅
 Other₆ _____
 Insurance HMO/Private₁ Medicare₂ Medicaid₃ Charity Care₄ Self Pay₅

Approximately how much does your household make in a given year?

- \$0-\$20,000₁ \$20,001-\$40,000₂ \$40,001-\$60,000₃ \$60,001-\$80,000₄ \$80,001 or more₅

What's the highest level of education you completed in school?

- less than high school graduate₁ high school graduate₂ vocational/tech school graduate₃
 some college₄ college graduate₅ any post graduate work₅

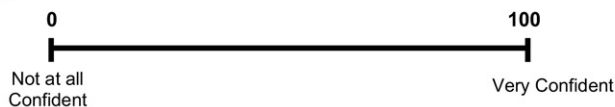
Insurance:

- Private/HMO Medicare₂ Medicaid₃ Charity Care₄ Self pay₅

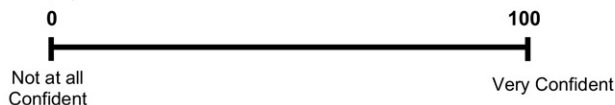
Please answer the following items

An abdominal CT is a computed tomographic scan – a special kind of radiology scan that shows the inside of your abdominal cavity, including organs, blood vessels and bones.

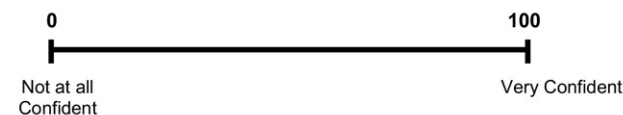
Rate how confident you would be with your medical evaluation (how the doctor figures out what is wrong with you) if it **ONLY** included **talking to you** about your problem and doing a **physical exam**



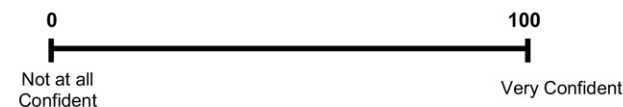
Rate how confident you would be with your medical evaluation by your doctor if it included talking to you, a physical exam **AND BLOOD TESTS**



Rate how confident you would be with your medical evaluation by your doctor if it included talking to you, a physical exam, blood tests **AND an ULTRASOUND**



Rate how confident you would be with your medical evaluation by your doctor if it included talking to you, a physical exam, blood tests **AND an abdominal CT scan (instead of an ultrasound)**

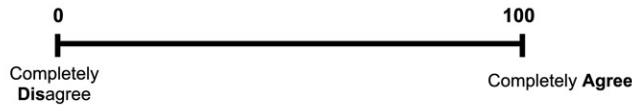


Compared to a chest X-ray (1 image), how much radiation does an abdominal CT scan have?
Pick only **ONE** answer

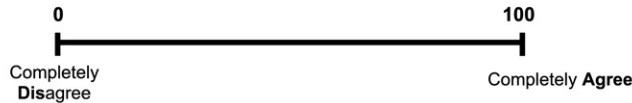
Same radiation as a chest X-ray	<input type="checkbox"/> N ₀ <input type="checkbox"/> Yes ₁
50 times more radiation than a chest X-ray	<input type="checkbox"/> N ₀ <input type="checkbox"/> Yes ₁
100 times more radiation than a chest X-ray	<input type="checkbox"/> N ₀ <input type="checkbox"/> Yes ₁
250 times more than a chest X-ray	<input type="checkbox"/> N ₀ <input type="checkbox"/> Yes ₁
300 times more than a chest X-ray	<input type="checkbox"/> N ₀ <input type="checkbox"/> Yes ₁
Over 350 times the radiation of a chest X-ray	<input type="checkbox"/> N ₀ <input type="checkbox"/> Yes ₁

Please rate your agreement with the following statements:

About 2-3 abdominal CTs give the same radiation exposure that survivors of the Hiroshima (WWII, Japan) nuclear bombing received



Receiving 2-3 abdominal CTs over a person's lifetime can increase the chances of cancer



Have you ever had a CT scan before TODAY (of any part of your body?)

N₀ Yes₁ Unsure₂

Medical Record Review

Subject Number _____

ED VISIT

Triage category 1 2 3 4 5

Reason for visit (chart): _____

Pt's reason for visit (self report): _____

Does the presentation involve a traumatic mechanism of injury (fall, MVC, assault, etc) N₀ Yes₁

Does the patient have pain? N₀ Yes₁

Patient Pain (as recorded on triage sheet, 0-10) _____

Medical management	
Blood work	<input type="checkbox"/> N ₀ <input type="checkbox"/> Yes ₁
US done	<input type="checkbox"/> N ₀ <input type="checkbox"/> Yes ₁
CT done	<input type="checkbox"/> N ₀ <input type="checkbox"/> Yes ₁

Final Diagnosis: _____

Disposition: Discharge₁ Admit₂ AMA₃

CT done at this ED visit? N₀ Yes₁

Prior CTs (5 years)	Number #		Number #
Total # of CTs in past year		Total # of CTs in past 5 years	