



Emergency medicine summary code for reporting CT scan results: implementation and survey results

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Abstract

Purpose The purpose of the study was to assess the emergency department (ED) providers' interest and satisfaction with ED CT result reporting before and after the implementation of a standardized summary code for all CT scan reporting.

Materials and methods A summary code was provided at the end of all CTs ordered through the ED from August to October of 2016. A retrospective review was completed on all studies performed during this period. A pre- and post-survey was given to both ED and radiology providers.

Results A total of 3980 CT scans excluding CTAs were ordered with 2240 CTs dedicated to the head and neck, 1685 CTs dedicated to the torso, and 55 CTs dedicated to the extremities. Approximately 74% CT scans were contrast enhanced. Of the 3980 ED CT examination ordered, 69% had a summary code assigned to it. Fifteen percent of the coded CTs had a critical or diagnostic positive result.

Conclusions The introduction of an ED CT summary code did not show a definitive improvement in communication. However, the ED providers are in consensus that radiology reports are crucial their patients' management. There is slightly increased satisfaction with the providers with less than 5 years of experience with the ED CT codes compared to more seasoned providers. The implementation of a user-friendly summary code may allow better analysis of results, practice improvement, and quality measurements in the future.

Keywords Standardized reporting · CT · Structured reporting · Reporting system · Reporting template

Introduction/background

A very large volume of radiologic studies, particularly CT scans, are ordered by emergency department (ED) providers from all levels of training and experience to properly triage patients and determine appropriate management. In order to maximize patient satisfaction and care while minimizing wait times, it is important to improve interdepartmental communication during this process. The complex imaging reports, and sometimes ambiguous verbiage can delay treatment, cause

harm or lead to incomplete transition of care to outpatient settings and recommendations for further evaluation of unexpected findings may not be performed [1]. Current radiology structured or template reporting may offer some improvement in communicating imaging results [2–6].

The breast reporting system, Breast Imaging Reporting and Data System (BI-RADS), is a model for this type summary code and has become widely accepted and uniformly applied [2]. BI-RADS was created because of the lack of uniformity and standardization in mammography practice reporting [7]. It helped reporting image findings in a concise and understandable manner, which in turn contributes to improve clarification, management, or quality assurance [7]. Similar summary codes now exist for characterizing liver, prostate, and lung lesions [3, 8, 9]. Consistency with the same language helps reduce inter-observer variability and improve our ability to monitor quality assurance for our referring providers [10, 11]. The unambiguity of this reporting will help both radiologists and referring providers by assisting radiologists to guide providers with appropriate recommendations. A recent study

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presented at the American College of Radiology showed that the majority of incidental findings on CT scans lack appropriate follow-up due to the uncertainty of recommendation from the radiologists' end [6].

We conducted a study to evaluate whether the use of a summary reporting code on all ED CTs will improve communication, satisfaction, and acceptance of ordering providers within the emergency department by a multi-site single specialty radiology group. The ultimate goal is to provide a standardized report summary lexicon for reporting imaging results to improve clarity, patient management, assure appropriate follow-up, and serve as a resource for performance improvement initiatives.

Methods

This prospective study assessed emergency medicine provider (EP) satisfaction with ED CT reporting before and after implementation of summary coding using an online survey at a large urban level 1 trauma center. The study was approved by the hospital's institutional review board, which granted a patient consent waiver.

The study took place over a 3-month period (August through October 2016) at an 867 bed urban teaching hospital with approximately 99,811 ED visits per year. All full-time ED attending physicians, resident physicians in post-graduate years 2 and 3, physician assistants, and nurse practitioners (Table 1) familiar with standard radiology department CT reporting prior to implementation of summary coding were emailed an invitation to an online survey using SurveyMonkey (www.surveymonkey.com). The survey included 11 questions (Table 2) that were created and peer reviewed by five physicians (three radiology attendings, one radiology resident, and one emergency medicine attending). Questions asked about the general satisfaction with CT reporting, the importance of CT reporting to patient management, the frequency of ambiguous CT reports, and how often clarification with a radiologist is required to interpret a report. EPs were asked to select the best answer to each question using nominal or Likert scales, depending on the question. Participation was voluntary, and responses were anonymous. The purpose of the study was outlined at the outset of the survey and was also discussed at the emergency medicine department staff meeting 2 weeks prior to the initial email invitation to participate.

Following the initial email distribution of the survey link, two additional requests to participate in the survey were emailed 1 week apart, totaling three invitations over 2 weeks in July 2016. Beginning on August 1, 2016, all ED CT studies (excluding CT angiography) included a summary code (SC) at the end of the report. The summary code included one of the following:

Table 1 Emergency department providers

| | |
|------------------------------|----|
| Full-time ED attending staff | 28 |
| Part-time ED attending staff | 11 |
| PGY—2 | 18 |
| PGY—3 | 18 |
| Full-time PA | 25 |
| Part-time PA | 14 |

- SC1 Negative or significant findings are unlikely. No recommendation for further imaging evaluation is indicated.
- SC2 Findings of potential importance for which further evaluation will likely be needed. Follow-up is not necessary during the next episode of care.
- SC3 Findings of potential clinical significance. Follow-up recommended, likely require further imaging or clinical diagnostic evaluation in the acute setting to determine significance.
- SC4 Diagnostic positive results: [indicate finding] (i.e., ureteral stone, appendicitis, etc.).
- SC5 Critical finding; specialty care providers will define a clinical management plan without further imaging evaluation.

The summary code was created to help the provider determine the need for further evaluation and/or the urgency of any suggested follow-up with regard to the CT findings. The authors developed the summary codes based upon personal experience, previous informal feedback from the ED, and review of published reporting guidelines such as CT colonography reporting utilizing C-RADS. Several iterations led to a final consensus among the authors.

The final summary codes were distributed to all radiology attendings and residents prior to implementation. Each radiologist was given a set of 20 de-identified ED CT reports and asked to provide the appropriate summary code for each to determine inter-rater agreement. Following this training, an email request for feedback to all radiologists as well as an hour-long session with available radiologists to gather feedback took place. All radiologists were comfortable with the five summary codes and committed to adding the appropriate code to ED CT reports before the trial started.

To ensure compliance with summary code reporting, frequent online reminders via email to all radiology attendings and residents were sent over 3 weeks leading up to implementation and continued once weekly during the 3-month implementation phase. An additional email reminder was sent twice daily by the study investigators, once in the morning and once in the evening, during the introductory phase. A written reminder with the summary codes was posted at each workstation occupied by the ED radiology attending.

Table 2 Pre-trial ED CT survey

| | |
|--|-----------|
| 1. Please select provider type | |
| Attending MD | 15 (40.5) |
| Trainee house staff PG year 1 | 0 |
| Trainee house staff PG year 2 | 6 (16.2) |
| Trainee house staff PG year 3 | 4 (10.8) |
| PA less than 1 year experience | 1 (2.7) |
| PA 1–4 years experience | 6 (16.2) |
| PA greater than 5 years experience | 5 (13.5) |
| The following ED CT coding system will be attached to CT reports: | |
| SC1—Negative or significant findings are unlikely. No recommendation for further imaging evaluation is indicated. | |
| SC2—Findings of potential importance for which further evaluation will likely be needed. Follow-up is not necessary during the next episode of care. | |
| SC3—Findings of potential clinical significance. Follow-up recommended, likely require further imaging or clinical diagnostic evaluation in the acute setting to determine significance. | |
| SC4—Diagnostic positive results: [indicate finding] (i.e., ureteral stone, appendicitis, etc.). | |
| SC5—Critical finding; specialty care providers will define a clinical management plan without further imaging evaluation. | |
| 2. How satisfied are you with the quality of ED CT scan reports? | |
| Extremely satisfied | 3 (8.3) |
| Very satisfied | 16 (44.4) |
| Satisfied | 15 (41.7) |
| Somewhat satisfied | 2 (5.6) |
| Not satisfied | 0 |
| 3. How satisfied are you with the turnaround time of ED CT scan reports? | |
| Extremely satisfied | 0 |
| Very satisfied | 5 (13.9) |
| Satisfied | 13 (36.1) |
| Somewhat satisfied | 13 (36.1) |
| Not satisfied | 5 (13.9) |
| 4. How important are radiology ED CT scan reports for your patient management? | |
| Extremely important | 26 (72.2) |
| Very important | 8 (22.2) |
| Important | 2 (5.6) |
| Somewhat important | 0 |
| Not important | 0 |
| 5. I find the frequency of ED CT reports to be ambiguous and needing further evaluation? | |
| Extremely frequently (90–100%) | 1 (2.8) |
| Frequently (61–89%) | 1 (2.8) |
| Occasionally (11–60%) | 22 (61.1) |
| Rarely (1–10%) | 11 (30.6) |
| Never (0%) | 1 (2.8) |
| 6. What is the number of times you have contacted a radiologist to clarify a radiology ED CT scan report in the last month? | |
| 0 | 2 (5.6) |
| 1–2 | 18 (50) |
| 3–5 | 9 (25) |

Table 2 (continued)

| | |
|--|-----------|
| > 5 | 7 (19.4) |
| The following ED CT coding system will be attached to CT reports: | |
| SC1—Negative or significant findings are unlikely. No recommendation for further imaging evaluation is indicated. | |
| SC2—Findings of potential importance for which further evaluation will likely be needed. Follow-up is not necessary during the next episode of care. | |
| SC3—Findings of potential clinical significance. Follow-up recommended, likely require further imaging or clinical diagnostic evaluation in the acute setting to determine significance. | |
| SC4—Diagnostic positive results: [indicate finding] (i.e., ureteral stone, appendicitis, etc.). | |
| SC5—Critical finding; specialty care providers will define a clinical management plan without further imaging evaluation. | |
| 7. When a CT report recommends a non-emergent follow-up study, how helpful would the ED CT codes be to you in preparing the discharge instructions that would recommend the necessary follow-up? | |
| Extremely helpful | 4 (11.1) |
| Very helpful | 11 (30.6) |
| May be helpful | 14 (38.9) |
| Not sure/neutral | 4 (11.1) |
| Probably not helpful | 3 (8.3) |
| Definitely not helpful | 0 |
| 8. When a CT report recommends a non-emergent follow-up study, how helpful would the ED CT codes be to you in preparing the sign-out to the inpatient team when the patient is admitted? | |
| Extremely helpful | 3 (8.3) |
| Very helpful | 9 (25) |
| May be helpful | 15 (41.7) |
| Not sure/neutral | 2 (5.6) |
| Probably not helpful | 6 (16.7) |
| Definitely not helpful | 1 (2.8) |
| 9. How helpful would you find it if each ED CT report included one of these labels (SC1, SC2, SC3, SC4, or SC5) and descriptors at the end of each report? | |
| Extremely helpful | 8 (22.2) |
| May be helpful | 18 (50) |
| Not sure/neutral | 6 (16.7) |
| Probably not helpful | 4 (11.1) |
| Definitely not helpful | 0 |
| 10. Comments _____ | |

A voice recognition template from the sharing pool was made available to all radiology attendings and residents using the “Pick List” format to allow easy and consistent selection of the appropriate summary code. The radiological information system (RIS) and picture archiving and communication system (PACS) are not able to distinguish the ordering site, and therefore, no systematic assignment of the summary code template to ED CTs was possible during the study period.

All CTs ordered from the ED were included except CT angiograms (CTAs). The RIS and PACS were used to determine the origin of the order for the scan. The study institution is part of a health system with several other institutions, which did not participate in this initial study period.

After three consecutive months after the addition of a summary code to ED CT reports, a post-survey (Table 3) was administered to the same group of EPs via email invitation with a SurveyMonkey link. The survey asked similar

Table 3 ED provider post-trial ED CT survey

| | |
|---|-----------|
| 1. Please select provider type | |
| Attending MD | 12 (37) |
| Trainee house staff PG year 1 | 0 |
| Trainee house staff PG year 2 | 6 (18.8) |
| Trainee house staff PG year 3 | 2 (6.3) |
| PA less than 1 year experience | 2 (6.3) |
| PA 1–4 years experience | 5 (15.6) |
| PA greater than 5 years experience | 5 (15.6) |
| 2. Did you complete the pre-trial survey? | |
| Yes | 19 (59.4) |
| No | 13 (40.6) |
| 3. How satisfied are you with the quality of ED CT scan reports? | |
| Extremely satisfied | 5 (15.6) |
| Very satisfied | 14 (43.8) |
| Satisfied | 12 (37.5) |
| Somewhat satisfied | 1 (3.1) |
| Not satisfied | 0 |
| 4. How satisfied are you with the turnaround time of ED CT scan reports? | |
| Extremely satisfied | 0 |
| Very satisfied | 10 (31.3) |
| Satisfied | 11 (34.4) |
| Somewhat satisfied | 9 (28.1) |
| Not satisfied | 2 (6.3) |
| 5. How important are radiology ED CT scan reports for your patient management? | |
| Extremely important | 23 (71.9) |
| Very important | 8 (25) |
| Important | 1 (3.1) |
| Somewhat important | 0 |
| Not important | 0 |
| 6. During the past 3 months, with the addition of the new ED CT coding system to the end of CT scan reports, how frequently do you find the new CT reports to be ambiguous and needing further evaluation? | |
| Extremely frequently (90–100%) | 0 |
| Frequently (61–89%) | 1 (3.1) |
| Occasionally (11–60%) | 17 (53.1) |
| Rarely (1–10%) | 14 (43.8) |
| Never (0%) | 0 |
| 7. During the past 3 months, with the addition of the new ED CT coding system to the end of CT scan reports, what is the number of times you have contacted a radiologist to clarify a radiology ED CT scan report? | |
| 0 | 8 (25) |
| 1–2 | 12 (37.5) |
| 3–5 | 12 (37.5) |
| > 5 | 0 |
| 8. During the past 3 months, with the addition of the new ED CT coding system to the end of CT scan reports, how helpful has the coding system been in preparing patient discharge instructions that recommend the necessary follow-up? | |
| Extremely helpful | 4 (12.5) |
| Very helpful | 10 (31.3) |
| May be helpful | 5 (15.6) |

Table 3 (continued)

| | |
|---|-----------|
| Not sure/neutral | 10 (31.3) |
| Probably not helpful | 3 (9.4) |
| Definitely not helpful | 0 |
| 9. During the past 3 months, with the addition of the new ED CT coding system to the end of CT scan reports, how helpful has the coding system been in preparing the sign-out to the inpatient team when the patient is admitted? | |
| Extremely helpful | 2 (6.3) |
| Very helpful | 8 (25) |
| May be helpful | 8 (25) |
| Not sure/neutral | 10 (31.3) |
| Probably not helpful | 3 (9.4) |
| Definitely not helpful | 1 (3.1) |
| 10. During the past 3 months, with the addition of the new ED CT coding system to the end of CT scan reports, how helpful have you found the coding system to be overall? | |
| Extremely helpful | 3 (9.4) |
| Very helpful | 9 (28.1) |
| May be helpful | 8 (25) |
| Not sure/neutral | 8 (25) |
| Probably not helpful | 2 (6.3) |
| Definitely not helpful | 2 (6.3) |
| 11. During the past 3 months, with the addition of the new ED CT coding system to the end of CT scan reports, what percentage of CT reports would you estimate have included the code? | |
| 90–100% | 10 (31.3) |
| 61–89% | 16 (50) |
| 11–60% | 6 (18.8) |
| 1–10% | 0 |
| 0% | 0 |
| 12. Do you have any suggestions for how the ED CT coding system might be better implemented or clarified? Please describe. | |

questions about satisfaction with CT reports since the implementation of summary codes over the past 3 months.

All EP responses from the pre- and post-implementation surveys were collected and aggregated. Data collected included the responses to all survey questions before and after the implementation of summary codes. Individual responses and how they changed after the implantation of the summary codes could not be attributed to any individual. The demographics of the respondents were collected. The total number of ED CTs performed, the number of scans that actually had the summary codes included during the study period were number of each summary code used, the body part examined, the level of training of the ordering provider, and the interpreting radiologist were collected. The presence of contrast and age of the patients were collected. The time of order entry and interpretation was also collected. The proportion of summary code compliance was among the radiology members was determined.

Results

The pre-implementation 10-question survey was sent to 114 EP. Thirty-seven (32% response rate) total EP responded to

the survey prior to implementation. The respondent characteristics are listed in Table 1.

The responses to the pre-implementation survey sorted by role and experience are listed in Table 2.

The post-implementation survey was sent to 114 EP (Table 3) and 60 radiology attending and 20 resident physicians (Table 4). Many radiologists in the multi-site practice do not participate in interpreting the ED CTs from the teaching hospital. Thirty-two (28%) of ED providers responded to the post-implementation survey.

During the 3-month period of the study, 3980 ED CTs were performed (Table 5).

Sixty-nine percent had an ED CT summary code assigned (Tables 6 and 7). Fifteen percent of the ED CTs received a SC4 or SC5.

Discussion

The work product of radiologist is a formal report that becomes part of the permanent medical record. The goal of radiology reports is to correctly document findings, document pertinent negatives and create a prioritized list of possible etiologies of positive findings, and, if necessary, recommend appropriate next steps or additional treatment or diagnostic steps.

A form of radiology report that allows data mining, follow-up, administrative tracking, and quality and performance metrics is also desired by providers, administrators, and payers [1].

Some non-standardized reports allow ambiguity and create potential for miscommunication and possible safety issues and might allow important recommendations to go unnoticed or unrecognized. It is also possible that trainees or midlevel providers may interpret results differently than more experienced providers.

A standardized summary lexicon for reporting of imaging results may improve care and allow more efficient care pathways. A standardized radiology summary reporting system can allow capture and analysis of results, improve systems for transition of care, and generate data for better research and performance improvement [1].

This study was performed to assess the EP interest and satisfaction as well as whether there is an improvement with ED CT result reporting before and after the implementation of a standardized summary code for all CT scan reporting. Sixty-seven percent of the EPs found the frequency of ED CT reports to be ambiguous and needing further evaluation at least occasionally prior to implementation of SC. This suggests there is a need for some improved system of reporting and communicating ED CT results. After the implementation of the SC, 56% of the ED providers found the frequency of ED

CT reports to be ambiguous and needing further evaluation at least occasionally.

The creation of BI-RADS had made great stride in unifying the way breast-imaging results get communicated to other specialties. Anecdotally, despite our results, Lung-RADS and LI-RADS communications have not been as successfully implemented. Our attempt to improve communication between the emergency department and the ED CT code was partially successful.

The fact that only 63% of the EP respondents felt an ED CT summary code may be helpful, would be very helpful, or would be extremely helpful after the trial suggests the actual ED SC used may not have been sufficient or optimal for the needs of the recipients and indicates room for improvement. Similarly, the radiologists using the summary codes opposed continuation of the ED CT summary coding after the trial (50% of the radiologists). Eighty-three percent would consider continuation with no/some/major improvement. This also suggests that the actual codes used need improvement.

It is interesting to note that there is a slight increase of satisfaction in EP with less than 5 years of experience compare to the EP with greater than 5 years of experience. In our hospital with rotating emergency medicine residents as well as newly employed midlevel providers who had joined the hospital, this result may be a reflection of an improved disposition towards electronic guidance by more recent graduates and new hires, as compared to more experienced providers.

Ninety-two percent of the radiologist reported being able to implement the coding with ease/relative ease or only mild difficulty which suggests that the opposition to the coding was not the onerous added work but perhaps the codes simply were not adequate or properly conveying the appropriate information.

This is supported by the fact that 51% of the radiologists felt the ED CT coding either did not change or mildly worsened communication with the EP.

Creating an appropriate and acceptable form of summary code is difficult and must meet expectations for all users and recipients or it will not be optimally effective. The goal of the current study was to develop and trial a summary code attached to all ED CT reports that would indicate the overall impression related to important and actionable findings and the urgency with which such recommendations should be implemented.

The institution prioritizes ED CT reporting as shown by having on site 24/7 staff attending radiologist coverage and often at least two radiology house staff on site. This contributes to the 94% of the EP response that they were satisfied with the quality of ED CT reports prior to the trial and 97% were satisfied with the quality of the reports after the trial. The rapid generation of comprehensive ED CT reports that allow triage and decision-making related to admission or discharge is laudable. However, a system that allows for documentation

Table 4 Radiologist post-trial ED CT survey

| | |
|---|-----------|
| 1. Do you think the ED CT coding is valuable? | |
| Yes, very valuable | 2 (5.4) |
| Yes, moderately valuable | 7 (18.9) |
| I am ambivalent about the coding; it is neither valuable nor harmful | 21 (56.8) |
| No, I do not think the coding has value | 6 (16.2) |
| No, I do not think there is value and it is a deterrent to proper patient care | 1 (2.7) |
| 2. Did you find the coding easy to implement? | |
| Yes, very easy | 0 |
| Yes, relatively easy | 15 (40.5) |
| I was able to implement it with only mild difficulty | 19 (51.4) |
| No, moderately difficult | 3 (8.1) |
| No, very difficult | 0 |
| 3. Do you think the coding should be implemented on a permanent basis? | |
| I strongly favor permanent usage for all CT, MR, PET, NM, and US studies in ED and outpatient settings | 2 (5.6) |
| I favor permanent implementation for ED CT | 1 (2.8) |
| I favor permanent implementation for ED CT with some revision and improvements | 15 (41.7) |
| I oppose continuation without major improvement and revisions | 12 (33.3) |
| I oppose continuation under any circumstances | 6 (16.7) |
| 4. What is your confidence level when selecting an ED CT code for your reports? | |
| Extremely confident | 0 |
| Confident | 14 (38.9) |
| Somewhat confident | 20 (55.6) |
| Not confident | 2 (5.6) |
| Extremely not confident | 0 |
| 5. Do you think the ED CT coding improves communication with our provider colleagues in the ED? | |
| I think the ED CT coding markedly improves communication | 4 (10.8) |
| I think the ED CT coding marginally improves communication | 14 (37.8) |
| I do not think there is any change in communication between ED providers and radiology with the use of ED CT coding | 16 (43.2) |
| I think the ED CT coding has mildly worsened communication | 3 (8.1) |
| I think the ED CT coding has definitely worsened communication | 0 |
| 6. Please comment on your feelings related to use of ED CT coding and give reasons for usage or discontinuation and any suggestions for improvements. _____ | |

of communication and assures appropriate subsequent diagnosis and follow-up would add value.

The EP and radiologist who do not have administrative duties may not appreciate the need for or importance of such a system and might account for the lack of enthusiasm for implementing a summary code on each report.

One hundred percent of the EP respondents felt the ED CT reports were important to patient management both before and after the trial. Since the CT result will often make a significant

impact on disposition of patients, the accuracy of the report is very important. Fifty percent of the EP responded that they were satisfied with the turnaround time of the ED CT reports prior to the trial, and 67% reported they were satisfied after the trial. This suggests that timely reporting is among the remaining highly important attributes of ED CT reporting desired by EP.

Sixty-six of the EP respondents felt the ED CT reports were ambiguous 100% of the time before the trial and 54% after the

Table 5 ED CTs performed

| | | | |
|-------------|---------------------|------------------|------------------|
| Type scan | Provided in Table 7 | | |
| Gender | F = 2072 | M = 1908 | |
| Age | Mean 57 | SD 21.7 | Range 18–102 |
| Time of day | 0700–1500 = 1180 | 1501–2300 = 1770 | 2301–0659 = 1030 |
| IV contrast | N = 1239 | Y = 2741 | |

Table 6 ED CT

| summary code assigned | | | |
|-----------------------|------|--------|--|
| SC1 | 1717 | (43.1) | |
| SC2 | 302 | (7.6) | |
| SC3 | 146 | (3.7) | |
| SC4 | 538 | (13.5) | |
| SC5 | 60 | (1.5) | |
| NC | 1217 | (30.6) | |

trial. This suggests EP acknowledge the need for clarity on reports and understand how ambiguity can affect patient care and potentially create liability issues. This may account for why prior to the trial, 73% of the EP respondents felt an ED CT summary code may be helpful or would be extremely helpful.

Prior to the trial, 44% had contacted radiology to clarify an ED CT report within the last month and 38% had contacted radiology the previous month to clarify a result after the trial. The fact that more than half of EPs have not contacted radiology in a month yet 73% felt a summary code might be helpful is difficult to rationalize. Perhaps in a hectic and intense environment, the EPs cannot or do not have time to consult and clarify reports and simply act in the best manner possible and proceed based upon their best impression.

This study demonstrates that the EPs feel the CT report is very important in determining patient care and management strategies. The provider's level of satisfaction with ED CT reports was 94% prior to the trial implementation and was 97% after the trial implementation.

Prior to the trial, 88.9% of the respondents from the EP felt an ED CT summary code might be helpful.

The results suggest there is interest in a summary code and that our pilot was somewhat accepted but some improvement and revision is likely necessary to get more widespread acceptance and achieve more uniformity and reliability.

Some radiologists subjectively seemed disinterested and were not broadly accepting of the new summary code as presented, even though we sought input and revised initial attempts to accommodate the suggestions of many stakeholders.

Table 7 ED CT summary code assigned

| Consolidated type scans | | |
|---|------|--------|
| Head and neck | 2240 | (56.3) |
| Head; head and cervical spine; head, cervical spine and maxillofacial; C spine and maxillofacial; IAC and temp bones; orbits; neck | | |
| Torso | 1685 | (42.3) |
| Chest; chest with spine; chest, abdomen, and pelvis; chest, abdomen, and pelvis with spine; chest, abdomen, and pelvis with spine and extremities; abdomen and pelvis; abdomen and pelvis with spine; pelvis; thoracic spine; lumbar spine; thoracic and lumbar spine | | |
| Extremities | 55 | (1.4) |

Leadership champions and highly visible support from the executive team will be necessary for sustained implementation, and perhaps, early successful data mining and demonstrable performance improvement results would also generate enthusiasm for continuing and improving the system.

This study had several limitations. The anonymity of the survey precluded direct correlation of survey responses between pre- and post-implementation of the SC. Not all participants responded to the survey despite several invitations. The sample size did not allow useful correlation with experience level, which is potentially important in ability to interpret and act on ED CT reports. Although there was repeated communication among the participants, there was not an executive champion in the ED or radiology departments to emphasize the potential importance to the institutional goals. The consistency with which the SC was applied among the users, and the inter- and intraobserver variation of applying the SC to ED CT was not assessed. Subjectively, there is some variation among the SC2 and SC3 applications. This would be an area of interest once the SC was refined and accepted and long-term use was anticipated.

In summary, an ED CT summary code attached to each ED CT report was trialed and generated some support but would need improvement and revision as well as executive support and a leadership champion to become permanent.

Key elements of a successful summary code would include timeliness, accuracy, actionable verbiage, measureable results, and trackable data management and should be easily understood to all levels of providers.

Once fully implemented and improved, rapid demonstration of benefits of data mining and some patient care improvement related to follow-up and management would cement the summary code usefulness.

Compliance with ethical standards

The study was approved by the hospital's institutional review board, which granted a patient consent waiver.

Conflict of interest The authors declare that they have no conflict of interest.

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