

Supplementary Material

Literature Search Strategy for PubMed, Web of Science, and Scopus

Companion to: Defensive medicine and advanced imaging overuse in emergency departments: A focused review of imaging stewardship and overcrowding. World Journal of Radiology, Manuscript NO: 127912.

1. Purpose and Scope of the Search

This narrative review was not conducted as a systematic review or meta-analysis; accordingly, no PRISMA-based protocol, formal study-selection algorithm, risk-of-bias assessment, or quantitative synthesis was applied. The purpose of the searches documented here was to identify a broad and representative body of clinically relevant literature on advanced-imaging overuse in the emergency department (ED), from which sources were purposively selected on the basis of relevance and methodological contribution.

Three bibliographic databases were searched: PubMed (MEDLINE; U.S. National Library of Medicine), Web of Science Core Collection (Clarivate), and Scopus (Elsevier). Searches were executed on 9 July 2026. Priority for inclusion was given to systematic reviews, meta-analyses, clinical guidelines, policy statements, large observational studies, and implementation studies relevant to emergency care.

2. Concept Structure

The search was organised around a modular, block-based structure. Six concept blocks (A–F) were defined from the key terms of the review. A primary search combined the three core blocks (A AND B AND C). Three additional thematic searches paired the two anchor blocks (A AND B) with each of the domain-specific blocks (D, E, F) to ensure adequate coverage of the review's major sections. Within each block, terms were combined with OR; blocks were combined with AND.

Supplementary Table 1

Block	Concept	Representative terms
A	Emergency care setting	emergency department, emergency room, emergency medicine, acute care
B	Advanced / diagnostic imaging	advanced imaging, diagnostic imaging, computed tomography (CT), magnetic resonance imaging (MRI), ultrasonography/ultrasound, radiology, neuroimaging
C	Overuse / low-value care	overuse, overutilization, low-value, unnecessary/inappropriate/excessive imaging, over-imaging
D	Drivers (defensive medicine, medico-legal)	defensive medicine, defensive imaging, malpractice, medico-legal, diagnostic uncertainty
E	Overcrowding / throughput	crowding, overcrowding, length of stay, throughput, boarding
F	Mitigation / stewardship	clinical decision support, decision rules, Choosing Wisely, imaging/diagnostic stewardship, artificial intelligence, machine learning, shared decision-making, audit and feedback, appropriateness criteria

3. Summary of Records Retrieved

Screening and selection. Titles and abstracts were screened by two authors against the sections of the review, and full texts were retrieved for records judged relevant. Priority was given to systematic reviews, meta-analyses, clinical

guidelines, policy statements, large observational studies, and implementation studies conducted in or directly applicable to emergency care. Records were excluded when they addressed elective or outpatient imaging with no emergency pathway, when they described technical performance with no appropriateness or utilization outcome, or when only an abstract was available. Reference lists of retrieved articles were hand-searched. Final selection was purposive, made on relevance and methodological contribution rather than by an exhaustive protocol; 111 sources are cited in the revised manuscript. The counts in Supplementary Table 2 describe the retrieval pool and not a screened, de-duplicated sample.

Supplementary Table 2 reports the number of records retrieved by each search line in each database on 2026-07-09. Counts reflect database content on the search date and will change over time. The four search lines overlap substantially; the union row removes within-database duplicates but not cross-database duplicates.

Line	Search line	PubMed	Web of Science	Scopus
S1	Core overuse (A AND B AND C)	734	408	417
S2	Drivers / defensive medicine (A AND B AND D)	297	232	287
S3	Overcrowding / throughput (A AND B AND E)	1,417	1,498	2,307

S4	Mitigation / stewardship (A AND B AND F)	1,374	1,065	1,394
Union	S1 OR S2 OR S3 OR S4 (within- database)	3,552	2,951	4,138
Union*	Union, English- language only	2,924	2,900	4,055

* English-language limit applied; the PubMed figure additionally applies the Humans filter. Counts are unique records within each database on the search date.

4. Full Search Strings

The complete query strings executed in each database are reproduced verbatim below. Terms are presented exactly as run; database-specific field tags and syntax are preserved so that each search can be re-executed and updated.

4.1 PubMed (MEDLINE)

Field tags: [Mesh] = Medical Subject Heading; [tiab] = title/abstract; [lang] = language; [PDAT] = publication date. Truncation is denoted by *.

Block A: Emergency care

("Emergency Service, Hospital"[Mesh] OR "Emergency Medicine"[Mesh] OR "emergency department"[tiab] OR "emergency departments"[tiab] OR "emergency room"[tiab] OR "emergency medicine"[tiab] OR "acute care"[tiab])

Block B: Imaging

("Diagnostic Imaging"[Mesh] OR "Tomography, X-Ray Computed"[Mesh] OR "Magnetic Resonance Imaging"[Mesh] OR "Ultrasonography"[Mesh] OR "advanced imaging"[tiab] OR "diagnostic imaging"[tiab] OR "computed tomography"[tiab] OR "CT scan"[tiab] OR "magnetic resonance imaging"[tiab])

OR MRI[tiab] OR ultrasonograph*[tiab] OR ultrasound[tiab] OR radiolog*[tiab]
OR neuroimaging[tiab])

Block C: Overuse

("Medical Overuse"[Mesh] OR overus*[tiab] OR overutili*[tiab] OR "over-
utili*[tiab] OR "low-value"[tiab] OR "low value"[tiab] OR "unnecessary
imaging"[tiab] OR "inappropriate imaging"[tiab] OR "inappropriate use"[tiab]
OR "excessive imaging"[tiab] OR overimaging[tiab] OR "over-imaging"[tiab])

Block D: Drivers

("Defensive Medicine"[Mesh] OR "defensive medicine"[tiab] OR "defensive
imaging"[tiab] OR "Malpractice"[Mesh] OR malpractice[tiab] OR "medico-
legal"[tiab] OR medicolegal[tiab] OR "diagnostic uncertainty"[tiab] OR
"Uncertainty"[Mesh])

Block E: Overcrowding

("Crowding"[Mesh] OR crowding[tiab] OR overcrowding[tiab] OR "over-
crowding"[tiab] OR "length of stay"[tiab] OR "throughput"[tiab] OR
"boarding"[tiab])

Block F: Mitigation

("Decision Support Systems, Clinical"[Mesh] OR "clinical decision support"[tiab]
OR "decision rule*[tiab] OR "Choosing Wisely"[tiab] OR "imaging
stewardship"[tiab] OR "diagnostic stewardship"[tiab] OR "Artificial
Intelligence"[Mesh] OR "artificial intelligence"[tiab] OR "machine learning"[tiab]
OR "shared decision-making"[tiab] OR "shared decision making"[tiab] OR
"audit and feedback"[tiab] OR "appropriateness criteria"[tiab])

Primary search (S1) = A AND B AND C. Thematic searches S2–S4 replace block
C with D, E, and F, respectively. The combined (union) search executed was:

((("Emergency Service, Hospital"[Mesh] OR "Emergency Medicine"[Mesh] OR
"emergency department*[tiab] OR "emergency departments"[tiab] OR
"emergency room*[tiab] OR "emergency medicine"[tiab] OR "acute care"[tiab]))
AND (("Diagnostic Imaging"[Mesh] OR "Tomography, X-Ray Computed"[Mesh]

OR "Magnetic Resonance Imaging"[Mesh] OR "Ultrasonography"[Mesh] OR "advanced imaging"[tiab] OR "diagnostic imaging"[tiab] OR "computed tomography"[tiab] OR "CT scan*"[tiab] OR "magnetic resonance imaging"[tiab] OR MRI[tiab] OR ultrasonograph*[tiab] OR ultrasound[tiab] OR radiolog*[tiab] OR neuroimaging[tiab])) AND (("Medical Overuse"[Mesh] OR overus*[tiab] OR overutili*[tiab] OR "over-utili*"[tiab] OR "low-value"[tiab] OR "low value"[tiab] OR "unnecessary imaging"[tiab] OR "inappropriate imaging"[tiab] OR "inappropriate use"[tiab] OR "excessive imaging"[tiab] OR overimaging[tiab] OR "over-imaging"[tiab])) OR (((("Emergency Service, Hospital"[Mesh] OR "Emergency Medicine"[Mesh] OR "emergency department*"[tiab] OR "emergency departments"[tiab] OR "emergency room*"[tiab] OR "emergency medicine"[tiab] OR "acute care"[tiab])) AND (("Diagnostic Imaging"[Mesh] OR "Tomography, X-Ray Computed"[Mesh] OR "Magnetic Resonance Imaging"[Mesh] OR "Ultrasonography"[Mesh] OR "advanced imaging"[tiab] OR "diagnostic imaging"[tiab] OR "computed tomography"[tiab] OR "CT scan*"[tiab] OR "magnetic resonance imaging"[tiab] OR MRI[tiab] OR ultrasonograph*[tiab] OR ultrasound[tiab] OR radiolog*[tiab] OR neuroimaging[tiab])) AND (("Defensive Medicine"[Mesh] OR "defensive medicine"[tiab] OR "defensive imaging"[tiab] OR "Malpractice"[Mesh] OR malpractice[tiab] OR "medico-legal"[tiab] OR medicolegal[tiab] OR "diagnostic uncertainty"[tiab] OR "Uncertainty"[Mesh])))) OR (((("Emergency Service, Hospital"[Mesh] OR "Emergency Medicine"[Mesh] OR "emergency department*"[tiab] OR "emergency departments"[tiab] OR "emergency room*"[tiab] OR "emergency medicine"[tiab] OR "acute care"[tiab])) AND ((("Diagnostic Imaging"[Mesh] OR "Tomography, X-Ray Computed"[Mesh] OR "Magnetic Resonance Imaging"[Mesh] OR "Ultrasonography"[Mesh] OR "advanced imaging"[tiab] OR "diagnostic imaging"[tiab] OR "computed tomography"[tiab] OR "CT scan*"[tiab] OR "magnetic resonance imaging"[tiab] OR MRI[tiab] OR ultrasonograph*[tiab] OR ultrasound[tiab] OR radiolog*[tiab]

OR neuroimaging[tiab])) AND (("Crowding"[Mesh] OR crowding[tiab] OR overcrowding[tiab] OR "over-crowding"[tiab] OR "length of stay"[tiab] OR "throughput"[tiab] OR "boarding"[tiab])) OR (((("Emergency Service, Hospital"[Mesh] OR "Emergency Medicine"[Mesh] OR "emergency department"[tiab] OR "emergency departments"[tiab] OR "emergency room"[tiab] OR "emergency medicine"[tiab] OR "acute care"[tiab])) AND (("Diagnostic Imaging"[Mesh] OR "Tomography, X-Ray Computed"[Mesh] OR "Magnetic Resonance Imaging"[Mesh] OR "Ultrasonography"[Mesh] OR "advanced imaging"[tiab] OR "diagnostic imaging"[tiab] OR "computed tomography"[tiab] OR "CT scan"[tiab] OR "magnetic resonance imaging"[tiab] OR MRI[tiab] OR ultrasonograph*[tiab] OR ultrasound[tiab] OR radiolog*[tiab] OR neuroimaging[tiab])) AND (("Decision Support Systems, Clinical"[Mesh] OR "clinical decision support"[tiab] OR "decision rule"[tiab] OR "Choosing Wisely"[tiab] OR "imaging stewardship"[tiab] OR "diagnostic stewardship"[tiab] OR "Artificial Intelligence"[Mesh] OR "artificial intelligence"[tiab] OR "machine learning"[tiab] OR "shared decision-making"[tiab] OR "shared decision making"[tiab] OR "audit and feedback"[tiab] OR "appropriateness criteria"[tiab]))))

English-language, human-only limit appended as: AND english[lang] AND humans[Mesh].

4.2 Web of Science Core Collection

Field tags: TS = Topic (searches title, abstract, author keywords, and Keywords Plus); LA = language; PY = publication year. Phrases in quotation marks are searched as exact phrases.

Block A: Emergency care

TS=("emergency department" OR "emergency departments" OR "emergency room" OR "emergency medicine" OR "acute care")

Block B: Imaging

TS=("advanced imaging" OR "diagnostic imaging" OR "computed tomography" OR "CT scan" OR "magnetic resonance imaging" OR MRI OR ultrasonography OR ultrasound OR radiology OR neuroimaging)

Block C: Overuse

TS=(overuse OR overutilization OR "over-utilization" OR "low-value" OR "unnecessary imaging" OR "inappropriate imaging" OR "inappropriate use" OR "excessive imaging" OR overimaging)

Block D: Drivers

TS=("defensive medicine" OR "defensive imaging" OR malpractice OR "medico-legal" OR medicolegal OR "diagnostic uncertainty")

Block E: Overcrowding

TS=(crowding OR overcrowding OR "length of stay" OR throughput OR boarding)

Block F: Mitigation

TS=("clinical decision support" OR "decision rule" OR "Choosing Wisely" OR "imaging stewardship" OR "diagnostic stewardship" OR "artificial intelligence" OR "machine learning" OR "shared decision-making" OR "shared decision making" OR "audit and feedback" OR "appropriateness criteria")

Search lines were formed as (A) AND (B) AND (C/D/E/F). The combined (union) search was the OR of the four lines; an English-language limit was applied as AND LA=(English).

4.3 Scopus

Field tag: TITLE-ABS-KEY searches article title, abstract, and keywords. LANGUAGE() and PUBYEAR operators apply language and date limits. Phrases in quotation marks are searched as loose phrases.

Block A: Emergency care

TITLE-ABS-KEY("emergency department" OR "emergency departments" OR "emergency room" OR "emergency medicine" OR "acute care")

Block B: Imaging

TITLE-ABS-KEY("advanced imaging" OR "diagnostic imaging" OR "computed tomography" OR "CT scan" OR "magnetic resonance imaging" OR MRI OR ultrasonography OR ultrasound OR radiology OR neuroimaging)

Block C: Overuse

TITLE-ABS-KEY(overuse OR overutilization OR "over-utilization" OR "low-value" OR "unnecessary imaging" OR "inappropriate imaging" OR "inappropriate use" OR "excessive imaging" OR overimaging)

Block D: Drivers

TITLE-ABS-KEY("defensive medicine" OR "defensive imaging" OR malpractice OR "medico-legal" OR medicolegal OR "diagnostic uncertainty")

Block E: Overcrowding

TITLE-ABS-KEY(crowding OR overcrowding OR "length of stay" OR throughput OR boarding)

Block F: Mitigation

TITLE-ABS-KEY("clinical decision support" OR "decision rule" OR "Choosing Wisely" OR "imaging stewardship" OR "diagnostic stewardship" OR "artificial intelligence" OR "machine learning" OR "shared decision-making" OR "shared decision making" OR "audit and feedback" OR "appropriateness criteria")

Search lines were formed as (A) AND (B) AND (C/D/E/F). The combined (union) search was the OR of the four lines; an English-language limit was applied as AND LANGUAGE(english).

5. Study Selection and Notes

Records retrieved by the searches were exported and screened by title and abstract for topical relevance. Because this is a narrative review, final source selection was purposive rather than protocol-driven: preference was given to systematic reviews, meta-analyses, guidelines and policy statements, validated clinical decision rules, large multicentre or national observational studies, and implementation/quality-improvement reports in emergency care. Reference lists of key articles were hand-searched for additional relevant sources (citation

snowballing). No language restriction was applied at the search stage other than the English-language union counts reported for reference; non-English records were excluded at screening.

Limitations. The search terms, though broad, may not capture every relevant record; grey literature and trial registries were not systematically searched. Database counts are time-stamped to the search date (2026-07-09) and are expected to change. Cross-database overlap was not de-duplicated in the counts above. As a narrative review, the synthesis reflects author-selected evidence and is subject to selection bias inherent to the design.

6. Reproducibility Statement

All searches were executed programmatically on 2026-07-09 via the official database APIs: NCBI E-utilities (PubMed), the Web of Science Starter API (Clarivate), and the Scopus Search API (Elsevier). The block structure and verbatim query strings in Section 4 allow the searches to be reproduced or updated directly in each database's native web interface (PubMed Advanced Search Builder, Web of Science Advanced Search, and Scopus Advanced Search).