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An audit of electronic request forms for CT examinations by general surgeons

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Abstract
Introduction: We aimed to ascertain the adequacy of completion of CT request forms in a district general hospital in London, England, against the standards delineated in guidelines published by the Royal College of Radiologists in 2011.
Materials and Methods: We conducted as a retrospective audit of both CT request forms and medical records over a four-month period for all patients undergoing CT Thorax/Abdomen/Pelvis, CT Abdomen/Pelvis and CT Kidney/Ureter/Bladder for surgical indications and requested by a surgical team in our institution.
CT request forms were collated from departmental lists for each surgical specialty and each request assessed for adequacy completeness against the RCR guideline's required parameters – by assigning a score for degree of completeness. A database of these results was constructed using a scoring system of 0-2 ranging from 0= incomplete, 1= complete but inadequate to 3= complete and adequate. The data was analysed in Excel for completion of the required field by each surgical specialty and as a department.
Results: 189 CT requests were analysed, showing 100% compliance with patient demographics which are auto populated on the computerised request system, meeting RCR standards. Overall 85% of requests scored 2 for Clinical Background, 95% for Clinical Question. Only 4.7% of the Consulting Physician field scored 2, with 95% scoring 0. Overall, 62% of requests were completed fully and adequately in all required fields.
Conclusion: Our CT requests met the RCR standards for patient demographics however were substandard in fields requiring clinician input. We will be implementing training sessions on how to adequately complete request forms and will re-audit in 4 months' time.

Keywords: electronic, Surgeons, adequacy, guidelines, demographics

1. Introduction
Computed Tomography has become one of the most relied-upon tools in the investigation of the general surgical patient, both electively and emergently. It is crucial for the requesting clinician to provide the reporting radiologist with accurate and comprehensive information to facilitate efficient triage, clinically relevant scan reportage and appropriately directed correspondence regarding findings. The accurately and comprehensively completed request form is the most basic pillar of effective communication between clinician and radiologist. The Royal College of Radiology Referral Guideline (2011) states that all CT request forms must include: (1) patient demographics (age, name, date of birth, address, hospital number and patient location), (2)name of requesting clinician, (3) name of the GP/consultant responsible for the patient's care, (4) clinical background and (5) clinical question to be answered [1].
The widespread adoption of electronic health record and patient management software in the UK has the potential to introduce confusion to this process – the name of the responsible consultant may be incorrect or not be amended when the patient moves along their clinical journey and thus investigations may be ordered in the name of the incorrect responsible consultant. This may lead to any urgent findings or the final report itself being delivered to the incorrect consultant with negative implications for patient safety.
We conducted a retrospective audit of request forms for CT thorax-abdomen-pelvis, CT abdomen-pelvis and CT kidney-urethra-bladder requests made by general surgical junior doctors for inpatients at a district general hospital in the UK.
The Royal College of Radiologists Referral Guidelines (2011) were the chosen standard against which request forms were audited. 100% completion of the request form was required for the form to be deemed compliant; for descriptive fields (such as clinical background and clinical history), information sufficient enough to understand a patient's clinical condition and offer an appropriate diagnosis was required.

2. Materials and Methods
We collated a list of all surgical inpatients in our hospital over a four-month period by manual reviewing the inpatient lists that surgical junior doctors compile and maintain daily to record patient locations and clinical course. The electronic health record (*Cerner CRS Millenium*) for each patient's care episode was reviewed to access both the CT request form as well as information to assess information in the descriptive fields against.
We included patients from the hospital's inpatient surgical services: colorectal surgery, emergency general surgery and upper gastrointestinal surgery. We excluded requests that resulted in no CT scan being done.

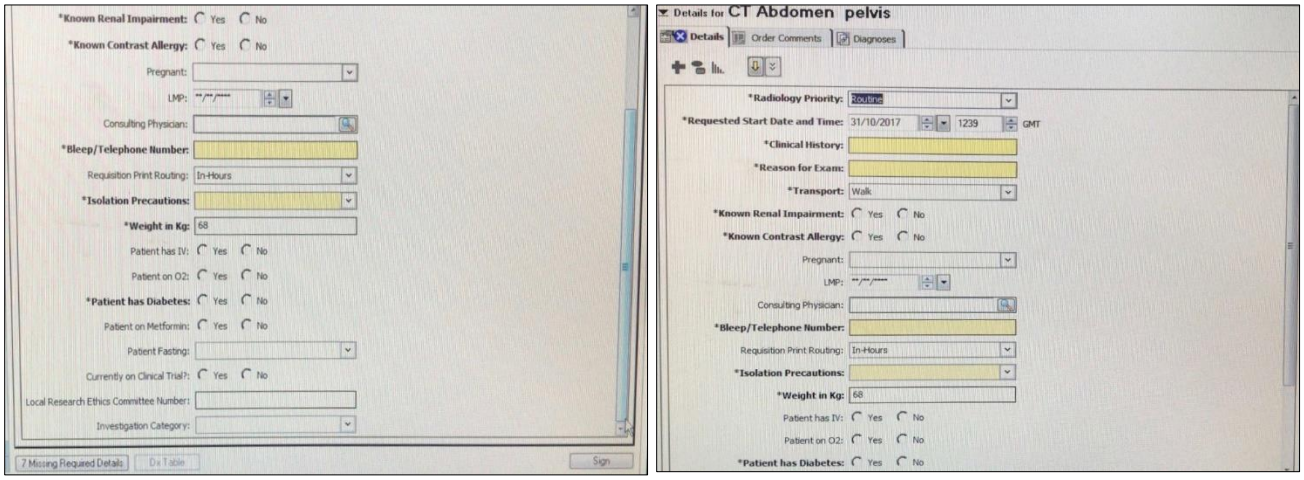

Image 1: Electronic CT request form: Cerner CRS Millennium. YELLOW and STARRED fields are mandatory

Each CT request form was assessed for the completion of data fields corresponding to the standards defined in the Royal College of Radiology Referral Guideline. The Cerner CRS Millennium system auto populates the electronic CT request form with patient demographics, patient location and requesting clinician – these cannot be edited at the time of CT scan request. Consulting Physician, Clinical History and Reason for Exam are editable by the requesting clinician.

A score of 0 indicated the field was not completed at all, 1 indicated the field was filled either insufficiently or incorrectly, and 2 indicated the field was completed both sufficiently and correctly. The automatically populated fields such as the patient demographics were given a score of 2.

Clinical History, Reason for Exam and Consulting Physician were independently scored by two senior surgical registrars, using the electronic health record to assess the free text entry for clinical accuracy and comprehensiveness. Disagreements were resolved by discussion between the two assessors to generate a single combined score for each CT request form.

This data was recorded in a table charting a completion score for each field calculated for each CT request form; the percentage fill rate of each editable field across all the included CT request forms was plotted on respective bar graphs, illustrating the performance of each of the three surgical teams.

3. Results

A total of 189 CT request forms were analysed during the 4-month period, 60% of which were requested by the Emergency General Surgery (EGS) team. The auto-populated parameters automatically scored 2, giving Patient Demographics, Patient Location and Requesting Clinician 100% compliance, therefore meeting the RCR standards for these sections.

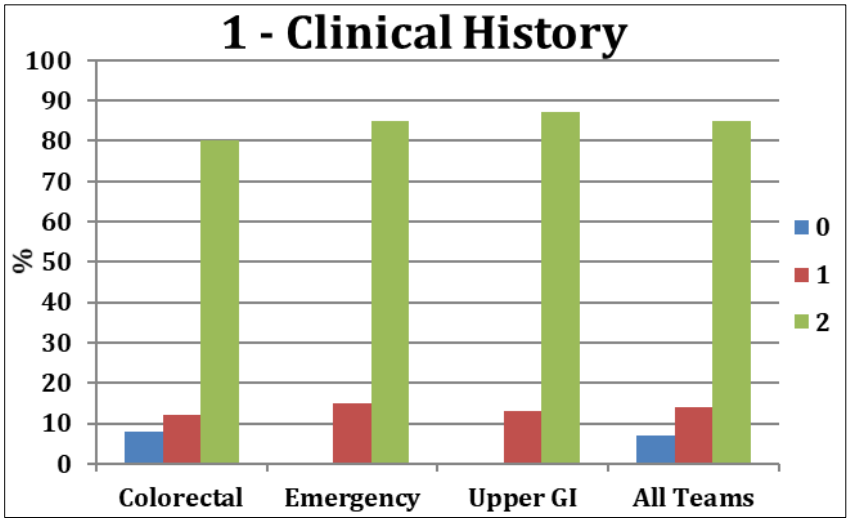

Fig 1: Adequate completion of the 'Clinical History' parameter

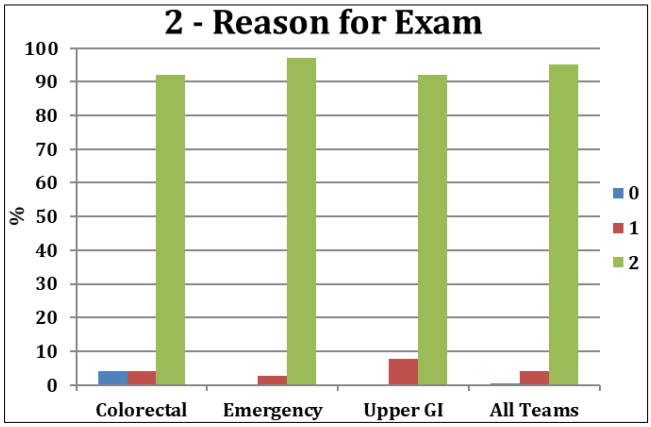

Fig 2: Adequate completion of the 'Reason for Exam' parameter

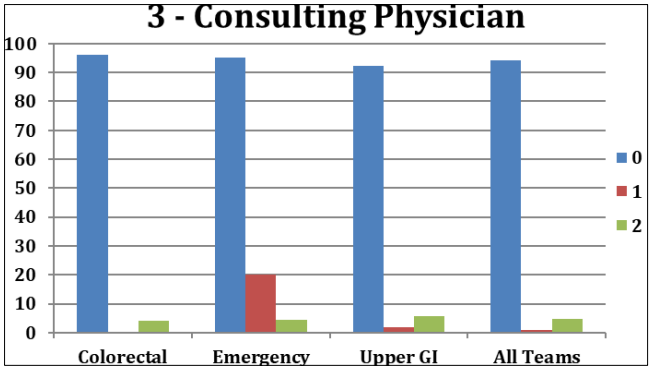

Fig 3: Adequate completion of the 'Consulting Physician' parameter

For the 'Clinical History' field, all 3 surgical teams scored 2 (*sufficient and correct information*) in more than 80% of requests to give an average of 85% across all the CT request forms; 7% scored zero due to failure to enter both *sufficient* and *correct* information (Fig1). For the 'Reason for Exam' field, all 3 surgical teams scored 2 in more than 90% of their requests to give an average of 95% across all the CT request forms. Only 4.7% of the 'Consulting Physician' fields were completed correctly and 95% were not completed at all. Overall only 62% of CT request forms had all fields filled out sufficiently and correctly.

4. Discussion

As the first contact between requesting clinicians and radiologists, the information provided in CT scan request forms informs the triage of scans, the clinical usefulness of information in CT scan reports as well as the timely and accurate conveyance of findings to the clinicians responsible for the patient's care. Correct clinical information may direct the radiologist to image the patient with another modality (such as ultrasound or magnetic resonance imaging) to limit unnecessary patient exposure to the risks of intravenous contrast and ionizing radiation, especially in children or pregnant women [1, 2]

It has been shown in other studies that receiving a high proportion of CT scan requests with insufficient information creates difficulty for radiologists in effectively triaging scans, increases time spent in remedial communication with requesting clinicians, Compromises ability to interpret scans and leads to reports which are suboptimal for surgical management decisions [3], Several studies have investigated inadequacy of information in radiological investigation request forms. One study found "*adequate and complete*" information in only 34% of request forms with only 48% having an "*adequate and complete*" past surgical history. Other studies have shown adequate request form completion rates as high as 72% and even 90%. With 62% of our request forms being comprehensively completed our results were superior to some but far inferior to others [4, 5]. With regards to the "consulting physician" parameter 83.1% of requests provided this information in the study by Akintomide *et al*. [6] with other studies finding much higher rates up to 99.7% [7]. Our study showed a much lower rate of completion at 4.7%, likely due to the *CRS Millenium* electronic system not requiring this field - the only parameter that is not mandatory. This echoed the findings of Adebayo *et al*. [8].

Maywald *et al*. (2012) [6] studied the completion of electronic request forms in comparison to paper forms, finding that using electronic forms reduces the number of errors made compared to paper forms but that clinical information provided is less adequate [9]. Our study confirms this tendency to under fill clinical information in electronic request forms. Additionally, we have highlighted a 95% failure rate in recording the responsible consultant physician and significant failure rates in providing adequate clinical history (15%) or giving a clear clinical question to be answered (5%).

The *Cerner CRS Millenium* system mandates a description of the clinical history, clinical question ('Reason for Exam') and contact details of the requesting clinician; it does not mandate the completion of the 'Consultant Physician' field – meaning attribution of the scan report defaults to the consultant named on the patient's care episode – which is often incorrect or not updated as the patient progresses through their clinical episode.

CRS Millennium electronic request forms do have one outstanding benefit - electronic forms auto populate data, guaranteeing 100% data entry into fields such as patient demographics and requesting clinician as required by RCR guidelines. This does not, however, prevent erroneous input of the auto-populated parameters by clerical staff nor does it guarantee sufficiency of data in manually entered information. As demonstrated in the CT request form example above, there are a number of other non-mandatory fields to be filled in on the *CRS Millennium* CT request form - such as if the patient requires supplemental oxygen, is diabetic, if they have renal dysfunction among others. These were noted to have been left unfilled in the overwhelming majority of cases, however are not included in the RCR guidelines so were not analysed. The only non-mandatory field included in the RCR standards is the 'Consultant' field, which was poorly completed in our study.

Without auto-population the completion rate of such fields would likely be lower, as shown by Akintomide *et al* and reflected in our study by the poor completion rate of the consultant field. Akintomide *et al* found the two fields most commonly left unfilled were the patient's telephone number and address (2.24% and 10.86% completion respectively). Auto population precludes illegible handwriting, found in other studies to be a problem in up to 16% of requests forms [3, 4, 10, 11].

5. Conclusion

CT scan requests made by the surgical teams in our district general hospital meet the RCR Referral Guideline (2011) standards for consistently providing correct patient demographics and location in the hospital but fail to meet the standards in fields which require manual input by the requesting clinician – especially the consulting physician responsible for the patient's care. There were notable shortcomings in providing sufficient and correct clinical history and a clear clinical question to be answered by the radiologist reporting on the examination. Inadequately completed CT request forms compromise clinically useful reporting of CT scans and lead to misdirection of correspondence, with the potential for delays in conveying findings and reports not being actioned by the clinicians responsible for the patient's care.

We feel that in institutions using electronic healthcare systems to request investigations the request form should have a mandatory text field for manually inputting the name of the Consulting Physician responsible for the patient's care – encouraging the requesting clinician to identify who this is and complete the form accordingly.

Out study highlights the ongoing need to educate junior surgical doctors via departmental induction to establish correct practice in completing request forms for imaging investigations.

6. Acknowledgements

We wish to thank our surgical colleagues at Kingston Hospital NHS Trust for their support in collating data for this study and offering us the opportunity to present it locally.

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