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ABSTRACT

BACKGROUND AND PURPOSE: The Joint Commission has identified timely reporting of critical results as one of the National Patient Safety Goals. We surveyed directors of neuroradiology fellowships to assess and compare critical findings lists across programs.

MATERIALS AND METHODS: A 3-question survey was e-mailed to directors of neuroradiology fellowships with the following questions: 1) Do you currently have a "critical findings" list that you abide by in your neuroradiology division? 2) How is that list distributed to your residents and fellows for implementation, if at all? and 3) Was this list vetted by neurology, neurosurgery, and otolaryngology departments? Programs with CF lists were asked for a copy of the list. Summary and comparative statistics were calculated.

RESULTS: Fifty-one of 89 (57.3%) programs responded. Twenty-one of 51 (41.2%) programs had CF lists. Lists were distributed during orientation, sent via Web sites and e-mails, and posted in work areas. Eleven of 21 lists were developed internally, and 5 of 21, with the input from other departments. The origin of 5 of 21 lists was unknown. Forty CF entities were seen in 20 submitted lists (mean, 9.1; range, 2–23). The most frequent entities were the following: cerebral hemorrhage (18 of 20 lists), acute stroke (15 of 20), spinal cord compression (15 of 20), brain herniation (12 of 20), and spinal fracture/instability (12 of 20). Programs with no CF lists called clinicians on the basis of "common sense" and "clinical judgment."

CONCLUSIONS: Less than a half (41.2%) of directors of neuroradiology fellowships that responded have implemented CF lists. CF lists have variable length and content and are predominantly developed by radiology departments without external input.

ABBREVIATIONS: ASNR = American Society of Neuroradiology; CF = critical findings

Patient safety and elimination of preventable medical errors continue to be major issues in health care and in radiology. Since the Institute of Medicine published its report *To Err Is Human: Building a Safer Health System*, in which as many as 98,000 annual patient deaths were attributed to medical errors, patient safety initiatives have been implemented across the country with the goal of designing better systems and public health processes.[1-4] Effective communication between health care providers has been identified as one of the major culprits resulting in poor outcomes.[5-7] In 2011, the Joint Commission added a new National

Patient Safety Goal, specific for communication in radiology, requiring "report[ing] critical results of tests and diagnostic procedures on a timely basis."[8] A failure to communicate critical radiographic findings in a timely manner can contribute to significant patient mortality and morbidity and is often the subject of medical malpractice claims against radiologists.[9-11] The Practice Guideline for Communication of Diagnostic Imaging Findings released by the American College of Radiology also addresses the issue of effective communication in radiology, emphasizing the need for the following: 1) "tailored" timeliness, 2) satisfactory communication between the radiologist and the referring provider, and 3) minimization of communication errors.[12] To improve patient safety and prevent adverse events, organizations have developed algorithmic approaches to reporting and communicating critical radiographic findings based on lists of critical findings.[7,13]

We conducted a 3-question survey among the directors of neuroradiology fellowship training programs to assess and compare the use of critical findings lists in academic neuroradiology across the country. Our goal was to determine the following:

Subject: Critical Findings

Colleagues:

I am currently authoring a manuscript on compliance with our "Neurosurgery-approved" critical findings list of abnormalities for which we must immediately contact our clinicians.

I wanted to ask you:

1. Do you currently have a "critical findings" list that you abide by in your neuroradiology division?

2. How is that distributed to your residents and fellows, if at all?

3. Was it vetted by your Neurology, Neurosurgery, ENT departments?

Dave Yousem

FIG 1. Three-question survey e-mailed to neuroradiology fellowship program directors.

1) How many of the programs have official critical findings lists and what pathology is included in such lists, 2) how critical findings lists are distributed to the fellows and residents, and 3) whether such lists were developed with input from clinical services. Because the Joint Commission has only recently added a new patient safety goal specific for communication of findings in radiology, we hypothesized that there are more programs without than with critical findings lists.

MATERIALS AND METHODS

The e-mail addresses of neuroradiology fellowship training program directors in the United States and Canada were obtained from the American Society of Neuroradiology Web site. Each fellowship program director listed by the ASNR was contacted twice in the fall of 2011 (October and November) and then again in the spring of 2012 (April and May) and was asked to voluntarily answer a 3-question survey regarding critical findings lists at their institution. The 3-question survey asked the following: 1) Do you currently have a "critical findings" list that you abide by in your neuroradiology division? 2) How is that list distributed to your residents and fellows for implementation, if at all? and 3) Was this list vetted by neurology, neurosurgery, and otolaryngology departments? A copy of this e-mail-based survey is depicted in Fig 1. Programs with critical findings lists received additional e-mail follow-up communication to solicit a copy of the critical findings list of the institution.

All e-mail communication with program directors was saved, and summary and comparative statistics were performed for all responses and submitted lists. Programs whose fellowship directors did not complete the survey were excluded from the analysis. We compared the number of programs with and without lists, the method of distribution of the lists to the fellows and residents, and the development of the lists with or without the input of the referring physician nonradiologists. For programs that e-mailed
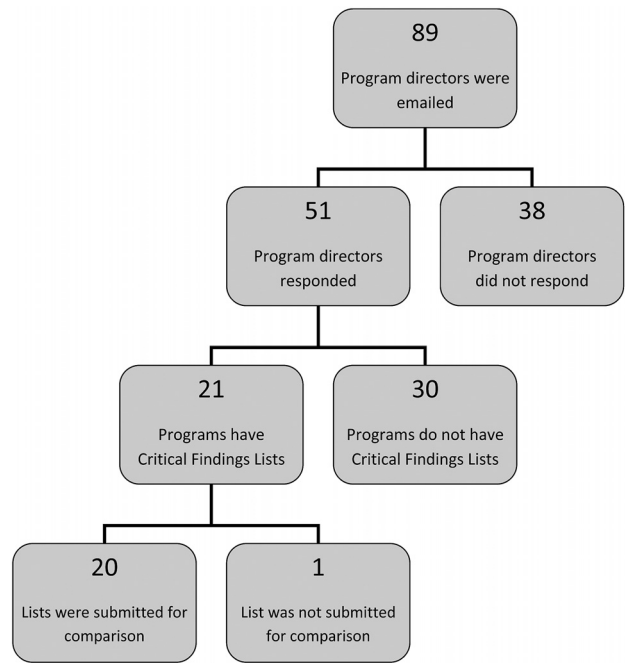

FIG 2. Neuroradiology fellowship program directors' responses to the e-mail-based survey concerning critical findings lists used in neuroradiology.

their critical findings lists, we analyzed the contents of the lists, looking for similarities and differences among the pathologies/entities included.

Given the small sample size and wide variability in the responses received, we focused on descriptive analyses and did not perform statistical tests to assess significant difference.

RESULTS

Survey Results

Fifty-one of 89 (57.3%) neuroradiology fellowship program directors listed on the ASNR Web site responded to the survey. Twenty-one of 51 (41.2%) programs that responded had critical findings lists, and 30 of 51 (58.8%) did not. Following additional communication via e-mail, 20 of the 21 (95.2%) programs with critical findings lists sent their lists. The overall participation in the survey is depicted in Fig 2.

Surveyed neuroradiology fellowship program directors distribute their critical findings lists to their fellows and residents in a number of ways. Ten of 21 (47.6%) distribute their lists during orientation/first week of the rotation, 9 of 21 (42.9%) post lists in work areas, 8 of 21 (38.1%) have lists available on a departmental/divisional Web site, 5 of 21 (23.8%) disseminate lists through e-mails, 4 of 21 (19.0%) include lists in their policy booklets, 2 of 21 (9.5%) present lists during conferences, and 1 of 21 (4.8%) allows access to the critical findings list via an electronic system.

Of the programs that responded to the survey and that have critical findings lists, 3 of 21 (14.3%) vetted the entities on the list with neurology, neurosurgery, or otolaryngology. Two of 21 (16.7%) program lists were drafted by a hospital-wide committee with representatives from all departments, including neurosciences and non-neurosciences. Eleven of 21 (52.4%) lists were composed internally by radiology departments without input

Forty different critical finding entities seen in 20 submitted neuroradiology critical findings lists

Critical Finding List Item	No. of Programs Listing Critical Finding
Cerebral hemorrhage[a]	18
Acute stroke	15
Spinal cord compression	15
Brain herniation	12
Spinal instability/spinal fracture	12
Hydrocephalus	8
Arteriovenous malformation/aneurysm	7
Mass/mass effect (new or enlarging)	7
Meningitis/intracranial abscess	7
Brain edema	6
Misplaced hardware	6
Sinus thrombosis	5
Skull depression/open fracture	5
Vascular dissection	5
Anything clinically important	3
Soft-tissue abscess	3
Spinal epidural abscess	3
Spinal ligamentous injury	3
Vascular occlusion	3
Acute sinusitis with osteomyelitis	2
Carotid stenosis	2
Clipped normal vessel	2
Epiglottitis	2
Findings suggestive of child abuse	2
Incompletely clipped aneurysm	2
Intraocular hematoma/orbital injury	2
Retained foreign body	2
Spinal cord infarction	2
Spinal cord mass	2
Spinal epidural hematoma	2
Acute intracranial process	1
Airway compromise	1
Brain death	1
Carotid artery injury	1
Creutzfeldt-Jakob disease	1
Increased intracranial pressure	1
Penetrating trauma	1
Pneumocephalus	1
Shunt malfunction	1
Surgically relevant congenital abnormality	1

[a] Cerebral hemorrhage category includes epidural, subdural, subarachnoid, parenchymal, and intraventricular blood collections as well as active bleeding.

from the relevant clinical departments. The origin of the remaining 5 of 21 (23.8%) lists was not clear to the surveyed program directors.

Critical Findings Lists

Forty different critical finding entities were seen in 20 submitted neuroradiology critical findings lists (Table). List lengths ranged from 2 to 23 items and averaged 9.1 items (SD = 5.9; median = 8.5). The top 5 most frequent entities included cerebral hemorrhage (present on 18 of 20 or 90% of the lists), acute stroke (15 of 20 or 75%), spinal cord compression (15 of 20 or 75%), brain herniation (12 of 20 or 60%), and spinal fracture/spinal instability (12 of 20 or 60%). Three of 20 (15%) lists included the "anything clinically important" category.

At some institutions, "cerebral hemorrhage" appeared as a single entry on the critical findings list and was implicitly or explicitly inclusive of epidural, subdural, subarachnoid, parenchymal, and intraventricular hemorrhage. At other institutions, how-

ever, the critical findings lists included a combination of separate entries for the different anatomic locations of acute blood products (4 of 20 programs or 20%). Two of 20 programs (10%) had separate critical findings items for cerebral hemorrhage and active bleeding.

Neuroradiology fellowship training programs with no critical findings lists make the decision to communicate with the referring physicians regarding a finding on the basis of "common sense," "clinical judgment," or "word of mouth." Some of the surveyed programs communicate all positive findings for studies ordered as urgent and/or "stat."

All program directors with or without critical findings lists say they document their communication with the referring providers or appropriate clinical teams in their official reports.

DISCUSSION

Less than a half, 21 of 51, of neuroradiology fellowship program directors who responded to our survey have critical findings lists in their divisions. There is a great variability in the length and content of the lists with cerebral hemorrhage, acute stroke, spinal cord compression, brain herniation, and spinal fracture/instability being the 5 most frequently included entities. Programs disseminate their critical findings lists in a variety of ways, most commonly by presenting them during orientation activities, by posting critical findings lists near the reading stations, and by promulgating them through Web sites and e-mails. Most neuroradiology critical findings lists are created internally by radiology departments and neuroradiology divisions without the input from the referring providers such as neurology, neurosurgery, or otolaryngology departments.

Our limited communication revealed that training programs with no critical findings lists contact the referring physicians to discuss radiographic findings on the basis of "common sense," "clinical judgment," or "word of mouth." Most interesting, 3 of 20 programs that disclosed their critical findings lists have the "anything clinically important" critical finding category included in their official lists. Adding this category to the list not only can potentially shorten it but can also serve as a reminder that no list can ever be complete and that there will be instances warranting direct communication for pathology not detailed in the official list. All programs with and without critical findings lists document their communication with the referring providers or appropriate clinical teams in their official reports.

By reporting on existing neuroradiology critical findings lists, the goal of our study was to facilitate conversations and ongoing effort within neuroradiology divisions across the country in developing such lists and communication standards that meet the Joint Commission mandates, with the hope of improving patient safety. We did not aim to devise a one-size-fits-all, all-encompassing critical findings list that must be adopted by all institutions. In our opinion, given the practice complexities and diverse workflows of health care centers throughout the country, each institution is uniquely suited to develop its own communication standards to care most effectively for the patient population it serves. Some institutions may decide to approve long detailed lists, and others may decide to favor brevity and depend more on clinical experience and judgment of the reporting neuroradiologist. A

critical findings list is simply a tool meant to facilitate clinical decision-making and interdepartment communication, not an absolute guideline in and of itself.

Some institutions have already adopted systems for keeping track of and reporting critical findings.[7,13] Anthony et al[13] reported on their 4-year experience with a departmental policy that defined critical findings as those that can cause mortality and significant morbidity or significant discrepancies between the preliminary and final interpretations. The authors stratified the severity of the critical findings on the basis of the perceived risk to the patient, which determined the mode and timing of communication, and introduced an "escalation process" to ensure timely communication that starts with the referring/covering physician and escalates to the attending physician, chief of service, department chair, and chief medical officer. The adherence to this policy increased with time, from 28.6% in 2006 to 90.4% in 2010, in a case mix in which approximately 10% of studies contained critical findings. Failure to properly document the communication and failure to communicate the findings in the predetermined time frame were the 2 main causes behind the noncompliance.[13]

Other authors have written extensively on the relationship between clarity and effectiveness of physician-to-physician and physician-to-patient communication and patient safety.[5,6,9-11,14] From the medical-legal point of view, as many as 80% of medical malpractice cases may result from or at least involve a breakdown in communication.[10,15,16] Both the American College of Radiology and the European Association of Radiology recognize the radiologist's duty to communicate effectively and in a timely fashion and to limit communication errors.[10]

Critical findings lists can result in unexpected medicolegal and patient health consequences. On the basis of the clinical context, a radiologist may decide to use his or her clinical judgment not to call about a critical finding included in the official list. If later this specific finding is linked to significant patient morbidity or mortality, that radiologist could potentially face an indefensible legal battle. At the extreme, an entity misreported as a critical finding on a study may prompt further clinical work-up. If such a work-up results in a complication leading to patient morbidity, the critical findings list, designed to improve patient safety, could inadvertently become the cause of poor outcome.

Our study has a number of limitations. Similar to other studies based on voluntary surveys, our study had a low participation rate. Only 57.3% (51 of 89) of neuroradiology fellowship directors responded to our survey; and of those whose programs use critical findings lists, 95.2% (20 of 21) submitted their lists for analysis. The ASNR Web site, from which we obtained the list of the current fellowship directors, may not have had the most up-to-date information, including e-mail addresses. Our study sampled academic medical centers with neuroradiology fellowship programs but did not look at the practices of radiology groups or academic medical centers without neuroradiology fellowships. When composing an all-inclusive list of critical findings list entities, we used our clinical discretion and experience in the field to merge some of the pathology categories (eg, hemorrhage = hematoma = bleed). For example, we combined spinal fracture with spinal instability and arteriovenous malformation with aneurysm.

The goal of our study was neither to devise an all-encompassing critical findings list nor to propose a standardized approach for reporting of clinically significant radiographic findings. By sharing our findings, we hope to facilitate the ongoing conversation and effort within neuroradiology divisions across the country in developing critical findings lists and communication standards leading to improvement in patient safety.

CONCLUSIONS

We conducted a 3-question survey among the directors of neuroradiology fellowship training programs to assess and compare critical findings lists across programs. Of the surveyed neuroradiology programs that responded, less than a half (41.2%) had critical findings lists that they disseminated during orientation, via Web sites and e-mails, and posting at workstations. Most neuroradiology critical findings lists were created by radiology departments without the input from neurology, neurosurgery, or otolaryngology departments. There was a great variability in the length and content of the lists with the most common entities being cerebral hemorrhage, acute stroke, spinal cord compression, brain herniation, and spinal fracture/instability. Training programs with no critical findings lists contacted the referring physicians and discussed radiographic findings based on "common sense," "clinical judgment," or "word of mouth."

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