



## ORIGINAL CONTRIBUTION

# Emergency Physician Perceptions of Medically Unnecessary Advanced Diagnostic Imaging

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## Abstract

**Objectives:** The objective was to determine emergency physician (EP) perceptions regarding 1) the extent to which they order medically unnecessary advanced diagnostic imaging, 2) factors that contribute to this behavior, and 3) proposed solutions for curbing this practice.

**Methods:** As part of a larger study to engage physicians in the delivery of high-value health care, two multispecialty focus groups were conducted to explore the topic of decision-making around resource utilization, after which qualitative analysis was used to generate survey questions. The survey was extensively pilot-tested and refined for emergency medicine (EM) to focus on advanced diagnostic imaging (i.e., computed tomography [CT] or magnetic resonance imaging [MRI]). The survey was then administered to a national, purposive sample of EPs and EM trainees. Simple descriptive statistics to summarize physician responses are presented.

**Results:** In this study, 478 EPs were approached, of whom 435 (91%) completed the survey; 68% of respondents were board-certified, and roughly half worked in academic emergency departments (EDs). Over 85% of respondents believe too many diagnostic tests are ordered in their own EDs, and 97% said at least some (mean = 22%) of the advanced imaging studies they personally order are medically unnecessary. The main perceived contributors were fear of missing a low-probability diagnosis and fear of litigation. Solutions most commonly felt to be “extremely” or “very” helpful for reducing unnecessary imaging included malpractice reform (79%), increased patient involvement through education (70%) and shared decision-making (56%), feedback to physicians on test-ordering metrics (55%), and improved education of physicians on diagnostic testing (50%).

**Conclusions:** Overordering of advanced imaging may be a systemic problem, as many EPs believe a substantial proportion of such studies, including some they personally order, are medically unnecessary. Respondents cited multiple complex factors with several potential high-yield solutions that must be addressed simultaneously to curb overimaging.

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A related commentary appears on page 475.

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While the exact contribution of emergency care to U.S. national health expenditures remains controversial,<sup>1-5</sup> emergency medicine (EM) is one of the high-cost clinical settings far exceeding its sustainable growth rate target.<sup>6</sup> Within EM there is significant variation in test-ordering rates,<sup>7-10</sup> and there has been a tremendous increase in utilization of advanced imaging despite little evidence to suggest associated improvement in patient outcomes.<sup>11-15</sup> The etiology of this increase is likely multifactorial and may include malpractice fear,<sup>16,17</sup> desire for diagnostic certainty,<sup>18</sup> lack of or inconsistent clinical decision instruments,<sup>18-20</sup> poor adoption of such decision instruments,<sup>21,22</sup> inadequate training in evidenced-based medicine,<sup>23,24</sup> slow knowledge translation,<sup>25</sup> perverse financial incentives,<sup>26</sup> requests of consulting and referring physicians,<sup>27,28</sup> and increased practice intensity and overall complexity of emergency care.<sup>28,29</sup> Regardless of etiology, there has been a strong push within EM to counter this behavior to provide high-value, cost-conscious care.<sup>1-5,30</sup>

Despite the current nationwide effort to improve value in health care, viewpoints of frontline practicing clinicians on how to achieve better health and decreased costs remain largely unknown.<sup>31</sup> Most physicians agree that they should take a greater role in reducing unnecessary tests,<sup>32</sup> but little is known about the extent to which the typical emergency physician (EP) believes unnecessary diagnostic testing occurs in his or her practice setting or what solutions, if any, she or he feels would help mitigate this practice. Such information is crucial to achieving high-value care and may be especially helpful in light of the upcoming 2015 *Academic Emergency Medicine (AEM)* consensus conference on diagnostic imaging.

We aimed to determine EP perceptions regarding 1) the extent to which they and their colleagues order medically unnecessary advanced diagnostic imaging, 2) factors that contribute most to this behavior, and 3) solutions that would be most effective at curbing this practice.

## METHODS

### Study Design and Population

This was a cross-sectional survey study, approved by the RAND Corporation Institutional Review Board (IRB). The final survey was administered to a nationally distributed, purposive sample of EPs recruited at four EM conferences and 15 distinct ED group meetings (faculty meetings, residency conferences, and community ED departmental meetings) between March and August 2013. The initial sampling approach was based on convenience, in that the investigators reached out to gain the permission of academic ED leaders in California with whom they were familiar. This was followed by a purposive sampling approach to recruit both community EPs and non-California EPs. Leaders of community EDs in California, as well as of EDs in other parts of the country, with whom the investigators had some familiarity, were approached for permission to administer the survey. The four conferences were selected in a similar fashion, to provide a geographic balance of

academic and community providers. Conference planning committees of both academic and continuing medical education conferences were contacted about the study; all conferences took place in California, but had attendees from throughout the country. Physicians practicing clinically in U.S. EDs, including those training in U.S. Accreditation Council for Graduate Medical Education–approved EM residency programs, were eligible for participation.

### Survey Development and Administration

As part of a larger, ongoing, RAND Corporation study on engaging physicians in the delivery of high-value health care, we conducted two preliminary multispecialty focus groups of nine physicians each, to explore the topic of decision-making around resource utilization. One focus group consisted of generalists and included family physicians, pediatricians, internists, and obstetrician/gynecologists, while the other consisted of a diverse group of specialists, including an anesthesiologist, a neurologist, surgeons, an EP, a radiologist, and internal medicine subspecialists. All participants were from the greater Los Angeles area, recruited by a focus group firm on behalf of the RAND Corporation, and paid for their participation. Participants included a mix of academic and community providers. We used qualitative analysis of the focus groups to refine and modify preliminary survey questions.

For survey refinement, we gained permission from physician executive leadership (e.g., the chief medical officer, chairman of the medical executive board, chancellor, and/or dean) of two health systems in the southern region of the country to pilot test the initial survey items among physicians practicing within those systems. The physician executive leaders within each system sent an e-mail to all full-time physicians working at their institutions endorsing the survey and requesting participation. The e-mail contained an electronic link to the initial pilot survey, which was held on a secure RAND Corporation–based electronic server. Both the e-mail and the home page of the Web-based survey contained the relevant IRB study information. Of the 184 physicians who completed the pilot survey, 15 self-identified as EPs.

The survey tool was then further adapted specifically for EM using a two-stage process similar to methods recommended or used in previous studies of related topics.<sup>17,32-34</sup> The first stage included reviews and iterative input from eight physician experts known for their work on resource utilization and decision-making within EM. The physician experts were selected largely based on convenience in that they were either working at institutions with which the investigators had professional relationships or recommended by one of the other experts; in addition, all of these physician experts had published on the topic of resource utilization in EM. Opinions about both the survey itself and the sampling technique were elicited. Feedback on overall survey topics and wording was incorporated into a revised tool, adapting existing measures whenever possible. Next, the survey was pilot tested on 12 EPs practicing across six different emergency departments (EDs) that included academic, community, safety-net, and

government-owned practice settings. Based on this multistage process, the survey was further refined to focus on medically unnecessary advanced diagnostic imaging (i.e., computed tomography [CT] and magnetic resonance imaging [MRI]), and the term “medically unnecessary study” was defined for participants as “a study you would not order if you had no external pressures and were only concerned with providing optimal medical care.”

The final survey (see Data Supplement S1, available as supporting information in the online version of this paper) was a 19-item questionnaire that asked EPs to quantify how frequently they perceived there to be 1) resource overuse of any or all diagnostic tests in their own EDs, 2) overuse of advanced diagnostic imaging (i.e., CT or MRI) in specific clinical scenarios, and 3) use of “medically unnecessary” advanced diagnostic imaging in their personal practices and the practices of members of their groups. Questions incorporated five-point Likert-type scales (i.e., “much too few” to “much too many”) used in prior surveys on similar topics.<sup>33</sup> EPs were asked to identify factors they believe contribute most to unnecessary imaging and solutions that would be most helpful in mitigating this practice. Demographic and practice-setting data were collected for each EP.

After respondents completed a paper-based questionnaire, a trained research assistant (RA), blinded to the study hypotheses, entered the data according to a defined protocol. Ten percent of the completed questionnaires were randomly selected and double-checked, with less than 0.03% error rate.

The study primary investigator (PI) or RA attended each department or residency meeting at a prespecified time and read the oral consent form (see Data Supplement S2, available as supporting information in the online version of this paper) to the group of providers at the site. At conferences, the study PI or RA engaged potential participants individually based on a directed script (Data Supplement S3, available as supporting information in the online version of this paper). Eligible providers who agreed to participate in the study were then given the survey to complete and return. To standardize survey administration across different sites, the PI and RAs followed a scripted response to frequently asked questions if they arose (see Data Supplement S4, available as supporting information in the online version of this paper). Physicians were given a \$5 coffee card in appreciation of their participation.

### Data Analysis

We present descriptive statistics of survey responses for the entire cohort and (in the online-only supplement) descriptive grouped comparisons of outcomes by physician characteristics (i.e., age, sex, clinical experience, and board certification) and systems characteristics (i.e., practice setting, geographic location, and compensation method). We included several potentially distinct cohorts in our sample frame, including board-certified compared to non-board-certified physicians, physicians who were or were not practicing in California, and community compared to academic physicians. We stratified our analyses by these subgroups to assess

similarities and differences in self-reported outcomes. However, given the nonrepresentative sample of EPs, we report only simple descriptive statistics, as it would be misleading to perform any statistical comparison testing (e.g., t-tests).<sup>35</sup> All analyses were conducted using Stata 13.0.

## RESULTS

We approached 478 EPs from 29 U.S. states in a non-random fashion, of whom 435 met inclusion criteria and completed the survey, for a response rate of 91%. Most respondents had been practicing EM for more than 10 years and were board-certified in the specialty. Salaried physicians and physicians practicing in California were overrepresented, while academic and community physicians were equally represented (Table 1).

Over 85% of EPs believed patients in their own EDs received too many diagnostic tests (e.g., blood tests, urine tests, imaging) in general (Figure 1). A similar left-skewed histogram was seen for each of the specific advanced imaging related clinical scenarios presented in the survey except for “Head CT for moderate head injury–GCS 10–with no intoxication” (see Data Supplement S5, available as supporting information in the online version of this paper). Almost all respondents (97%) acknowledged personally ordering at least some medically unnecessary imaging (CT or MRI) and, on average, acknowledged doing this to a similar, although slightly smaller degree (22% vs. 27%), than they felt was true of colleagues in their own groups (Figure 2). Self-perceived unnecessary ordering was slightly associated

Table 1  
Characteristics of Participating Emergency Physicians (*n* = 435)

Demographics	Number (%) <sup>*</sup>
Age (yr), mean (range)	42.2 (26–71)
Female sex	134 (30.8)
Clinical experience	
Years of clinical practice, mean (range)	13.7 (0.75–45)
Board-certified in EM	296 (68.4)
Practice location	
California	296 (68.2)
Pennsylvania	33 (7.6)
Connecticut	27 (6.2)
Arizona	16 (3.7)
Other <sup>†</sup>	62 (14.3)
Practice type <sup>‡</sup>	
Academic ED	207 (50.6)
Community ED	202 (49.4)
Group-based HMO	82 (18.9)
Reimbursement method <sup>§</sup>	
Salary	301 (69.2)
Hourly wage	67 (15.4)
Fee-for-service	34 (7.8)
Bonuses based on productivity	50 (11.5)

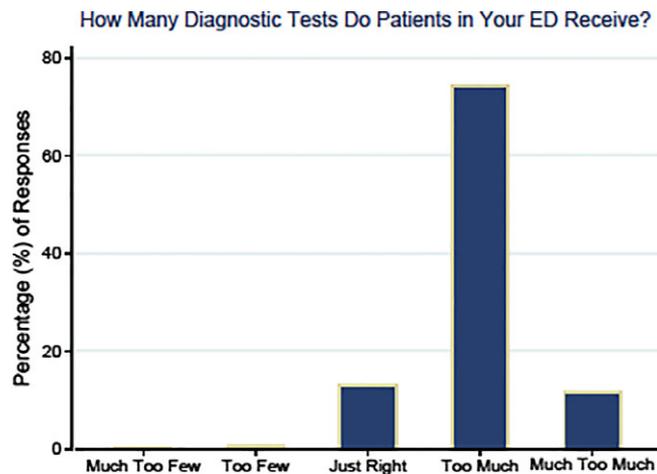
HMO = health maintenance organization.

<sup>\*</sup>Unless otherwise noted.

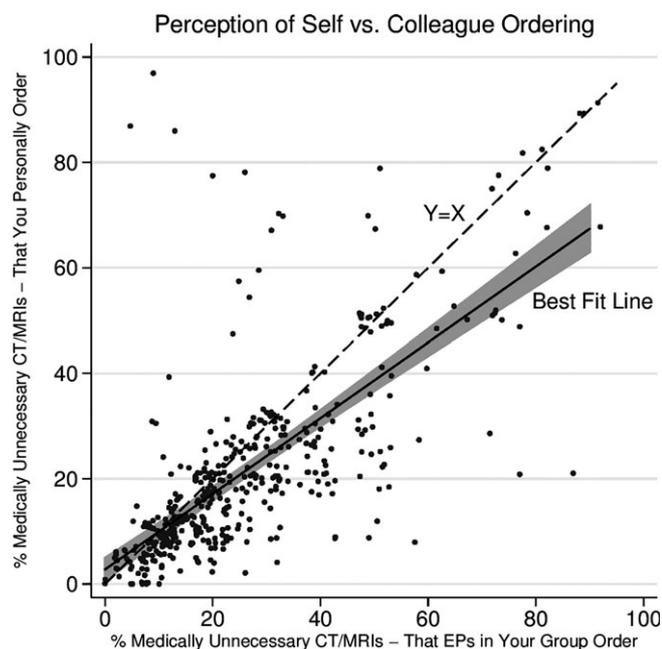
<sup>†</sup>Physicians from 25 other U.S. states completed the survey.

<sup>‡</sup>An ED was considered academic if it was fully staffed by EM residents-in-training.

<sup>§</sup>Some respondents indicated multiple reimbursement methods.



**Figure 1.** Emergency physicians perception of diagnostic test utilization. The exact wording of the corresponding question was as follows: “Thinking about *all* the diagnostic tests patients in your emergency department (ED) receive, overall do they receive ...”.



**Figure 2.** Emergency physicians perception of self- versus colleague CT/MRI ordering behavior. The *dashed line* is a theoretical line where self- versus colleague-perceived CT/MRI ordering behavior is equivalent. The *solid line* is the best-fit line of the actual data with a surrounding 95% confidence interval (*shaded area*).

with physician practice location and type of practice setting; specifically, physicians practicing in California (20% vs. 26%) and within a group-based health maintenance organization (18% vs. 25%) perceived themselves to order fewer unnecessary advanced imaging studies compared to their counterparts (see Data Supplement S6, available as supporting information in the online version of this paper).

The main perceived contributors to medically unnecessary image-ordering behavior were fear of missing a

low-probability diagnosis and fear of litigation. From a list of eight options, which also allowed respondents to write in a separate reason of their own choosing, these two factors were the most often selected as “almost always a reason” or “often a reason” (Table 2). The most frequent ( $n = 21$ ) written-in response referred to the request of a non-EP (e.g., referring, consulting, or admitting physician). The overwhelming majority (97%) of respondents perceived that increased personal reimbursement was rarely or never a contributor to the ordering of unnecessary imaging studies.

Solutions most commonly felt to be “extremely” or “very” helpful for reducing medically unnecessary imaging included malpractice reform (79%), increased patient involvement through education (70%) and shared decision-making (56%), physician feedback on test-ordering metrics (55%), and improved education of physicians on diagnostic testing (50%; Table 3). The most frequent ( $n = 4$ ) written-in solution was related to encouraging societal change away from a perceived “no-miss” attitude.

## DISCUSSION

A recent Institute of Medicine committee estimated that \$210 billion is wasted annually on excess health care services, which could be prevented by eliminating unnecessary tests, procedures, and treatments.<sup>36,37</sup> In this large, national, purposive survey, most respondents perceived that too many diagnostic tests are ordered in their own EDs. With the recent call to action in EM for the development of quality measures that encourage more efficient use of CT and MRI,<sup>38</sup> and the upcoming AEM consensus conference on optimizing diagnostic imaging utilization, understanding frontline physician insights and beliefs on solving such issues is critical to reliably achieving high-quality, cost-conscious care.<sup>30,31,39</sup> Moreover, if physicians are not involved in crafting patient-centered efforts at rational test ordering, others might step in with less sensitivity to maintaining or improving quality of care.<sup>40,41</sup>

The most striking finding of our study is that the overwhelming majority of the EPs we asked believed that they and their colleagues order a substantial amount of medically unnecessary imaging. Although the physicians we queried may not be representative of EPs at large, the degree to which they endorsed this as an issue suggests that this feeling is, at the very least, far from uncommon. Furthermore, this belief about resource utilization is almost certainly not unique to EPs,<sup>33,42</sup> and given the influence of social desirability bias, their responses suggest that the problem may be even greater than identified here.

Our results demonstrate that overimaging is not a problem related to lack of insight on the part of individual physicians, but rather a systemic problem, where doctors feel they are under so much pressure to order studies that they engage in a behavior that they themselves believe may be wrong. Fixing this, then, must surely involve addressing those contributing external pressures. Our respondents identified multiple elements of the practice environment as driving overimaging, suggesting that no isolated approach to curbing this

Table 2  
Perceived Largest Contributors to Ordering Medically Unnecessary Advanced Imaging\*

Perceived Contributors	Almost Always or Often a Reason	Sometimes a Reason	Rarely or Almost Never a Reason
Fear of missing a diagnosis, even if there is a low likelihood	299 (68.9)	110 (25.3)	25 (5.8)
Avoidance of potential malpractice issues	279 (64.3)	120 (27.6)	35 (8.1)
Patient or family expectations	172 (39.7)	198 (45.7)	63 (14.6)
Standard practice in medical group or among closest colleagues	167 (38.5)	153 (35.2)	114 (26.3)
Standard practice in EM	151 (34.9)	189 (43.6)	93 (21.5)
The test saves time	102 (23.6)	172 (39.7)	159 (36.7)
Administrative pressure to increase group reimbursement	6 (1.4)	16 (3.7)	410 (94.9)
Increase personal reimbursement	3 (0.7)	10 (2.3)	419 (97.0)

Data are reported as number (%).  
EM = emergency medicine.  
\*Respondents were also offered an "other" category to write in additional ideas.

Table 3  
Solutions Perceived to be Most Helpful to Reduce Unnecessary Advanced Imaging\*

Potential Solution	Extremely or Very Helpful	Somewhat Helpful	Not Very Helpful or Not Helpful at All
Reform malpractice	343 (78.9)	77 (17.7)	15 (3.4)
Educate patients and families	304 (69.9)	109 (25.1)	22 (5.0)
Involve patients more in shared decision-making surrounding diagnostic testing for low-probability clinical outcomes	242 (55.9)	156 (36.0)	35 (8.1)
Provide feedback to physicians on test ordering behavior compared to peers in same practice	238 (54.8)	163 (37.6)	33 (7.6)
Improved education of physicians on diagnostic testing	218 (50.2)	157 (36.2)	59 (13.6)
Staff the department to allow more time for clinical evaluation	170 (39.7)	157 (36.7)	101 (23.6)
Create and disseminate voluntary guidelines for when to order studies in specific clinical scenarios	165 (37.9)	190 (43.7)	80 (18.4)
Eliminate financial incentives to physicians to order the test	141 (32.7)	103 (23.9)	187 (43.4)
Implement computer decision support to assist physicians	109 (25.2)	171 (39.5)	153 (35.3)
Limit reimbursement to only studies that meet guidelines	90 (20.7)	83 (18.9)	262 (60.4)
Offer financial incentives to physicians who order fewer studies	76 (17.5)	106 (24.4)	252 (58.1)

Data are reported as number (%).  
\*Respondents were also offered an "other" category to write in additional ideas.

issue will succeed. Consistent with what others have found, addressing multiple aspects of this problem simultaneously will be required.<sup>43,44</sup>

Fear of malpractice was one of the most frequently cited contributing factors, and tort reform was most commonly endorsed as the solution with the greatest potential to curb overimaging. Defensive medicine due to perceived medicolegal liability is widespread<sup>17,45</sup> and has been linked with higher imaging use and health care costs.<sup>16,17,45-48</sup> While some have advocated that tort reform should be central to policies aimed at reducing excessive medical spending,<sup>45,49</sup> studies evaluating the effect of actual reform efforts have demonstrated a limited effect on cost reduction and physician behavior.<sup>46,49-54</sup> However, given the high malpractice concern among physicians in our sample and others,<sup>17,45,51</sup> we believe that although tort reform would not be sufficient to eliminate overuse,<sup>54</sup> it may be a necessary initial step. As long as the specter of liability is so prevalent, it may be difficult to convince EPs to change their practice patterns. At the same time, it would be useful to educate

EPs that the actual risk posed by legal liability is likely lower than the perceived risk, which may allay these fears.<sup>17,51</sup>

Respondents cited tort reform as the most important *solution* to reducing unnecessary imaging, but they endorsed concern about missing a low-probability diagnosis as the most substantial *driver* of overimaging. While two single-center studies failed to find a relation between stress due to uncertainty, on the one hand, and increased testing in ED patients, on the other, both were underpowered, and thus their findings cannot be considered definitive.<sup>9,55</sup> Others have argued that the role of uncertainty in clinical decision-making affects physician practice variation, and we endorse this view.<sup>56</sup> We believe that the existing desire in modern U.S. health care, to minimize and even eliminate any diagnostic uncertainty, is a primary contributor to our current, resource-intensive approach.<sup>5,32,57,58</sup> While this professional culture may be well-intentioned, in the case of advanced imaging it has not only failed to improve patient outcomes,<sup>11-15</sup> but has also led to overdiagnosis

and overtreatment, resulting in substantial harm.<sup>5,42,59</sup> Physicians in our sample clearly acknowledged their fear of uncertainty, and most felt that improved training on diagnostic testing would be helpful. Toward this end, some excellent resources are available to EPs, including AEM Evidence-Based Diagnostics section, *Evidence-Based Emergency Care* textbook,<sup>60</sup> and www.thentt.com Web site, which provide systematic approaches to understanding diagnostic test utility for common ED diagnoses.

The value of any diagnostic test, including but not restricted to imaging, is in large part to resolve clinical uncertainty. It is therefore important to stress that not all tests with a “negative” result are by definition “unnecessary,” nor are all “positive” tests by definition “necessary.” We believe that an unnecessary test is one that—regardless of what it does or does not find—cannot be expected to change the pretest probability of disease in a clinically meaningful way. Future research should evaluate whether formal training in probabilistic reasoning could help physicians cope better with uncertainty and therefore decrease unnecessary testing.<sup>61,62</sup>

Beyond this, addressing the low tolerance for uncertainty—on the part of both physicians and patients—will clearly require addressing a number of fundamental and generally unchallenged beliefs that are widespread in our society, including the perceived wisdom about error as the cause of any bad outcome, omission as a far greater danger than commission, the ability of technology to solve all problems, benefit (but not harm) from information gathering of any kind, and certainty that “catching things early” is beneficial.<sup>58</sup> We are hopeful that the efforts such as those surrounding the “Preventing Overdiagnosis” conference may help start to address such myths.<sup>42</sup>

Physicians in our sample also frequently identified increased patient engagement and physician feedback on test-ordering behavior as solutions to overimaging. Increased involvement of ED patients in a shared decision-making process has in fact been shown to improve patient satisfaction and decrease utilization without causing patient harm.<sup>63,64</sup> Prior studies have found that almost all ED patients express a strong desire to receive medical information irrespective of acuity,<sup>65</sup> but it remains unclear if EPs feel this tool could be routinely incorporated into their practice and if this would actually result in decreased health care costs.<sup>66</sup> Future studies should further evaluate ways to appropriately incorporate shared decision-making in emergency care with the goal of reducing overuse. Finally, while benchmarking based on simple auditing and feedback would not address appropriateness, it may help inform the discussion on methods to reduce both overuse and underuse.<sup>67</sup> Like other physicians,<sup>33</sup> respondents in this study stated that they were amenable to, and interested in, receiving practice feedback on test-ordering metrics; rapid-cycle feedback has recently been advocated by leaders in emergency care as a method for increasing value in EM.<sup>5</sup>

## LIMITATIONS

While we attempted to include a wide range of EPs in terms of geographic location, type of practice, and

clinical experience, we cannot state that our cohort is representative of EPs in general. Especially with our strong geographic bias, in that about two-thirds of respondents were from California, it would be inappropriate to estimate with any precision what percentage of EPs do or do not agree with the sentiments expressed by our respondents. Given the nonrepresentative nature of our sample, we have only presented simple descriptive statistics, as it would be potentially misleading to conduct hypothesis testing with statistical measures of comparison.<sup>35</sup> We did, however, capture a broad range of characteristics of U. S. EPs in our sample, and since there is no reason to imagine that our respondents are *extremely* atypical, the results strongly suggest that at least a nontrivial proportion of EPs believe overimaging is a significant problem. Moreover, within our sample, all subgroups indicated similar sentiments regarding overimaging, which suggests that our results are applicable to a variety of practice settings.

Second, while we attempted to follow EM-relevant methodological guidelines for survey design,<sup>34</sup> it is uncertain whether or not an average EP can accurately estimate the unnecessary image ordering behavior of his/her colleagues. It is possible that because resident physicians see patients alongside multiple faculty members, they may be able to provide more accurate estimates; at the same time, however, residents may be less capable of judging medical necessity of imaging due to their relative lack of clinical experience. Additionally, self-reports of unnecessary ordering behavior may be flawed due to social-desirability and selection biases. For example, despite significant literature to support the hypothesis that financial incentives are tied to physician practice behavior,<sup>26,68–71</sup> respondents in our sample rarely acknowledged this as a contributing factor or a potential solution, regardless of their own reimbursement method. Thus certain proposed solutions, such as aligning financial incentives to reduce testing, may have been discredited due to their undesirability, while the value of more socially acceptable options, like increased patient involvement, may have been exaggerated.

Finally, the survey did not offer an exhaustive list of potential contributors to unnecessary imaging. After much deliberation during the survey development, we chose not to list a request from another (nonemergency) physician as one of the possible contributors to medically unnecessary imaging. We did this because our goal was to identify factors that were actionable by, and dependent on, the EM community alone. Several of our respondents added this independently, as an important driver of such behavior, and we suspect that this might have been selected by many if it had been listed; future efforts aimed at decreasing unnecessary imaging should also address this aspect of emergency care. The survey tool similarly did not offer an exhaustive list of potential solutions to optimize imaging use. For example, some have suggested that increased patient cost-sharing could conceivably help reduce low-yield imaging. Such an approach has the potential to result in indiscriminate reduction in utilization, however, affecting both unnecessary and necessary care. It is important to recognize that overuse and underuse are closely tied in modern American medicine, perhaps related to economic

drivers in the United States. Thus, endeavors to reduce unnecessary care must not be undertaken without also creating systematic safeguards to ensure the maintenance of appropriate care.<sup>72</sup>

## CONCLUSIONS

Understanding practicing clinician viewpoints is crucial to designing interventions aimed at achieving high-value care. While physicians are taught that their primary responsibility is to the single patient before them, and while attention to resource stewardship can sometimes conflict with the best interests of an individual patient, we do have an obligation to the commons as well. In addition, it is easy to forget that inappropriate testing can cause medical harm—not merely in the abstract, but to individual patients. We are not aware of any prior study that has sought to identify the perceived contributors as well as practical solutions, from a physician standpoint, to the problem of overimaging. Physician respondents in our survey endorsed multiple complex factors as well as several potential high-yield solutions that must be addressed simultaneously to curb overimaging in emergency medicine.

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### Supporting Information

The following supporting information is available in the online version of this paper:

**Data Supplement S1.** Survey.

**Data Supplement S2.** Oral consent script.

**Data Supplement S3.** Conference oral consent script.

**Data Supplement S4.** Frequently asked questions script.

**Data Supplement S5.** Perceived CT utilization by clinical scenario.

**Data Supplement S6.** Perception of medically unnecessary CT/MRI use by physician characteristics.

### Academic Emergency Medicine is going green!

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