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CRITICAL CHOICES: ASSESSING THE JUSTIFICATION OF CT SCANS IN ABDOMINAL EMERGENCIES AT A TERTIARY EMERGENCY UNIT

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Abstract

Background:
Computed Tomography (CT) is central to diagnosing abdominal emergencies, offering high sensitivity and specificity. However, balancing its diagnostic benefits against radiation risks, costs, and overuse is critical, particularly in resource-limited settings.

Objective:
To evaluate the justification of abdominal CT scans in abdominal emergencies at a tertiary emergency department in Peshawar, Pakistan, assess diagnostic performance against clinical outcomes, and identify patterns of overuse.

Methods:
A retrospective cross-sectional study was conducted at Lady Reading Hospital from January to June 2024, including 135 patients who underwent non-contrast abdominal CT for traumatic and non-traumatic emergencies. CT justification was assessed using established clinical guidelines, including those from the New Hampshire Trauma Medical Review Committee (2010) for trauma imaging principles and the StatPearls guidelines on Acute Abdomen (updated February 15, 2025) for general evaluation of acute abdominal pain. Data were analyzed using SPSS version 26, employing descriptive statistics and the Chi-square test, with significance set at $p < 0.05$.

Results:
Most patients were young males (mean age: 28.7 years), with trauma accounting for 68.1% of presentations, predominantly firearm injuries (24.4%) and road traffic accidents (21.5%). Positive CT findings were observed in 46.7% of cases. Trauma patients had a higher proportion of justified scans (61.1%) compared to non-trauma (38.9%), though not statistically significant ($p = 0.061$). CT showed high positive predictive value (88.2%) but low negative predictive value (15.4%), with sensitivity and specificity of 57.7% and 50.0%, respectively. Notably, 20.6% of patients with negative CT scans required surgery.

Conclusion:
While abdominal CT remains vital for emergency diagnosis, findings reveal potential overuse and limited reliability in excluding pathology, especially in trauma. Implementing locally adapted guidelines, structured clinical assessment, and adjunctive imaging could enhance diagnostic yield, reduce unnecessary radiation, and improve patient outcomes in similar resource-constrained

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environments.

INTRODUCTION

Computed Tomography (CT) scans are a cornerstone of emergency medicine, utilizing X-rays and advanced computer algorithms to produce high-resolution, cross-sectional images of internal organs, blood vessels, and bones, offering exceptional sensitivity and specificity for diagnosing abdominal emergencies such as acute pain, blunt trauma, and visceral injuries. Their critical role lies in enabling rapid, accurate diagnoses that guide treatment and enhance patient outcomes, particularly in high-stakes scenarios like polytrauma or acute abdominal conditions.[1] However, justifying CT use requires balancing diagnostic benefits against risks, including radiation exposure, costs, and potential overuse, to ensure alignment with evidence-based clinical practice.[2]

Globally, CT utilization in abdominal emergencies has surged, contributing to accurate diagnoses in 45.05% of acute abdominal pain cases, though inappropriate use is prevalent, with 135 unwarranted scans reported, particularly among younger patients.[3] In blunt abdominal trauma, CT achieves 100% sensitivity and 98% specificity, significantly influencing surgical decisions, while whole-body CT (WBCT) detects abdominal injuries in 23% of polytrauma cases—often tied to motor vehicle collisions (80% of blunt injuries)—and reduces mortality odds to 0.94 compared to selective scanning. [4] Technological advances, such as ultra-low-dose CT (ULD-CT), minimize radiation to radiography-equivalent levels while maintaining diagnostic accuracy, and hybrid PET/CT outperforms standard scans in complex cases like fever of unknown origin, offering a 19.4% diagnostic contribution versus 5.8% for conventional CT scans. [5]

The decision to employ CT scans is shaped by patient factors (e.g., age, comorbidities, symptoms like arthralgia or elevated CRP >30 mg/L), physician factors (e.g., diagnostic uncertainty, experience), and systemic issues (e.g., resource availability, radiology turnaround times). [6] In Pakistan, research highlights CT's superiority over FAST ultrasound in detecting visceral injuries in trauma, yet studies often focus on related areas like neuroimaging, where brain CT scans at the University of Lahore Teaching Hospital identified atrophy (31.2%) and infarction (25.2%) in trauma cases, leaving abdominal-specific justification and overuse underexplored. [7],[8] Internationally, CT's transformative role is evident, with WBCT reducing hospital stays and operative needs, though up to one-third of scans are deemed unnecessary, emphasizing the need for stringent criteria and interventional radiology for nonoperative management. [9],[10]

A significant research gap exists in Pakistan, where the lack of abdominal-specific studies on CT justification, radiation risk management, and overuse in high-volume tertiary emergency units contrasts with robust international evidence on guideline adherence and overuse. This gap is critical given the rising prevalence of CT scans, potential for unnecessary radiation exposure, and absence of localized guidelines in resource-constrained settings. This study aims to bridge this gap by critically evaluating the justification of CT scans in abdominal emergencies at a Pakistani tertiary emergency unit, assessing alignment with clinical guidelines, identifying patterns of use and overuse, and proposing context-specific recommendations to optimize diagnostic efficacy, enhance patient safety, and improve emergency care efficiency.

The main objective of this study is to evaluate the rationale of abdominal CT scan use in abdominal emergencies in a tertiary emergency department according to set clinical guidelines. The secondary objective is to assess the results of patients with negative abdominal CT scans who later receive laparotomy, determining missed pathologies or differential diagnoses for the purpose of determining the diagnostic performance of CT in abdominal emergencies. The third objective is to evaluate cases with negative CT scan results that disclose trauma or conditions unrelated to the initial abdominal

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emergency, to establish their clinical relevance and patient management implications.

METHODOLOGY

This cross-sectional observational retrospective study was conducted in the Radiology Department of Lady Reading Hospital (LRH), Peshawar, over a six-month period from 1st January to 30th June 2024. The sample size was calculated using the OpenEpi sample size calculator, applying a 12% frequency from published literature[1], a 95% confidence interval, and a 5% margin of error, yielding a minimum of 135 patients. The sampling technique was simple convenient sampling. The inclusion criteria were patients undergoing non-contrast CT abdomen in the Accident and Emergency Department for abdominal trauma or non-traumatic abdominal emergencies. The exclusion criteria were incomplete Hospital Management Information System (HMIS) records, including missing CT indications or management details. Ethical approval was obtained from the Institutional Research and Ethics Board of Lady Reading Hospital prior to data collection.

Data collection involved retrieving retrospective records from HMIS for all eligible patients within the study period. All CT scans were performed using an Optima GE 16-slice scanner and interpreted on the PACS system by a consultant radiologist (Fellow of the College of Physicians and Surgeons Pakistan, CPSP). Management information was documented by emergency physicians and residents. The justification for each CT scan was assessed using established clinical guidelines, including the New Hampshire Trauma Medical Review Committee (2010) principles for trauma imaging, which emphasize selective CT use, balancing diagnostic benefits against radiation risks, and limiting scans in cases requiring transfer for definitive care.[27] For non-traumatic cases, justification incorporated guidelines from StatPearls on Acute Abdomen (updated February 15, 2025), focusing on thorough history, physical examination, and targeted imaging for conditions like appendicitis, cholecystitis, and pancreatitis.[28] Scans were considered unjustified if they could have been replaced by another imaging modality or were not indicated according to guidelines. Data analysis was performed using SPSS version 26. Descriptive statistics were used to summarize demographics, clinical presentations, CT findings, patient management outcomes and CT findings with laparotomy results to assess diagnostic accuracy and identify missed pathologies in patients with negative CT scans. The Chi-square test was applied to assess the association between CT justification and presentation type (trauma versus non-trauma).

RESULTS

Table 1: Demographic and Clinical Characteristics of Study Participants (n = 135)

Variable	Category	Frequency (n)	Percentage (%)
Age group	≤ 10 years	13	9.6
	11–20 years	33	24.4
	21–30 years	38	28.1
	31–40 years	19	14.1
	41–50 years	16	11.9
	> 50 years	16	11.9
Gender	Male	117	86.7
	Female	18	13.3
Presentation	Trauma	92	68.1
	Non-trauma	43	31.9
CT Indication	Road Traffic Accident (RTA)	29	21.5
	Stab injury (SI)	9	6.7
	Firearm injury (FAI)	33	24.4
	Bomb blast injury (BBI)	5	3.7
	Abdominal pain	32	23.7

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	Physical Assault	14	10.4
	Fever	1	0.7
	Blunt Trauma	1	0.7
	History of Fever	11	8.1
Abdominal Findings	Positive	63	46.7
	Negative	72	53.3
Laparotomy Findings	Acute appendicitis	4	2.9
	Renal injury	1	0.7
	Intra-abdominal Hematoma	2	1.5
	Gut injury	7	5.2
	Pancreatic injury	1	1.9
	Ectopic pregnancy	1	0.7
	Negative laparotomy	4	3
	Urinary Bladder Injury	1	0.7
	Gut Perforations	2	1.5
	Liver Injury	3	2.2

Table 1 shows that 135 patients undergoing abdominal CT scans in a tertiary emergency unit, the majority were young adults, with the 21–30-year age group being most represented (28.1%), and there was a marked male predominance (86.7%). Trauma was the primary reason for presentation (68.1%), with firearm injury (24.4%) and road traffic accidents (21.5%) as the leading indications, reflecting the high burden of violence and high-energy injuries in the population served. Non-traumatic indications, though less common, were largely due to abdominal pain (23.7%) and history of fever (8.1%). Overall, abdominal CT scans revealed positive findings in 46.7% of patients, indicating that more than half of the scans showed no acute intra-abdominal pathology. Among those undergoing laparotomy, gut injuries were the most frequent intraoperative finding (5.2%), followed by acute appendicitis (2.9%) and liver injury (2.2%). The relatively high proportion of negative CT scans and laparotomies highlights the importance of refining imaging indications to optimize resource use and reduce unnecessary radiation exposure, especially in resource-limited emergency care settings.

Table 2: Justification of CT abdominal examinations in traumatic vs non-traumatic cases (n=72)

Presentation Type	CT Scans Justification		χ^2 (df)	p-value
	Positive findings	Negative findings		
Trauma	44 (61.1%)	48 (76.2%)	3.52 (1)	0.061
Non-trauma	28 (38.9%)	15 (23.8%)		

In assessing the justification of CT abdominal examinations, defined as the presence of positive intra-abdominal findings, 44 of the trauma patients (61.1%) demonstrated justified scans compared to 28 non-trauma patients (38.9%) as shown in table 2. Negative abdominal CT findings were recorded in 48 trauma patients (76.2%) and 15 non-trauma patients (23.8%). While trauma cases showed a higher proportion of justified scans than non-trauma cases, the difference did not reach statistical significance (χ^2 = 3.52, df = 1, p = 0.061). This suggests that although CT imaging tended to yield more positive findings in trauma patients, a substantial proportion of both trauma and non-trauma scans were negative, raising considerations about the selective use of CT in both groups to optimize diagnostic yield and minimize unnecessary imaging.

Table 3: Management Outcomes in Patients with Negative Abdominal CT Findings (n=63)

Management Outcomes	n (%)
Conservative	7 (11.1%)

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Discharged	24 (38.1%)
Managed for Other Pathology	19 (30.2%)
Surgical	13 (20.6%)

Among patients with negative abdominal CT findings, management outcomes varied widely as shown in table 3. Conservative treatment was pursued in 7 cases (11.1%), while 24 patients (38.1%) were discharged without further intervention. A considerable proportion, 19 patients (30.2%), were managed for other pathologies identified clinically or through alternative investigations. Notably, 13 patients (20.6%) with initially negative abdominal CT findings proceeded to surgical intervention, suggesting that certain acute abdominal pathologies may not be readily apparent on imaging or that clinical deterioration prompted operative exploration despite negative imaging results. This pattern underscores the importance of integrating clinical judgment with imaging results to avoid missed diagnoses and ensure timely management.

Table 4: Diagnostic Agreement Between CT-Scan and Laparotomy Findings (n=26)

CT Scan Findings	Laparotomy Findings		Positive Predictive Value (PPV)	Negative Predictive Value (NPV)	Sensitivity	Specificity
	Positive	Negative				
CT Positive	15(20.8%)	2 (2.8%)	88.2%	15.4%	57.7%	50.0%
CT Negative	**11(17.5%)**			**2 (3.2%)**		

Comparison of CT findings with laparotomy results revealed variable diagnostic agreement in table 4. Among patients with positive CT scans, 15 (20.8%) were confirmed to have positive intra-abdominal findings at laparotomy, while 2 (2.8%) were laparotomy-negative, yielding a positive predictive value (PPV) of 88.2%. Of those with negative CT scans, 11 (17.5%) were found to have positive findings on laparotomy, and only 2 (3.2%) were truly negative, resulting in a low negative predictive value (NPV) of 15.4%. The overall sensitivity of CT in detecting pathologies subsequently confirmed at laparotomy was 57.7%, while specificity was 50.0%. These results indicate that while a positive CT scan was generally reliable in predicting intra-abdominal pathology, a negative scan did not reliably exclude significant injury or disease, reinforcing the need for continued clinical vigilance and, in selected cases, operative exploration despite negative imaging.

DISCUSSION

The current research assessed the demographic profile, indications, diagnostic yield, and correlation with management of abdominal CT scans in a tertiary emergency setting, highlighting important considerations for their selective use. Our cohort showed a predominance of young male trauma patients, consistent with previous literature reporting higher incidence of severe injuries in young adults due to road traffic accidents, interpersonal violence, and occupational hazards.[11] Non-trauma indications were less common but most commonly included abdominal pain and fever, consistent with the patterns observed in emergency imaging literature.[12] This demographic imbalance is significant to emergency radiology resource planning, as trauma continues to be the chief generator of imaging demand.

Though CT scans showed positive findings on the abdomen in 46.7% of patients, the percentage of negative scans—particularly among trauma patients—reflects overuse concerns raised in recent literature.[13, 14] While our trauma group had a greater percentage of appropriate scans compared to the non-trauma group, the difference was not significant.[15] This result is congruent with findings that clinical prediction models, including the NEXUS abdominal criteria and focused assessment

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with sonography for trauma (FAST), may decrease unnecessary use of CT without a decrement in safety.[16, 17] These findings emphasize the necessity for enhanced pre-CT triage protocols that include clinical and point-of-care imaging evaluation as outlined in the New Hampshire Trauma Medical Review Committee guidelines (2010), which advocate for limiting CT scans to those that will change management and avoiding routine scans in stable patients or those requiring transfer.[6]

The association of CT results with laparotomy results indicated a high positive predictive value (88.2%) but a low negative predictive value (15.4%). These findings are concordant with the literature demonstrating that although CT possesses high rule-in value for abdominal disease, its capacity to exclude severe injury—especially hollow viscus and mesenteric injuries—is still limited.[18, 19] The low specificity (50.0%) and sensitivity (57.7%) reported here are consistent with figures in other resource-constrained environments, where delayed presentation, inadequate imaging protocols, and variability among readers can lead to missed diagnoses.[20, 21] It stresses the need for a high index of suspicion in patients clinically degrading despite negative CT findings, aligning with StatPearls recommendations (2025) for acute abdomen evaluation, which emphasize integrating thorough history, physical examination (including signs of peritonitis), and serial assessments rather than relying solely on imaging.[27]

Our observation that 20.6% of patients with negative CT scans nevertheless underwent surgery is consistent with evidence that some intra-abdominal diseases, such as early ischemia, small bowel perforation, and minimal-volume bleeding, are radiographically occult on initial imaging.[22, 23] Serial clinical evaluation, laboratory markers, and, where indicated, repeated imaging have been suggested to obviate these risks.[24, 25] Decision-making should also be multidisciplinary, combining surgical and radiological input to compromise between diagnostic confidence and delayed intervention risks.[26]

In short, although abdominal CT is still a non-negotiable in the acute environment, our findings—and with them, modern evidence—urges a wiser and more selective practice, particularly in settings of limited resources. Protocol-based utilization, in line with clinical grading scores and the use of adjunctive modalities, can possibly increase diagnostic yield at the expense of unnecessary radiation and costs. Future studies need to emphasize the validation of locally derived decision rules and the optimization of imaging protocols for common injury patterns in various groups.

CONCLUSION

This study demonstrates that while abdominal CT is indispensable for diagnosing abdominal emergencies, its use in a tertiary emergency setting often exceeds guideline-based justification, with a considerable proportion of negative scans suggesting overuse and unnecessary radiation exposure, particularly in younger trauma patients. Despite a high positive predictive value, the low negative predictive value and moderate sensitivity highlight CT's limitations in excluding significant pathology, underscoring the need for integrating structured clinical assessment, point-of-care imaging, and multidisciplinary decision-making. Implementing locally adapted protocols and evidence-based selection criteria, such as those from the New Hampshire Trauma Medical Review Committee (2010) and StatPearls on Acute Abdomen (2025), can optimize diagnostic yield, reduce unnecessary imaging, and enhance patient safety in resource-limited emergency care environments.

REFRENCES

1. *Achatz G, Schwabe K, Brill S, Zischek C, Schmidt R, Friemert B, et al. Diagnostic options for blunt abdominal trauma. European Journal of Trauma and Emergency Surgery. 2022;48(5):3575-89.*
2. *Salerno S, Terranova MC, Anzelmo M, Vinci A, Vernuccio F, Collura G, et al. Are we overusing abdominal computed tomography scans in young patients referred in an emergency for acute abdominal pain? Polish journal of radiology. 2022;87(1):187-93.*
3. *Shaish H, Ream J, Huang C, Troost J, Gaur S, Chung R, et al. Diagnostic accuracy of unenhanced computed tomography for evaluation*

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

of acute abdominal pain in the emergency department. JAMA surgery. 2023;158(7):e231112-e.

4. Fathi M, Mirjafari A, Yaghoobpoor S, Ghanikolahloo M, Sadeghi Z, Bahrami A, et al. Diagnostic utility of whole-body computed tomography/pan-scan in trauma: a systematic review and meta-analysis study. Emergency radiology. 2024;31(2):251-68.
5. Addala TE, Greffier J, Hamard A, Snene F, Bobbia X, Bastide S, et al. Early results of ultra-low-dose CT-scan for extremity traumas in emergency room. Quantitative Imaging in Medicine and Surgery. 2022;12(8):4248.
6. Iacobellis F, Abu-Omar A, Crivelli P, Galluzzo M, Danzi R, Trinci M, et al. Current standards for and clinical impact of emergency radiology in major trauma. International Journal of Environmental Research and Public Health. 2022;19(1):539.
7. Akhtar H, Farooq SMY, Shan A, Naeem M, Azhar A, Dar SS, et al. Frequency, Causes and Findings of Brain Computed Tomography Scan at University of Lahore Teaching Hospital: Frequency, Causes and Findings of Brain Computed Tomography Scan. Pakistan Journal of Health Sciences. 2022:23-8.
8. Garba I, Zarb F, McEntee MF, Fabri SG. Computed tomography diagnostic reference levels for adult brain, chest and abdominal examinations: A systematic review. Radiography. 2021;27(2):673-81.
9. Ly K-H, Costedoat-Chalumeau N, Liozon E, Dumonteil S, Ducroix J-P, Sailler L, et al. Diagnostic value of 18F-FDG PET/CT vs. chest-abdomen-pelvis CT scan in management of patients with fever of unknown origin, inflammation of unknown origin or episodic fever of unknown origin: a comparative multicentre prospective study. Journal of Clinical Medicine. 2022;11(2):386.
10. Pu L, Ashraf SF, Gezer NS, Ocak I, Dresser DE, Leader JK, et al. Estimating 3- D whole- body composition from a chest CT scan. Medical Physics. 2022;49(11):7108-17.
11. Ashley JR, Burczak KW, Cotton BA, Clements TW. Management of blunt abdominal trauma. British Journal of Surgery. 2024;111(7):znae168.
12. Rodriguez NM, Mower WR, Raja AS, Gupta M, Montoy JC, Parry B, et al. Accuracy of physician gestalt in prediction of significant abdominal and pelvic injury in adult blunt trauma patients. Academic Emergency Medicine. 2023;30(10):1039-46.
13. Qamar SR, Evans D, Gibney B, Redmond CE, Nasir MU, Wong K, et al. Emergent comprehensive imaging of the major trauma patient: a new paradigm for improved clinical decision-making. Canadian Association of Radiologists Journal. 2021;72(2):293-310.
14. Ochieng EO. Patterns of Computed Tomography Findings in Patients With Blunt Abdominal Trauma at the Kenyatta National Hospital: UON; 2021.
15. Al Omran B, Patil JD, Anala A, Menezes P, Ahmed N, Cheffi I, et al. Prevalence of computed tomography overuse for mild head injury in adults. Cureus. 2023;15(2).
16. Hsia C-C, Wang C-Y, Huang J-F, Hsu C-P, Kuo L-W, Ouyang C-H, et al. Diagnostic accuracy of computed tomography for the prediction of the need for laparotomy for traumatic hollow viscus injury: systematic review and meta-analysis. Journal of Personalized Medicine. 2021;11(12):1269.
17. SHOPEN N, LAHAV Z, KANANI F, HABERMAN S, EBRIL S, FINKELSTEIN S, et al. A Clinical Decision Instrument to Safely Reduce Abdominopelvic CT Use in Minor Blunt Trauma Patients. 2025.
18. Naeem M, Hoegger MJ, Petraglia III FW, Ballard DH, Zulfiqar M, Patlas MN, et al. CT of penetrating abdominopelvic trauma. Radiographics. 2021;41(4):1064-81.
19. Alahmad H, Hobani A, Alasmi M, Alshahrani AM, Abanomy A, Alarifi M, et al. Investigating the Potential Overuse of Pan-Computed Tomography (PanCT) Examinations in Trauma Cases in Emergency Departments. Medicina. 2024;60(11):1742.
20. Blažienė K, Nożewski J, Cibulskė V, Kunigonytė M, Košytė D, Bareikis K, et al.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Overuse of CT for minor head trauma patients: a retrospective analysis from Poland and Lithuania trauma centres. Medicina. 2024;60(12):1908.

21. *Zarama V, Torres N, Duque E, Arango-Ibañez JP, Duran K, Azcárate V, et al. Incidence of intra-abdominal injuries in hemodynamically stable blunt trauma patients with a normal computed tomography scan admitted to the emergency department. BMC Emergency Medicine. 2024;24(1):103.*
22. *Liang T, Roseman E, Gao M, Sinert R. The utility of the focused assessment with sonography in trauma examination in pediatric blunt abdominal trauma: a systematic review and meta-analysis. Pediatric emergency care. 2021;37(2):108-18.*
23. *Paes FM, Durso AM, Pinto DS, Covello B, Katz DS, Munera F. Diagnostic performance of triple-contrast versus single-contrast multi-detector computed tomography for the evaluation of penetrating bowel injury. Emergency radiology. 2022;29(3):519-29.*
24. *Kim HW, Park BR, Hong TH. Application of computed tomography in the identification of hollow viscus injuries in blunt trauma patients. Journal of acute care surgery. 2022;12(1):29-33.*
25. *Wolmarans A, Fru PN, Moeng MS. Accuracy of CT scan for detecting hollow viscus injury in penetrating abdominal trauma. World journal of surgery. 2023;47(6):1457-63.*
26. *Khalid H, Saleem E, Saghir N, Shahid AR, Raza S, Razaq N. EXPLORING CULTURAL IMPACTS ON PATIENT COMFORT IN OPPOSITE-GENDER ULTRASOUND EXAMINATIONS: A CROSS-SECTIONAL ANALYSIS AMONG RADIOLOGY RESIDENTS AND PRACTITIONERS. 2025.*
27. *New Hampshire Trauma Medical Review Committee. Guidelines for the imaging of the trauma patient [Internet]. Concord (NH): New Hampshire Department of Safety, Division of Fire Standards and Training and Emergency Medical Services; 2010 [cited 2025 Aug 11]. Available from: https://www.nh.gov/safety/divisions/fstems/ems/documents/traumaguidelines.pdf25.*
28. *Patterson JW, Kashyap S, Dominique E. Acute Abdomen [Internet]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Last update Jul 11, 2022 [cited 2025 Aug 11]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK459328/*