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Quality Improvement

Improving Clinical Information on Whole-Body CT Requests for Major Trauma: A Quality Improvement Study

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Abstract

Aims/Background: Whole-body computed tomography (WBCT) is central to major trauma assessment, but appropriate justification and reporting depend on adequate clinical information at the time of request. The Royal College of Radiologists (RCR) 2024 major trauma guidance recommends six minimum data elements for trauma WBCT requests. This quality improvement project aimed to improve documentation compliance and reduce inappropriate WBCT requests at a district general hospital. **Methods:** A completed audit cycle was undertaken. Consecutive adult trauma patients undergoing WBCT were identified in a baseline audit (Cycle 1; n = 100, September–December 2024) and a post-intervention re-audit (Cycle 2; n = 100, September–December 2025). Three interventions were introduced: educational feedback to Department of Radiology and Department of Emergency Medicine staff, an RCR-derived electronic request proforma embedded within CareFlow Electronic Patient Record (EPR), and real-time radiologist feedback. Primary outcomes were compliance with the six RCR minimum dataset standards and the proportion of requests meeting RCR WBCT criteria. **Results:** Baseline compliance varied across documentation domains. In Cycle 1, documentation rates were 74% for mechanism of injury, 94% for primary survey findings, 7% for haemodynamic status, 5% for preceding investigations, 13% for past medical history, and 0% for trauma team leader contact details. Following intervention, mechanism documentation improved to 100% ($p < 0.001$), haemodynamic status to 93% ($p < 0.001$), and trauma team leader contact details to 92% ($p < 0.001$). Primary survey documentation remained high at 97% ($p = 0.306$). Past medical history increased to 18% ($p = 0.329$), while preceding investigations remained low at 4% ($p = 1.000$). Requests meeting RCR WBCT criteria increased from 57% to 96% ($p < 0.001$), while non-compliant requests fell from 43% to 4%. This represented 39 potentially avoidable scans and approximately 780 mSv of theoretically avoided radiation exposure per 100 requests. **Conclusion:** A theory-informed intervention combining education, a mandatory electronic proforma, and real-time radiologist feedback substantially improved trauma WBCT request documentation and reduced inappropriate requests. Embedding minimum datasets into electronic requesting systems is a low-cost, scalable strategy to support compliance with the Ionising Radiation (Medical Exposure) Regulations [IR(ME)R] 2017, as amended in 2020, and radiation stewardship.

Keywords: X-ray computed tomography; multiple trauma; quality improvement; radiology information systems; patient safety; clinical audit

1. Introduction

Whole-body computed tomography (WBCT) is the standard imaging modality for adult major trauma patients, offering rapid detection of life-threatening injuries. However, the diagnostic utility of WBCT depends critically on the quality of clinical information provided at the time of request. Inadequate information can lead to misinterpretation, delayed reporting, unnecessary additional imaging, and inappropriate scanning [1].

The Royal College of Radiologists (RCR) major adult trauma radiology guidance (June 2024) outlines Standard 7, mandating six minimum data elements for WBCT requests:

1. Mechanism of injury
2. Primary survey findings and area of concern
3. Haemodynamic instability status
4. Results of preceding investigations (e.g., focused assessment with sonography in trauma [FAST] scan, digital radiography)
5. Any significant medical/surgical history (if known)
6. Accurate contact details of the trauma team leader (TTL) or responsible senior clinician

The target is 100% compliance. A request proforma is provided in Fig. 1.

Despite the availability of national guidance, consistent implementation of recommended documentation standards in routine trauma practice may remain challenging. Trauma imaging requests are frequently generated in time-critical and clinically complex circumstances, where information may be evolving, incomplete, or communicated verbally between members of the multidisciplinary trauma team [1]. The continued inclusion of trauma-request documentation within the RCR AuditLive programme reflects the importance of local evaluation of compliance with these

A2 Sample whole-body trauma CT request form

Patient name:			
Address:		DOB:	
		Sex:	
Consultant:		Contact phone number/bleep:	
Indication			
RTA	Injury to more than one body region		
	Fatality at scene		
	High speed impact		
Fall	Injury to more than one body region		
	Fall from over 3 m		
Assault	Injury to more than one body region		
Reduced GCS with unknown mechanism of injury			
Other/additional info			
Current GCS			
Haemodynamically	Stable	Unstable	
Clinical regions of concern			
Head		Abdo pelvis	
C-spine		All	
Thorax		None	
Clinical questions to be answered:			
LMP		Catheterised	
Referring doctor and contact phone number/bleep		Date	
Signature			

Fig. 1. The Royal College of Radiologists whole-body trauma CT request form. The local mandatory electronic request proforma was adapted from Appendix 2 of the Royal College of Radiologists (RCR) major adult trauma radiology guidance (2024) and embedded within CareFlow Electronic Patient Record, version 6.1.6.14 (System C, London, UK). Reproduced with permission from the Royal College of Radiologists. CT, computed tomography; GCS, Glasgow Coma Scale; RTA, road traffic accident; LMP, last menstrual period; DOB, date of birth.

standards [2]. Adequate clinical information supports appropriate justification and protocol selection and may improve the accuracy, clinical relevance, and diagnostic confidence of radiological interpretation [1,3]. Incomplete documentation may therefore represent not only an administrative deficiency but also a systems-level barrier to consistent justification, effective communication, and compliance with radiation-protection requirements [1,4].

Although national guidance defines the minimum information expected within a major trauma computed tomography (CT) request [1], evidence regarding interventions designed to embed these requirements into electronic

requesting workflows remains limited. In particular, the effectiveness and sustainability of combined education, mandatory structured electronic fields, and contemporaneous radiologist feedback in improving both documentation quality and the appropriateness of WBCT requesting have not been well characterised.

At Kettering General Hospital, a district general hospital with a major trauma unit, anecdotal observation suggested that WBCT requests frequently lacked this essential information. This raised concerns regarding compliance with the Ionising Radiation (Medical Exposure) Regulations 2017, as amended in 2020, and the potential for unnecessary or inadequately justified radiation exposure. WBCT is associated with a substantial radiation dose, estimated at approximately 20 mSv, with a corresponding lifetime attributable cancer risk of approximately 1 in 1000, while unnecessary examinations also place additional demands on radiology services [5].

This quality improvement project aimed to quantify baseline compliance with the RCR minimum dataset and evaluate whether a multi-component intervention could improve documentation quality and the appropriateness of WBCT requesting, with the objective of achieving the recommended 100% compliance target.

2. Methods

2.1 Context

Kettering General Hospital is a 600-bed district general hospital in the East Midlands, with a Department of Emergency Medicine seeing approximately 100,000 annual attendances as a major trauma unit. Pre-intervention, trauma WBCT requests used free-text entry within the electronic requesting system CareFlow Electronic Patient Record (EPR) (System C, London, UK), which interfaces with the clinical radiology information system (CRIS) for image acquisition and reporting, with no mandatory template. Requests were initiated in CareFlow EPR by Department of Emergency Medicine clinicians, with the clinical information then transmitted to CRIS for radiologist review and reporting.

2.2 Study Design and Theoretical Framework

A completed quality improvement cycle using a plan-do-study-act (PDSA) methodology was undertaken (Fig. 2), comprising a retrospective baseline audit, targeted interventions, and prospective re-audit [6]. Interventions were informed by three complementary models:

1. Capability, Opportunity and Motivation-Behaviour (COM-B) framework [7]:

• Capability was addressed through education sessions that explained the RCR standards and provided practical examples of adequate documentation.

• Opportunity was addressed by embedding the mandatory proforma within the electronic requesting system, making it the default pathway.

• Motivation was addressed through real-time radiologist feedback and departmental feedback sessions highlighting baseline deficiencies and radiation exposure implications.

2. Human factors principles [8]: Mandatory fields were designed as a "forcing function", a constraint that prevents progression without completion of essential information, thereby reducing reliance on memory or clinical judgement alone.

3. Control theory [9]: Real-time feedback acted as a comparator mechanism, alerting referrers when their request deviated from the standard and enabling immediate correction.

2.3 Baseline Audit (Cycle 1)

Consecutive adults (≥18 years) undergoing trauma WBCT requested from the Department of Emergency Medicine between 1 September and 31 December 2024 were included (n = 100). Inclusion criteria were: Adult patients referred from the Department of Emergency Medicine, including patients transferred for assessment, provided that the WBCT request was generated locally. Exclusion criteria were: Inpatient requests, repeat WBCT scans for the same trauma episode, patients transferred from other hospitals with WBCT already performed, and paediatric patients. Each request was assessed for the six RCR minimum data elements: Mechanism of injury, primary survey findings, haemodynamic status, preceding investigations, relevant past medical history, and trauma team leader (TTL) contact details. Data were extracted from the electronic request forms in CareFlow EPR and the associated CRIS radiology information system records. Requests were also classified as meeting or not meeting local major trauma WBCT criteria based on the documented mechanism of injury, suspected anatomical distribution of injury, initial clinical findings, haemodynamic status, trauma team assessment, preceding investigations, and other relevant clinical factors, in accordance with RCR guidance. High-risk mechanisms, such as high-speed road traffic collisions or falls from a height greater than 3 m, were considered alongside clinical evidence of significant or multi-region injury rather than as standalone indications for WBCT.

Assessments were performed independently by two reviewers: A radiology consultant (Cycle 1: RRS; Cycle 2: RRS) and another consultant radiologist (LN). Disagreements were resolved by consensus discussion. Inter-rater reliability was assessed using Cohen's kappa; the mean kappa coefficient across all items was 0.89 (range 0.82–0.95), indicating excellent agreement.

2.4 Interventions (Introduced Sequentially June–July 2025)

1. Education and feedback: Baseline findings were presented to Department of Radiology and Department of Emergency Medicine staff, via two 60-minute departmen-

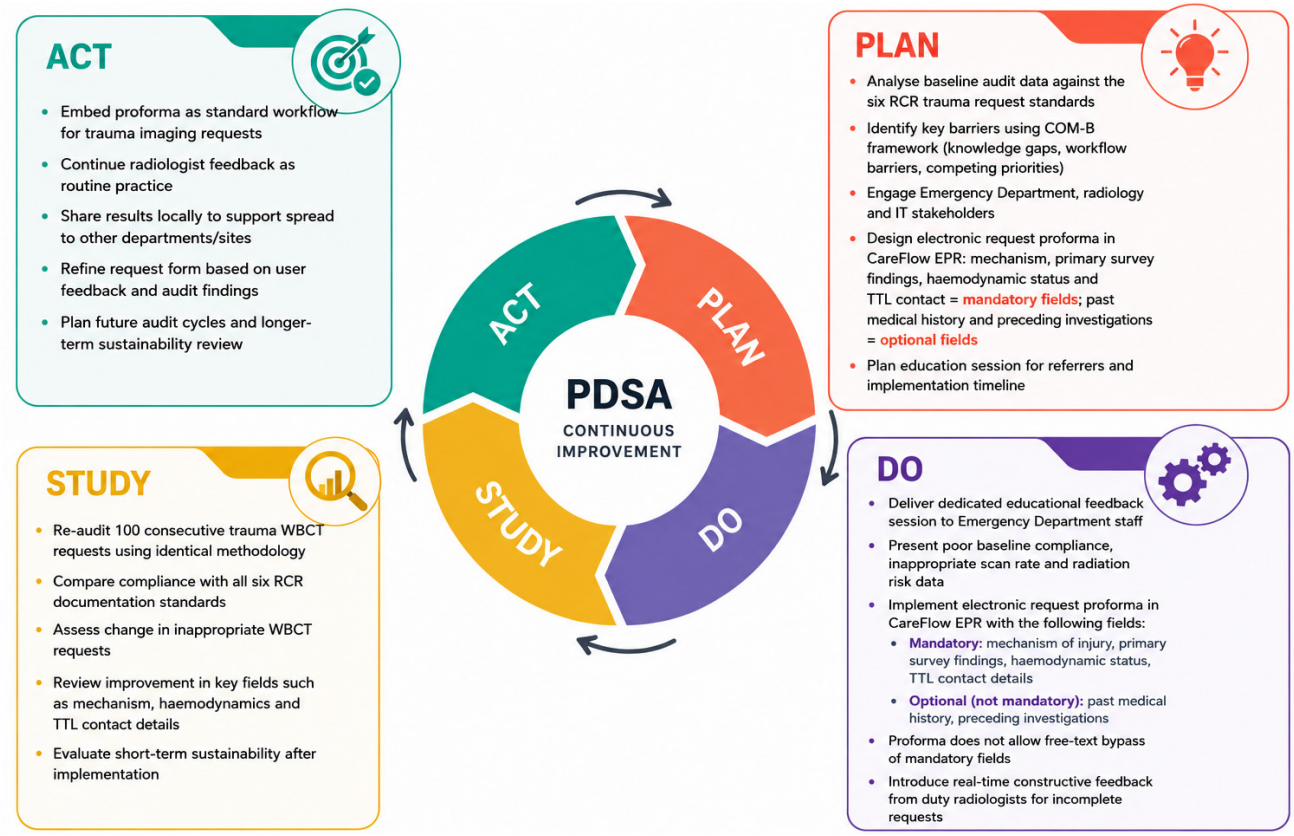

Fig. 2. Plan-do-study-act (PDSA) cycle for the whole-body computed tomography (WBCT) request quality improvement intervention. This figure was created using Canva web-based design platform (https://www.canva.com). RCR, Royal College of Radiologists; TTL, trauma team leader; COM-B, Capability, Opportunity and Motivation-Behaviour framework; IT, information technology; EPR, Electronic Patient Record.

tal teaching sessions held in June 2025: One during the monthly radiology audit meeting and one during the Department of Emergency Medicine audit meeting. The sessions targeted clinical staff involved in trauma WBCT requesting, including Department of Emergency Medicine consultants, registrars, junior doctors, and radiology registrars. Meetings covered the RCR minimum dataset requirements, baseline audit findings, rates of inappropriate requesting, and associated radiation exposure, including estimated lifetime cancer risk. A written summary was circulated by email to staff who were unable to attend.

2. Mandatory electronic minimum dataset: A structured proforma based on Appendix 2 of the Royal College of Radiologists guidance was embedded within CareFlow EPR. Mandatory structured fields had to be completed before submission and could not be bypassed by entering information solely within the free-text section. Additional free-text information could, however, be provided under "other/additional information" to document complex or case-specific clinical details. Past medical history and preceding investigations were not mandatory fields, reflecting that this information may genuinely be unavailable at the time of the initial trauma request; however, both could be entered under "other/additional information" when known. The proforma permitted responses of "unknown" or "not yet available" where information was genuinely unavailable at the time of the request. For the purposes of the audit, compliance with these documentation items was recorded only when relevant information was explicitly provided or when the absence of relevant past medical history or preceding investigations was clearly stated. Entries recorded as "unknown", "not yet available", unclear, or absent were classified as non-compliant for the relevant item because they did not provide interpretable clinical information to support imaging justification or protocol selection.

3. Real-time radiologist feedback: Duty radiologists provided immediate, constructive feedback on incomplete or unjustified requests. Feedback was delivered by direct telephone discussion with the requesting clinician for more substantial concerns or, where appropriate, through a text comment within the electronic requesting system for minor deficiencies. Feedback was provided by the consultant radiologist or senior radiology registrar on duty and generally addressed the identified documentation or justification deficiency, the clinical reasoning required to support the request, and relevant patient safety or radiation protection considerations. Owing to the practical constraints of contemporaneous documentation during routine clini-

cal work, verbal feedback was not recorded using a standardised template within the EPR or CRIS system. Consequently, the frequency, content, and delivery of individual feedback episodes were not formally audited.

2.5 Re-Audit (Cycle 2)

A prospective re-audit using the same inclusion/exclusion criteria and assessment methodology was undertaken between 1 September and 31 December 2025 (n = 100), assessing the same six documentation standards and appropriateness criteria.

2.6 Outcome Measures

Primary outcome: Proportion of requests compliant with each RCR minimum dataset item.

Secondary outcomes:

- Proportion meeting RCR proforma criteria for appropriate WBCT
- Change in inappropriate request rate
- Diagnostic yield of WBCT scans according to indication status (baseline audit only)
- Radiation exposure implications (estimated avoidable dose)

2.7 Statistical Analysis

Continuous variables were presented as mean ± standard deviation (SD) for approximately normally distributed data and median with interquartile range (IQR) for non-normally distributed data. Categorical variables were presented as n (%). Normality was assessed using the Shapiro–Wilk test. Age was non-normally distributed in both cycles and was therefore compared between audit cycles using the Mann–Whitney U test. Categorical variables were compared using Pearson's chi-square test or Fisher's exact test, as appropriate, depending on expected cell counts. Statistical significance was defined as $p < 0.05$.

For diagnostic yield analyses, WBCT findings were dichotomised as normal versus abnormal, with abnormal findings including single traumatic findings and major or multi-region traumatic injury. The association between request indication status and diagnostic yield was reported as an odds ratio (OR) with 95% confidence interval (CI), calculated using univariable binary logistic regression. The OR represents the odds of an abnormal WBCT finding in indicated requests compared with non-indicated requests. Analyses were performed using IBM SPSS Statistics version 31.0 (IBM Corp., Armonk, NY, USA).

2.8 Sustainability and Reporting

Re-audit data were collected over four months post-intervention; longer-term sustainability was not formally assessed. This manuscript follows Standards for QUality Improvement Reporting Excellence (SQUIRE) 2.0 guidelines [10].

2.9 Adverse Events Monitoring

No formal adverse event monitoring protocol was established for this quality improvement project, as the interventions involved changes to documentation processes rather than direct patient care interventions. However, the project team actively monitored for unintended consequences through informal feedback from clinical staff during the intervention period. No adverse consequences were reported. Any potential safety concerns would have been escalated through the hospital's incident reporting system.

3. Results

A total of 200 consecutive major trauma whole-body computed tomography (WBCT) requests were analysed, comprising 100 requests in the baseline audit (Cycle 1) and 100 requests in the re-audit following intervention (Cycle 2).

3.1 Baseline Characteristics

Patients in Cycle 2 were significantly younger than those in Cycle 1 (median age 56.5 vs 70.5 years; $Z = 2.97$, $p = 0.003$). Sex distribution did not differ significantly between cycles [male sex 58.0% vs 55.0%; $\chi^2(1) = 0.18$, $p = 0.669$]. The mechanism-of-injury profile did not differ significantly between cycles [$\chi^2(3) = 5.91$, $p = 0.116$], with falls remaining the commonest mechanism (61.0% vs 68.0%), followed by road traffic collision-related trauma (32.0% vs 25.0%) (Table 1).

3.2 Compliance With RCR Request Standards

Baseline compliance with the Royal College of Radiologists (RCR) minimum dataset standards was variable and poor across several domains (Fig. 3). In Cycle 1, detailed mechanism of injury was documented in 74% of requests, primary survey findings in 94%, haemodynamic status in 7%, preceding investigations in 5%, relevant past medical history in 13%, and trauma team leader (TTL) contact details in 0%.

Following the multi-component intervention, marked improvements were observed in most domains. Detailed mechanism documentation increased from 74% to 100% (absolute increase +26%; Fisher's exact $p < 0.001$), haemodynamic status documentation from 7% to 93% [+86%; $\chi^2(1) = 147.92$, $p < 0.001$], past medical history documentation from 13% to 18% [+5%; $\chi^2(1) = 0.95$, $p = 0.329$], and TTL contact documentation from 0% to 92% (+92%; Fisher's exact $p < 0.001$). Primary survey findings also improved from 94% to 97% [+3%; $\chi^2(1) = 1.05$, $p = 0.306$]. Preceding investigations changed from 5% to 4% (–1%; Fisher's exact $p = 1.000$).

3.3 Appropriateness of WBCT Requests

At baseline, 57.0% of WBCT requests met RCR trauma criteria, compared with 96.0% following intervention [absolute increase +39%; $\chi^2(1) = 42.30$, $p < 0.001$].

Table 1. Baseline demographic and injury characteristics of patients undergoing whole-body computed tomography in the initial audit and re-audit cycles.

Characteristic	Audit (Cycle 1) n = 100	Re-audit (Cycle 2) n = 100	Test statistic	*p*-value
Age, median (IQR), years	70.5 (50.5–82.3)	56.5 (34.0–72.0)	Z = 2.97	0.003
Male sex, n (%)	55 (55.0)	58 (58.0)	$\chi^2(1) = 0.18$	0.669
Female sex, n (%)	45 (45.0)	42 (42.0)		
Mechanism of injury, n (%)			$\chi^2(3) = 5.91$	0.116
Fall-related trauma	68 (68.0)	61 (61.0)		
Road traffic collision/vehicle-related	25 (25.0)	32 (32.0)		
Assault	2 (2.0)	6 (6.0)		
Other trauma	5 (5.0)	1 (1.0)		

Age is presented as median with interquartile range (IQR), as it was non-normally distributed on Shapiro–Wilk testing, and was compared between cycles using the Mann–Whitney U test. Categorical variables are presented as n (%) and were compared using Pearson's chi-square. The mechanism-of-injury *p*-value represents comparison of the overall distribution of injury mechanisms between audit cycles. A *p*-value < 0.05 was considered statistically significant.

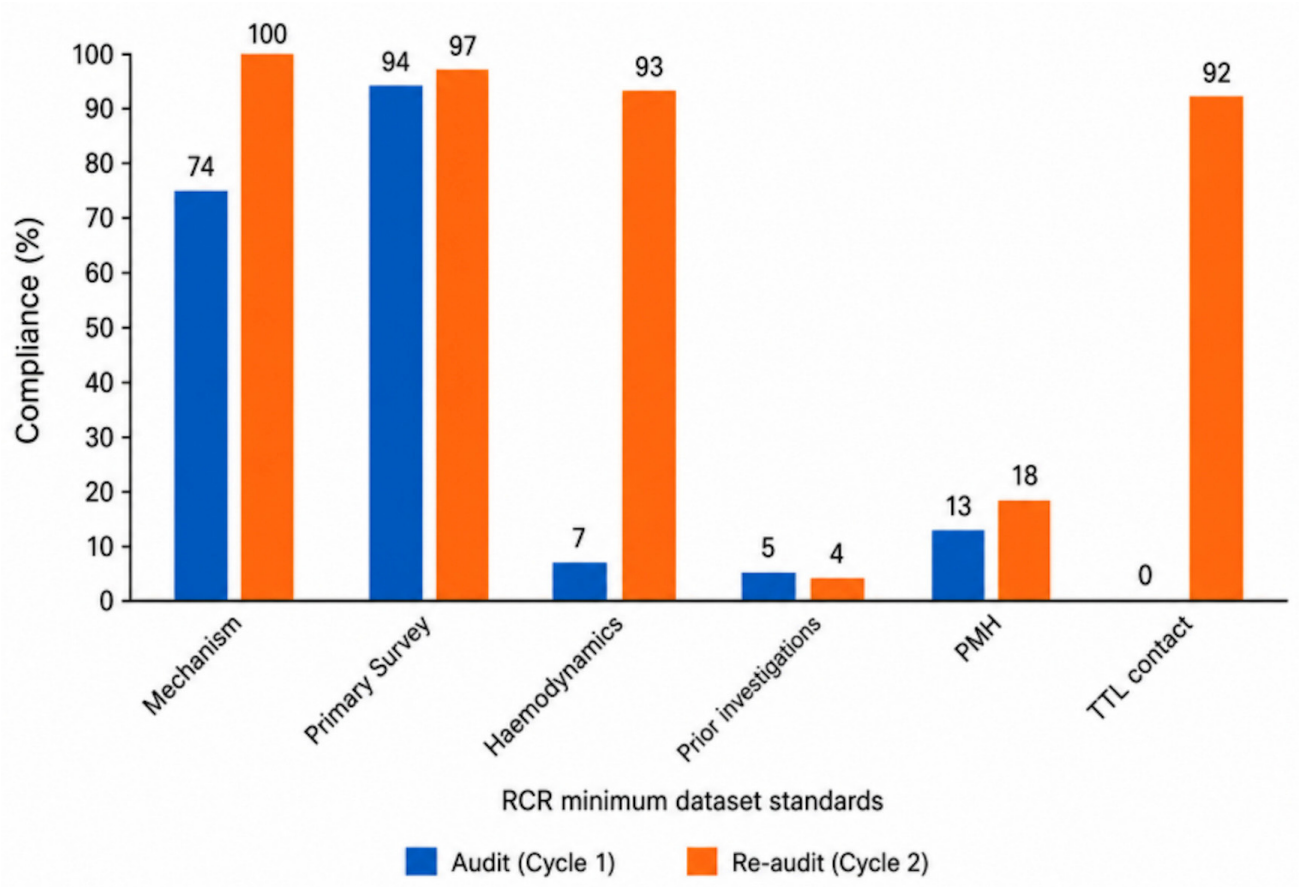

Fig. 3. Compliance with Royal College of Radiologists (RCR) minimum dataset standards for major trauma whole-body computed tomography (WBCT) requests before and after intervention. The figure includes the six RCR minimum dataset items. Data are shown as percentage compliance. This figure was created by the authors using Microsoft PowerPoint for Microsoft 365, version 16.99 (Microsoft Corporation, Redmond, WA, USA). PMH, past medical history.

Conversely, requests not meeting criteria fell from 43.0% to 4.0%.

Among requests meeting RCR criteria, the most common documented indications were fall injury involving more than one body region, high-speed impact, and fall greater than 3 m. Non-compliant requests decreased across all recorded categories, particularly isolated symptoms or single-region pain, vague concern for occult injury, medical or non-trauma concerns, and minor low-energy mechanisms (Table 2).

Table 2. Appropriateness and indication categories for trauma whole-body computed tomography requests before and after intervention.

Request category/indication	Audit (Cycle 1), n = 100	Re-audit (Cycle 2), n = 100	Test statistic	*p*-value
Overall appropriateness			$\chi^2(1) = 42.30$	<0.001
Requests meeting RCR WBCT criteria	57 (57.0)	96 (96.0)		
Requests not meeting RCR WBCT criteria	43 (43.0)	4 (4.0)		
Documented indication among requests meeting RCR WBCT criteria				
RTA injury to >1 body region	10 (10.0)	10 (10.0)		
High-speed impact	9 (9.0)	19 (19.0)		
Fall injury to >1 body region	24 (24.0)	38 (38.0)		
Fall >3 m	7 (7.0)	18 (18.0)		
Assault injury to >1 body region	3 (3.0)	5 (5.0)		
Reduced GCS with unknown mechanism	3 (3.0)	4 (4.0)		
Fatality at scene	1 (1.0)	2 (2.0)		
Reason requests did not meet RCR WBCT criteria				
Isolated symptoms/single-region pain	9 (9.0)	0 (0.0)		
Query occult injury/vague concern	7 (7.0)	1 (1.0)		
Medical/non-trauma concern	8 (8.0)	1 (1.0)		
Minor injury/low-energy mechanism	12 (12.0)	1 (1.0)		
Explained reduced GCS/non-trauma cause	4 (4.0)	0 (0.0)		
Insufficient documentation/not stated	3 (3.0)	1 (1.0)		

Values are presented as n (%). The statistical comparison applies only to the overall proportion of requests meeting versus not meeting Royal College of Radiologists (RCR) whole-body computed tomography (WBCT) criteria between Cycle 1 and Cycle 2. Because "meeting criteria" and "not meeting criteria" are complementary categories, a single chi-square test and *p*-value are presented. Indication and non-compliant request subcategories are presented descriptively and were not tested separately. RCR, Royal College of Radiologists; RTA, road traffic accident; GCS, Glasgow Coma Scale.

3.4 Diagnostic Yield in Baseline Audit

In the baseline cohort, WBCT findings were classified into three mutually exclusive categories: Normal, single traumatic finding, or major/multi-region traumatic injury. Among non-indicated WBCT requests, 27 scans were normal (62.8%), 13 showed a single traumatic finding (30.2%), and three demonstrated major or multi-region traumatic injury (7.0%). Among indicated requests, 35 scans were normal (61.4%), 16 showed a single traumatic finding (28.1%), and six demonstrated major or multi-region traumatic injury (10.5%). Overall, abnormal findings were identified in 16/43 non-indicated scans (37.2%) and 22/57 indicated scans (38.6%), with no significant difference in diagnostic yield between groups [$\chi^2(1) = 0.02$, $p = 0.887$; OR 1.06, 95% CI 0.47–2.40] (Fig. 4).

3.5 Radiation Exposure Implications

The reduction in inappropriate WBCT requests from 43 to 4 per 100 requests represents 39 potentially avoidable scans per 100 requests. Assuming an average effective dose of 20 mSv per WBCT, this equates to approximately 780 mSv of theoretical avoided radiation exposure per 100 requests, equivalent to approximately 355 average annual background radiation exposures in the UK (2.2 mSv/year) or 7800 chest radiographs (0.1 mSv each) [2].

3.6 Unintended Consequences

No adverse consequences were reported. Some referrers initially expressed frustration at the mandatory proforma fields, but this was resolved within two weeks. Radiologists reported improved efficiency in reporting due to better clinical information.

4. Discussion

4.1 Findings and Comparison With Existing Literature

The intervention improved documentation for mechanism (+26%), haemodynamic status (+86%), and TTL contact details (+92%). The lack of significant improvement in documentation of preceding investigations (–1%) and past medical history (+5%) may reflect genuine unavailability of this information at the time of request, alongside omission of these fields from the RCR proforma. This aligns with Depasquale and Crockford [11], who reported that less than 20% of clinical histories were detailed. Primary survey documentation was already high at baseline (94%), leaving little room for improvement. The increase in appropriate WBCT requests from 57% to 96% is clinically significant, as inadequate clinical information is associated with inaccurate reporting, while accurate information helps radiologists construct more useful reports [12].

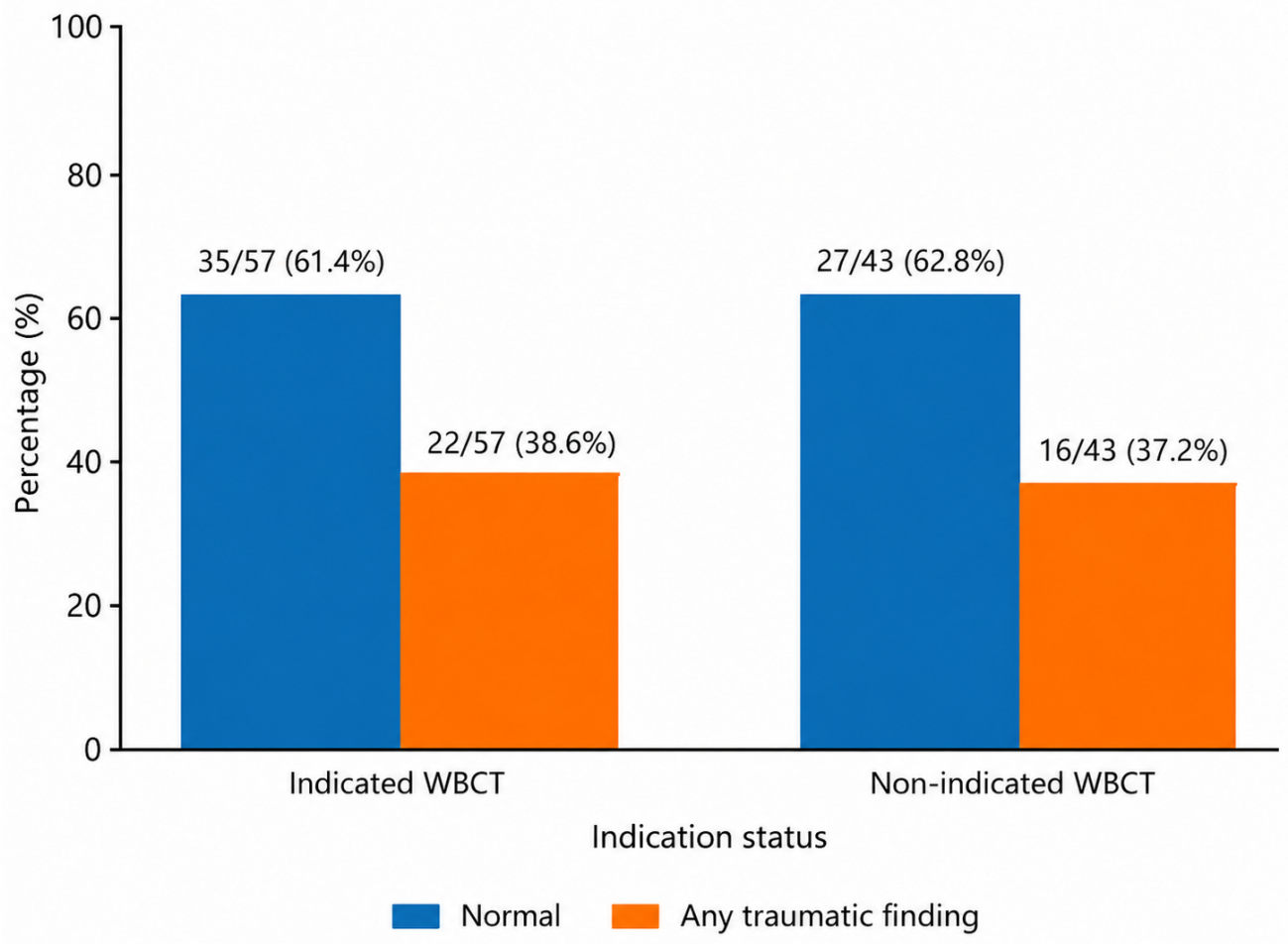

Fig. 4. Diagnostic yield of baseline (Cycle 1) whole-body computed tomography requests by indication status. Grouped bar chart showing normal scans and scans with any traumatic finding among indicated and non-indicated WBCT requests. "Any traumatic finding" was defined as the presence of either a single traumatic finding or a major/multi-region traumatic injury on WBCT. Data labels show the number/total (%) within each indication-status group. This figure was created by the authors using Microsoft PowerPoint for Microsoft 365, version 16.99 (Microsoft Corporation, Redmond, WA, USA). WBCT, whole-body computed tomography.

The similar baseline diagnostic yield between indicated and non-indicated requests (37.2% vs 38.6%, p = 0.887) should not be interpreted as evidence that justification criteria lack value. Justification frameworks balance expected clinical benefit against radiation burden, opportunity cost, and downstream resource use, rather than simply maximising positive scan rates. A positive finding does not retrospectively justify a poorly supported WBCT request. The key improvement was safer, more consistent decision-making, rather than merely a change in positivity rate. Moreover, many isolated traumatic findings in the non-indicated group may have been detectable using targeted imaging guided by the clinical assessment, although this was not directly evaluated.

Our findings align with Ananthan and Whitfield [13], who showed that a graded assertive communication model reduced inappropriate abdominal radiograph requests. The present study extends this principle to major trauma CT imaging, where poor justification carries substantial radiation exposure, scanner delays, and potential distraction from time-critical diagnoses.

While electronic clinical decision support systems can reduce inappropriate imaging, they often require significant investment [14]. This project demonstrates that a simpler intervention, such as a mandatory minimum dataset combined with feedback, achieves substantial gains without sophisticated algorithms or expensive software redevelopment. To our knowledge, this is the first study to apply mandatory minimum datasets to trauma WBCT requesting, showing that workflow redesign can reduce inappropriate scanning at much lower cost.

4.2 Radiation Exposure and Service Impact

The reduction in inappropriate WBCT requests from 43 to 4 per 100 requests corresponded to an estimated 780 mSv of theoretical avoided radiation exposure. Beyond radiation safety, fewer unjustified scans may improve scanner availability, reduce reporting workload, shorten Depart-

ment of Emergency Medicine bottlenecks, and allow prioritisation of patients with greater clinical need. A systematic review of 149 studies found that unnecessary CT scans significantly burden the healthcare system by increasing Department of Emergency Medicine wait times and lengths of stay, costing nearly a billion dollars annually [15].

4.3 Sustainability and Context

The re-audit period included four months after full implementation and suggests early sustainability of the intervention. Key factors likely supporting sustainability include: (1) The proforma became embedded in routine workflow, (2) Radiologist feedback became an accepted professional norm, and (3) Department of Emergency Medicine leadership endorsed the changes. Nevertheless, sustainability beyond the measured period remains unproven. Behavioural gains can erode with staff turnover, alert fatigue, or workflow drift, particularly in rotating junior doctor workforces. Reassessment at 12 and 24 months would provide stronger evidence of durability.

4.4 Limitations

This single-centre before-and-after study cannot exclude temporal confounding, secular trends, or concurrent service changes unrelated to the intervention. The re-audit cohort was significantly younger than the baseline cohort, which may have influenced documentation patterns or trauma complexity. However, the mechanism-of-injury profile was similar between cycles, and the improvement in documentation was large and consistent across most domains, making confounding by age alone an unlikely explanation for the observed changes. Variables such as trauma severity, level of consciousness, haemodynamic instability, and availability of collateral history may directly affect completion of RCR minimum dataset items, particularly past medical history and preceding investigations, and were not adjusted for. Some outcomes relied on information recorded in request forms and may not fully reflect undocumented clinical reasoning at the bedside. Classification of appropriateness and diagnostic yield involved reviewer judgement; however, inter-rater reliability was excellent (kappa 0.89), reducing the risk of classification bias. The study was not powered to detect differences in patient outcomes such as missed injuries, mortality, or time to definitive treatment. The radiation exposure analysis should be interpreted as an illustrative estimate based on an assumed average WBCT dose rather than as a patient-specific dosimetric or clinical outcome. No formal cost-effectiveness analysis was performed. This study should therefore be interpreted as a pragmatic quality improvement evaluation demonstrating improved process measures within one institution, rather than definitive evidence that the intervention independently improves patient-level outcomes or reduces clinically measured radiation harm. Accordingly, these findings demonstrate a strong association between the intervention and improved process measures, but do not establish definitive causation.

4.5 Implications for Practice and Policy

This project provides a practical and replicable template for hospitals seeking to improve trauma imaging governance. Because the intervention primarily required workflow redesign rather than new hardware or advanced software, implementation costs are likely low. Hospitals without structured trauma imaging request templates should consider them as a patient safety and quality improvement priority.

4.6 Future Directions

Future work should include: (1) A third audit cycle at 12–24 months to assess long-term sustainability; (2) Inclusion of past medical history and preceding investigations as additional mandatory fields alongside the RCR proforma; (3) Evaluation of patient-level outcomes, including missed injuries, time to diagnosis, escalation delays, and mortality; (4) Cost-effectiveness analysis incorporating avoided scans, reporting time, and operational flow benefits; and (5) Qualitative interviews with referrers and radiologists to understand barriers, acceptability, and unintended consequences.

5. Conclusion

A theory-informed intervention combining education, mandatory electronic fields, and radiologist feedback was associated with improved documentation quality and fewer inappropriate WBCT requests. Embedding minimum datasets within electronic requesting systems may provide a scalable, low-cost approach to supporting Ionising Radiation (Medical Exposure) Regulations [IR(ME)R] compliance and radiation stewardship.

Key Points

• Baseline compliance with RCR minimum standards for trauma WBCT requests was poor, particularly for haemodynamic status, senior contact details and prior investigations.

• Education, a mandatory electronic proforma and radiologist feedback improved 4/6 key documentation domains to 92–100%.

• Appropriate WBCT requests increased from 57% to 96%, while inappropriate requests fell from 43% to 4% ($p < 0.001$).

• The reduction in inappropriate WBCT requests represented 39 potentially avoidable scans and around 780 mSv of theoretical avoided radiation exposure per 100 requests.

• Mandatory minimum datasets in electronic requesting systems are a low-cost way to improve IR(ME)R compliance and patient safety.

Availability of Data and Materials

The datasets used and analysed during the current study are available from the corresponding author upon reasonable request. Anonymised data will be shared for academic purposes subject to appropriate data-sharing agreements.

Author Contributions

RRS and LN: Conceptualisation, methodology and investigation. JN: Data curation, formal analysis, writing—original draft, supervision, project administration. IMI: Investigation, data curation. All authors contributed to revising the manuscript critically for important intellectual content. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This service evaluation/quality improvement initiative did not require formal research ethics approval. The project was registered with the Kettering General Hospital Clinical Audit Department under project codes Rad/CA/2024-25/19 for the baseline audit and KGH Rad/QI/2025-26/17 for the re-audit. The project was conducted in accordance with relevant institutional governance requirements and the ethical principles of the Declaration of Helsinki, where applicable. Data were anonymised and reported only in aggregate. Supporting documentation confirming the project's registration and governance status is available from the hospital's Clinical Audit Department upon request.

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Conflicts of Interest

The authors declare no conflicts of interest.

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