

SUPPLEMENTAL FILE

What works for and what hinders de-implementation of low-value care in emergency medicine practice? A scoping review.

Appendix 1. Search concepts and terms

Concept	Synonyms
Low-value care	health services misuse OR medical overuse OR unnecessary procedures OR inappropriate prescribing OR potentially inappropriate medication list OR health services overuse OR health services overutilization OR low-value OR low value OR unnecessary test OR unnecessary medication OR unnecessary surgery OR choosing wisely OR overdiagnosis OR overmedication OR overtreatment OR unwanted medical care OR medical reversal OR unwarranted OR unjustified
De-implementation	deprescriptions OR de-implement OR deimplement OR disinvest OR deadopt OR de-adopt OR disadopt OR decrease OR discontinue OR defund OR decommission OR decline OR delist OR reverse OR reject OR reallocate OR relinquish OR re-appraise OR re-prioritize OR redeploy OR abandon OR reassess OR replace OR reduce OR stop OR withdraw
Emergency Medicine	emergency physician OR emergency clinician OR emergency care provider OR emergency care specialist OR emergency medicine physician OR emergency medicine specialist OR emergency specialist OR emergentologist OR health personnel OR health care personnel OR health facilities OR health care facility OR emergency department OR ED OR casualty department OR accident and emergency OR emergency medicine OR hospital emergency service OR emergency room OR emergency unit OR emergency ward OR emergency outpatient unit or emergency service

Appendix 2. The Theoretical Domains Framework domains and definitions (Adapted from Cane et al¹ under creative commons attribution licence CC BY 2.0)

Domain	Definition
1. Knowledge	An awareness of the existence of something
2. Skills	An ability or proficiency acquired through practice
3. Social/professional role and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting
4. Beliefs about capabilities	Acceptance of the truth, reality or validity about an ability, talent, or facility that a person can put to constructive use
5. Optimism	The confidence that things will happen for the best or that desired goals will be attained
6. Beliefs about Consequences	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation
7. Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus
8. Intentions	A conscious decision to perform a behaviour or a resolve to act in a certain way
9. Goals	Mental representations of outcomes or end states that an individual wants to achieve
10. Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives
11. Environmental context and resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour
12. Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours
13. Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event
14. Behavioural regulation	Anything aimed at managing or changing objectively observed or measured actions

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Appendix 3: Mixed Methods Appraisal Tool²

Category of study designs	Methodological quality criteria	Responses			
		Yes	No	Can't tell	Comments
Screening questions (for all types)	S1. Are there clear research questions?				
	S2. Do the collected data allow to address the research questions?				
	<i>Further appraisal may not be feasible or appropriate when the answer is 'No' or 'Can't tell' to one or both screening questions.</i>				
1. Qualitative	1.1. Is the qualitative approach appropriate to answer the research question?				
	1.2. Are the qualitative data collection methods adequate to address the research question?				
	1.3. Are the findings adequately derived from the data?				
	1.4. Is the interpretation of results sufficiently substantiated by data?				
	1.5. Is there coherence between qualitative data sources, collection, analysis and interpretation?				
2. Quantitative randomized controlled trials	2.1. Is randomization appropriately performed?				
	2.2. Are the groups comparable at baseline?				
	2.3. Are there complete outcome data?				
	2.4. Are outcome assessors blinded to the intervention provided?				
	2.5. Did the participants adhere to the assigned intervention?				
3. Quantitative non-randomized	3.1. Are the participants representative of the target population?				
	3.2. Are measurements appropriate regarding both the outcome and intervention (or exposure)?				
	3.3. Are there complete outcome data?				
	3.4. Are the confounders accounted for in the design and analysis?				
	3.5. During the study period, is the intervention administered (or exposure occurred) as intended?				
4. Quantitative descriptive	4.1. Is the sampling strategy relevant to address the research question?				
	4.2. Is the sample representative of the target population?				
	4.3. Are the measurements appropriate?				
	4.4. Is the risk of nonresponse bias low?				
	4.5. Is the statistical analysis appropriate to answer the research question?				
5. Mixed methods	5.1. Is there an adequate rationale for using a mixed methods design to address the research question?				
	5.2. Are the different components of the study effectively integrated to answer the research question?				
	5.3. Are the outputs of the integration of qualitative and quantitative components adequately interpreted?				
	5.4. Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?				
	5.5. Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?				

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Appendix 4: Database search strategies**MEDLINE**

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions <1946 to December 02, 2022>(Search performed on December 05,2022)

- 1 exp Health Services Misuse/ 19066
- 2 exp Inappropriate Prescribing/ 4451
- 3 exp Potentially Inappropriate Medication List/ 917
- 4 (health services overuse or health services overutilization or low-value or low value or choosing wisely or unnecessary surger* or unnecessary medication* or unnecessary test* or overdiagnos* or overmedication or overtreatment or unwanted medical care or medical reversal* or unwarranted or unjustified).mp. 25020
- 5 exp Deprescriptions/ 913
- 6 (de-implement* or deimplement* or disinvest* or deadopt* or de-adopt* or disadopt* or decreas* or discontinu* or defund* or decommission* or declin* or delist* or revers* or reject* or reallocat* or relinquish* or re-apprais* or re-prioriti?* or redeploy* or abandon* or reassess* or replac* or reduc* or stop* or withdraw*).mp. 7736202
- 7 exp Health Personnel/ 597352
- 8 exp Health Facilities/ 878494
- 9 exp Emergency Medicine/ 15401
- 10 1 or 2 or 3 or 4 45650
- 11 5 or 6 7736517
- 12 7 or 8 or 9 1376617
- 13 10 and 11 and 12 3117

EMCARE

Ovid Emcare <1995 to 2022 Week 46>(Search performed on December 05,2022)

- 1 inappropriate prescribing.mp. 2038
- 2 exp potentially inappropriate medication/ 442
- 3 (health services overuse or health services overutilization or low-value or low value, or choosing wisely or unnecessary surger* or unnecessary medication* or unnecessary test* or overdiagnos* or overmedication or overtreatment or unwanted medical care or medical reversal* or health services misuse or unwarranted or unjustified).mp. 9233
- 4 exp deprescription/ 180
- 5 (de-implement* or deimplement* or disinvest* or deadopt* or de-adopt* or disadopt* or decreas* or discontinu* or defund* or decommission* or declin* or delist* or revers* or reject* or reallocat* or relinquish* or re-apprais* or re-prioriti?* or redeploy* or abandon* or reassess* or replac* or reduc* or stop* or withdraw*).mp. 1926711
- 6 exp health care personnel/ 713273
- 7 exp health care facility/ 509400
- 8 exp emergency medicine/ 12718
- 9 exp emergency ward/ 60032
- 10 exp emergency physician/ 6346
- 11 1 or 2 or 3 11544
- 12 4 or 5 1926786
- 13 6 or 7 or 8 or 9 or 10 1077751
- 14 11 and 12 and 13 1253

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EMBASE

(Search performed on December 05,2022)

Embase Session Results		
No.	Query	Results
#4	#1 AND #2 AND #3	1,170
#3	'emergency physician' OR 'emergency ward' OR 'emergency medicine' OR 'emergency health service'	457,800
#2	'de-implement*' OR 'disinvest*' OR 'deadopt*' OR 'decreas*' OR 'discontinu*' OR 'defund*' OR 'decommission*' OR 'declin*' OR 'delist*' OR 'revers*' OR 'reject*' OR 'reallocat*' OR 'relinquish*' OR 're-apprais*' OR 're-prioriti*' OR 'redeploy*' OR 'abandon*' OR 'reassess*' OR 'replac*' OR 'reduc*' OR 'stop*' OR 'withdraw*'	10,443,429
#1	'low-value' OR 'choosing wisely' OR 'medical overuse'/exp OR 'medical overuse' OR 'overdiagnos*' OR 'overtreatment'/exp OR 'overtreatment' OR 'overmedication'/exp OR 'overmedication' OR 'unwanted medical care' OR 'potentially inappropriate medication'/exp OR 'potentially inappropriate medication' OR 'inappropriate prescribing'/exp OR 'inappropriate prescribing' OR 'medical reversal' OR 'unnecessary test*' OR 'unnecessary medication*' OR 'unnecessary surger*' OR 'unwarranted' OR 'unjustified'	52,970



CINAHL(Search performed on December 05,2022)

Monday, December 05, 2022 5:47:22 AM

#	Query	Limiters/Expanders	Last Run Via	Results
S49	(S41 OR S42 OR S43 OR S44 OR S45) AND (S46 AND S47 AND S48)	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	1,469
S48	S41 OR S42 OR S43 OR S44 OR S45	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	1,071,010
S47	S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	1,275,744
S46	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	16,360
S45	(MH "Physicians,Emergency")	Expanders - Apply equivalent subjects Search modes - SmartText Searching	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	980
S44	(MH "Emergency Service+")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	70,857
S43	(MH "Emergency Medicine+")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	13,391
S42	(MH "Health Facilities+")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	527,585
S41	(MH "Health Personnel+")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	627,953
S40	"withdraw"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	32,156
S39	"stop"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	37,505

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S38	"reduc""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	712,411
S37	"replac""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	118,935
S36	"reassess""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	6,751
S35	"abandon""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	6,993
S34	"redeploy""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	521
S33	"reprioriti?""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	188
S32	"reapprais""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	2,668
S31	"relinquish""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	623
S30	"reallocat""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	725
S29	"reject""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	19,277
S28	"revers""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	81,494
S27	"delist""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	100
S26	"declin""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	90,119

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S25	"decommission""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	121
S24	"defund""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	69
S23	"discontinuu""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	31,408
S22	"decreas""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	399,471
S21	"disdopt""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	0
S20	"deadopt""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	9
S19	"disinvest""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	255
S18	"deimplement""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	56
S17	""unjustified""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	632
S16	"unwarranted"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	1,149
S15	"unnecessary treatment"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	2,319
S14	"unnecessary test"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	18
S13	(MH "Unnecessary Procedures")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	3,925

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S12	"overmedication"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	63
S11	"overtreatment"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	1,737
S10	""unwanted medical care""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	37
S9	"medical reversal"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	16
S8	"potentially inappropriate medication list"	Expanders - Apply equivalent subjects Search modes - SmartText Searching	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	4,330
S7	"potentially inappropriate medication list"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	0
S6	"overdiagnosis"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	1,612
S5	"choosing wisely"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	829
S4	"low-value health care"	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	40
S3	""low-value""	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	1,519
S2	(MH "inappropriate prescribing")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	3,405
S1	(MH "Health Services Misuse+")	Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	Interface - EBSCOhost Research Databases Search Screen - Basic Search Database - CINAHL Complete	6,083

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 Scopus

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Enter query string

{emergency physician*} OR {emergency clinician*} OR {emergency care provider*} OR {emergency care specialist*} OR {emergency medicine physician*} OR {emergency medicine specialist*} OR {emergency specialist*} OR {emergentologist*} OR {emergency department*} OR {ED*} OR {casualty department*} OR {accident and emergency} OR {emergency medicine} OR {hospital emergency service*} OR {emergency room*} OR {emergency unit*} OR {emergency ward*} OR {emergency outpatient unit*}

[Outline query](#) [Add Author name / Affiliation](#) [Clear form](#) [Search Q](#)

ALL("Cognitive architectures") AND AUTHOR-NAME(smith)

TITLE-ABS-KEY(*somatic complaint wom?n) AND PUBYEAR AFT 1993

SRCTITLE(*field ornith*) AND VOLUME(75) AND ISSUE(1) AND PAGES(53-66)

Operators

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Field codes ?

Textual Content ▾

Affiliations ▾

Authors ▾

Biological Entities ▾

Chemical Entities ▾

Conferences ▾

Document ▾

Editors ▾

Funding ▾

Keywords ▾

Publication ▾

References ▾

Subject Areas ▾

Pre-generated queries ?

UN Sustainable Development Goals 2020 ▾

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Search history

Combine queries...

e.g. #1 AND NOT #3

4

({health services misuse} OR {inappropriate prescribing} OR {potentially inappropriate medication list} OR {health services overuse} OR {health services overutilization} OR {low-value} OR {low value} OR {choosing wisely} OR {unnecessary surger*} OR {unnecessary test*} OR {unnecessary medication*} OR {overdiagnos*} OR {overmedication} OR {overtreatment} OR {unwanted medical care} OR {medical reversal*} OR {unwarranted} OR {unjustified}) AND ("deprescri*" OR "de-implement*" OR "deimplement*" OR "disinvest*" OR "deadopt*" OR "de-adopt*" OR "disadopt*" OR "decreas*" OR "discontinu*" OR "defund*" OR "decommission*" OR "declin*" OR "delist*" OR "revers*" OR "reject*" OR "reallocat*" OR "relinquish*" OR "re-apprais*" OR "re-prioriti?" OR "redeploy*" OR "abandon*" OR "reassess*" OR "replac*") AND ({emergency physician*} OR {emergency clinician*} OR {emergency care provider*} OR {emergency care specialist*} OR {emergency medicine physician*} OR {emergency medicine specialist*} OR {emergency specialist*} OR {emergentologist*} OR {emergency department*} OR {ED*} OR {casualty department*} OR {accident and emergency} OR {emergency medicine} OR {hospital emergency service*} OR {emergency room*} OR {emergency unit*} OR {emergency ward*} OR {emergency outpatient unit*})

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2,243 document results

3

{emergency physician*} OR {emergency clinician*} OR {emergency care provider*} OR {emergency care specialist*} OR {emergency medicine physician*} OR {emergency medicine specialist*} OR {emergency specialist*} OR {emergentologist*} OR {emergency department*} OR {ED*} OR {casualty department*} OR {accident and emergency} OR {emergency medicine} OR {hospital emergency service*} OR {emergency room*} OR {emergency unit*} OR {emergency ward*} OR {emergency outpatient unit*}

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645,097 document results

2

"deprescri*" OR "de-implement*" OR "deimplement*" OR "disinvest*" OR "deadopt*" OR "de-adopt*" OR "disadopt*" OR "decreas*" OR "discontinu*" OR "defund*" OR "decommission*" OR "declin*" OR "delist*" OR "revers*" OR "reject*" OR "reallocat*" OR "relinquish*" OR "re-apprais*" OR "re-prioriti?" OR "redeploy*" OR "abandon*" OR "reassess*" OR "replac"

16,251,002 document results

1

{health services misuse} OR {inappropriate prescribing} OR {potentially inappropriate medication list} OR {health services overuse} OR {health services overutilization} OR {low-value} OR {low value} OR {choosing wisely} OR {unnecessary surger*} OR {unnecessary test*} OR {unnecessary medication*} OR {overdiagnos*} OR {overmedication} OR {overtreatment} OR {unwanted medical care} OR {medical reversal*} OR {unwarranted} OR {unjustified}

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87,629 document results

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Appendix 5. Grey literature search strategies

Citation search

Search strategy: Manual search for articles meeting eligibility criteria from included articles and relevant excluded literature reviews³⁻¹⁷

Results: 42

Content experts

Number of content experts contacted: 10(Prof Louise Cullen, Prof Gerben Keijzers, Prof Daniel Fatovich, Prof Diana Egerton-Warburton, A/Prof Emma Tavender, Dr Libby Haskell, Dr Robyn Linder, Ms Jessica Sheppard and Ms Anne-Marie Martin)

Search strategy: “Seminal works and/or grey literature exploring barriers/enablers/interventions to de-implement low-value care in emergency medicine practice”

Results: 4

Websites

Search terms: “low-value OR “de-implementation” OR “emergency medicine”

Searched websites(URL’s):

Google scholar(<https://scholar.google.com/>)

Choosing wisely US(<https://www.choosingwisely.org/>)

Choosing wisely Australia(<https://www.choosingwisely.org.au/>)

Choosing Wisely Canada(<https://choosingwiselycanada.org/>)

National Institute for Health and Care Excellence(<https://www.nice.org.uk/>)

Right care alliance(<https://rightcarealliance.org/>)

Lown institute(<https://lowninstitute.org/>)

Results: 0

Canadian Agency for Drugs and Technologies in Health(CADTH) Grey Matters Tool

Search terms: “low-value OR “de-implementation” OR “emergency medicine”

Results: 0

Appendix 6: Excluded studies with reasons

Study ID	Study	Published Year	Reason for Exclusion
2	Abitbol	2021	Not ED setting
3	Ablordeppey	2021	Not de-implementation of low value care
4	Ablordeppey	2021	Not deimplementation of low value care
5	Adedayo	2021	Not ED setting
6	Adenaw	2020	Not deimplementation of low value care
7	Ahc	2018	Not primary source
8	Ahc	2019	Not primary source
11	Al-Sani	2017	Abstract only publication
13	Aldridge	2018	Not deimplementation of low value care
14	Allameen	2019	Not deimplementation of low value care
15	Alsaad	2018	Not primary source
16	AmiriJabalbareh	2020	Not deimplementation of low value care
17	Anderson	2015	Not outcome of interest
18	Andruchow	2017	Abstract only publication
20	Anonymous	2014	No outcome of interest
21	Applebaum	2020	Not ED setting
24	Attali	2006	Not ED setting
25	Ayanruoh	2009	No outcome of interest
27	Baeza	2010	Not de-implementation of low value care
28	Bahadirli	2021	Not de-implementation of low value care
30	Bailey	2013	No outcome of interest
29	Bailey	2013	No outcome of interest
31	Baird	2019	Not ED setting
32	Bajaj	2018	Abstract only publication
34	Barbieri	2016	Not ED setting
35	Barnes	2016	Not primary source
36	Bennett	2020	Not primary source
37	Berezin	2020	Not outcome of interest
39	Bernhardt	2019	Abstract only publication
40	Berthiaume	2003	Not ED setting
41	Bevins	2021	Not ED setting
42	Beylin	2017	Abstract only publication
43	Bishop	2017	Not ED setting
45	Bock	2016	Abstract only publication
46	Body	2014	Not de-implementation of low value care
47	Boice	2018	Not primary source
50	Bornstein	2019	Not de-implementation of low value care
51	Bosch	2019	Not de-implementation of low value care
52	Boyle	2019	Sample size <30

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53	Bradshaw	2021	Not deimplementation of low value care
54	Brandis	1994	Not ED setting
55	Brandt	2011	Not primary source
56	Broniatowski	2018	Not outcome of interest
57	Brown	2017	Not de-implementation of low value care
59	Buckmaster	2006	Not ED setting
60	Buehrle	2020	duplicate
62	Campbell	2018	Not deimplementation of low value care
64	Celikkayalar	2021	Not deimplementation of low value care
65	Chan	2020	Abstract only publication
66	Chou	2018	No outcome of interest
67	Chou	2019	Not outcome of interest
68	Chou	2019	Not outcome of interest
70	Clemency	2018	Not de-implementation of low value care
71	Colla	2016	Not ED setting
73	Corcione	2021	Not de-implementation of low value care
74	Coronel	2016	Not ED setting
75	Coronel	2017	Not ED setting
78	Crilly	2020	duplicate
79	Cummings	2020	Not ED setting
81	Daniel	2018	Not primary source
82	Davies	2016	Not de-implementation of low value care
83	Day	2016	Not primary source
85	deCastro	2018	Not ED setting
88	Donzelli	2021	Not primary source
90	Dowling	2016	Abstract only publication
89	Dowling	2016	duplicate
91	Dowling	2018	Not de-implementation of low value care
93	Dowling	2020	duplicate
92	Dowling	2020	Not primary source
98	Duyvewaardt	2017	Abstract only publication
99	Eastin	2017	Not deimplementation of low value care
100	Echavarria	2018	Not de-implementation of low value care
101	Elbeddini	2021	Not primary source
104	Elliott	2011	Not outcome of interest
105	Embrett	2018	Not ED setting
107	Engel-Rebitzer	2019	Not outcome of interest
109	Ericksson	2018	Not ED setting
112	Fenton	2016	Not ED setting
115	FerrerasAmez	2017	duplicate
116	Fishe	2021	Not primary source
117	FormigaRibas	2020	Not de-implementation of low value care
119	Foy	2013	Not de-implementation of low value care

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121	Freund	2017	Not de-implementation of low value care
122	Friedman	2021	Not primary source
124	Gardiner	2019	Abstract only publication
126	Gazarin	2020	Not ED setting
127	Gervais	2021	Not de-implementation of low value care
128	Gilchrist	2021	Not de-implementation of low value care
129	Gines	2016	Not de-implementation of low value care
131	Gracia-SanRomán	2004	Not de-implementation of low value care
133	Griffith	2013	Not de-implementation of low value care
134	Griffith	2011	Not de-implementation of low value care
135	Griffith	2018	Not de-implementation of low value care
136	Gupta	2020	Abstract only publication
137	Gupta	2021	Not outcome of interest
140	Hartley	2016	Not ED setting
141	Haseeb	2022	Not de-implementation of low value care
143	Haskell	2021	Not outcome of interest
146	Haskell	2022	duplicate
147	Heavens	2014	Abstract only publication
149	Hess	2012	Not de-implementation of low value care
150	Hicks	2018	Not primary source
151	Hidayat	2019	Not deimplementation of low value care
153	Himelfarb	2019	duplicate
154	Ho	2018	Not outcome of interest
156	Homann	2014	Not de-implementation of low value care
157	Horng	2019	Not deimplementation of low value care
161	Huckins	2016	Not de-implementation of low value care
162	Huyer	2018	Not de-implementation of low value care
164	Ieraci	2016	Not primary source
167	Irfan	2015	duplicate
166	Irfan	2015	Not ED setting
168	Ismail	2018	Abstract only publication
169	Isouard	1999	Not deimplementation of low value care
170	Ito	2010	Not primary source
171	Iyengar	2019	Not de-implementation of low value care
172	Jacobson	2017	Abstract only publication
174	Jain	2020	Abstract only publication
178	Jones	2014	Not outcome of interest
180	Jones	2017	Not de-implementation of low value care
181	Joy	2019	Not deimplementation of low value care
184	Kanzaria	2014	Duplicate
185	Karon	2008	Not primary source
187	Kiechle	2017	Abstract only publication
188	Kilian	2019	Abstract only publication

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190	Kirkpatrick	2015	Not de-implementation of low value care
191	Kiyatkin	2011	Sample size <30
192	Klatte	2016	Not ED setting
193	Klein	2016	duplicate
195	Kline	2013	Not de-implementation of low value care
197	Kline	2017	Not de-implementation of low value care
198	Kobes	2020	Not de-implementation of low value care
199	Kroenke	1987	Not ED setting
200	Kua	2021	Not ED setting
201	Kulanthaivelu	2018	Not de-implementation of low value care
203	Lapic	2017	Not deimplementation of low value care
205	LeBlanc	2020	Not outcome of interest
208	Leis	2019	Not ED setting
209	Letourneau	2020	Not de-implementation of low value care
210	Leventhal	2018	Not deimplementation of low value care
211	Levy	2014	Not outcome of interest
213	Liao	2019	Abstract only publication
214	Lin	2014	Abstract only publication
215	Lin	2016	duplicate
219	Link	2016	Duplicate
218	Link	2016	Not ED setting
221	Lowe	1991	Not de-implementation of low value care
222	Lowy	2021	Sample size <30
223	Lyon	2017	Not de-implementation of low value care
224	MacTier	2018	Abstract only publication
227	Mafi	2018	Not ED setting
228	Mahomedradja	2021	Not ED setting
229	Mallows	2013	Not de-implementation of low value care
230	Marchi	2020	Not primary source
231	Markovitz	2020	Not outcome of interest
232	Marroquin	2012	Not de-implementation of low value care
233	Martello	2018	Sample size <30
234	Martins	2017	Not ED setting
235	Mascioli	2010	Not de-implementation of low value care
236	Masood	2017	Not outcome of interest
237	Masood	2018	duplicate
238	Masood	2020	Abstract only publication
239	Masood	2020	duplicate
241	Maughan	2015	Not outcome of interest
240	Maughan	2015	Not outcome of interest
243	McCarthy	2013	Not deimplementation of low value care
244	Meeker	2014	Not ED setting
245	Mehta	2014	Not ED setting

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246	Melamed	2021	Abstract only publication
247	Melnick	2017	Not de-implementation of low value care
248	Merck	2015	Not deimplementation of low value care
249	Micek	2014	Not ED setting
250	Michelson	2019	Not de-implementation of low value care
251	Mieiro	2016	Abstract only publication
253	Minerowicz	2015	Not ED setting
254	Moeslein	2015	Abstract only publication
255	Molaei	2016	Not de-implementation of low value care
257	Montejo	2021	duplicate
259	Morrissey	2019	Abstract only publication
261	Moss	2019	Not ED setting
262	Mrazek	2020	Not de-implementation of low value care
263	Muckley	2017	duplicate
264	Mulcare	2014	duplicate
265	Mulcare	2015	Abstract only publication
266	Mulders	2020	Not de-implementation of low value care
268	Murphy	2020	Not de-implementation of low value care
270	Nakama	2021	Not de-implementation of low value care
271	Naunheim	2019	Not de-implementation of low value care
274	Nwulu	2014	Not ED setting
275	O,ÃConnor	2021	Not ED setting
276	Obrien	2013	Abstract only publication
277	Ogden	2020	Not primary source
278	Oliver	2021	Not de-implementation of low value care
281	Osorio	2020	Not de-implementation of low value care
280	Osorio	2020	Not ED setting
282	Ostby	2020	Not de-implementation of low value care
283	Ostrow	2017	Abstract only publication
285	Paluck	2021	Not deimplementation of low value care
286	Parchman	2020	Not de-implementation of low value care
287	Parchman	2022	Not ED setting
288	Payraastre	2012	Not de-implementation of low value care
289	Petrou	2016	Not outcome of interest
290	Phelan	2019	Not deimplementation of low value care
291	Plapp	2000	Not primary source
292	PloSeco	2020	Abstract only publication
293	Powell	2020	Not ED setting
294	Pozo-Rosich	2020	Not de-implementation of low value care
296	Prodanuk	2020	Abstract only publication
298	Raskolnikov	2020	Not de-implementation of low value care
300	Reisman	2018	Abstract only publication
301	Rico	2021	Not ED setting

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303	Ritter	2019	Not de-implementation of low value care
304	Roman	2014	Not primary source
305	Royuela	2019	Not deimplementation of low value care
307	Sánchez	2013	duplicate
308	Saha	2017	Not ED setting
309	Sahota	2017	Not primary source
310	Saleem	2019	Not ED setting
312	Schefft	2019	Not ED setting
313	Schlesinger	2017	Not ED setting
314	Schubart	2001	Not ED setting
315	Schwab	2020	Abstract only publication
316	Schwartz	2019	Not ED setting
317	Scorgie	2014	Not deimplementation of low value care
319	Sharma	2021	Not ED setting
322	Sharp	2016	Not de-implementation of low value care
324	Sheikh	2017	Not primary source
325	Shelton	2018	Abstract only publication
326	Sheps	2019	Abstract only publication
327	Sheps	2020	Not de-implementation of low value care
328	Shinwa	2019	Not ED setting
329	Shishido	2021	Not ED setting
330	Shrestha	2020	Not de-implementation of low value care
331	Siddiqi	2019	Not de-implementation of low value care
332	Sieck	2021	Not de-implementation of low value care
333	Simone	2019	Not de-implementation of low value care
334	Singh	2019	Abstract only publication
335	Singh	2020	duplicate
336	Singh	2020	Not outcome of interest
337	Sivaram	1997	Not ED setting
338	Skitch	2016	Not ED setting
341	Smith	2019	Not ED setting
342	Soltwisch	2016	Not ED setting
343	Sprecher	2019	Not ED setting
347	Stefan	2019	duplicate
349	Stevens	2015	duplicate
351	Stevens	2019	Abstract only publication
352	Strauss	2019	Not ED setting
353	Streck	2012	Not outcome of interest
354	Sucov	1999	Not deimplementation of low value care
355	Sullivan	2018	Not outcome of interest
356	Sun	2018	Not outcome of interest
357	Sun	2016	Abstract only publication
358	Sun	2017	Not outcome of interest

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359	Surcin	2001	Not deimplementation of low value care
360	Taher	2020	Not ED setting
361	Tan	2022	Not de-implementation of low value care
362	Tarrant	2021	Not ED setting
363	Tawadrous	2017	duplicate
365	Taylor	2018	Not de-implementation of low value care
366	Tegegn	2018	Not ED setting
367	Tejedor-Sojo	2018	duplicate
370	Thangarasu	2011	Not deimplementation of low value care
371	Thom	2017	Abstract only publication
372	Thomas	2018	Not ED setting
373	Torabi	2019	Not deimplementation of low value care
374	Trautner	2011	Not ED setting
375	Troyer	2015	Not de-implementation of low value care
377	vanDaalen	2017	Not ED setting
378	Vandenberg	2020	duplicate
379	Vanderman	2017	Not ED setting
381	Vaughan	2021	duplicate
382	Vaughan	2021	duplicate
383	Venkatesh	2017	duplicate
384	Venkatesh	2018	Not deimplementation of low value care
385	Venkatesh	2021	Not outcome of interest
386	Vidyarthi	2015	Not de-implementation of low value care
387	Volz	2011	Abstract only publication
388	Walrath	2017	Abstract only publication
389	Wang	2018	Not ED setting
390	Weddle	2016	Not ED setting
391	Wehling	2017	Not primary source
392	Wiencek	2019	Not de-implementation of low value care
393	Williams	1986	Not ED setting
394	Wilson	2015	Not primary source
395	Wilson	2017	Not de-implementation of low value care
397	Wise	2017	duplicate
396	Wise	2017	Not primary source
398	Xia	2019	Not ED setting
399	Yadav	2018	duplicate
401	Young	2020	Not ED setting
402	Yousefifard	2020	Not de-implementation of low value care
403	Yuzuk	2017	Not outcome of interest
405	Zaver	2014	Abstract only publication
406	Zaver	2014	duplicate
408	Zhou	2018	Not ED setting

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Appendix 7: Summary characteristics of included studies

Author	Year	Country	Design	Sites	Sample size		Low-value care target	Pathology/Clinical indication	Outcome*	Effective de-implementation	Intervention facets
Abhilash ¹⁸	2020	India	QNR	S	8377	Oxygen		COPD exacerbation/ ACS/ Trauma/ Shock/ Unconsciousness	I Y		S
Ahluwalia ¹⁹	2019	US	QNR	S	359	Rapid Streptococcal Test	Pharyngitis		I Y		M

Akenroye ²⁰	2014	US	QNR	S	2929	CXR, RSV test, Salbutamol, Antibiotics	Bronchiolitis	I	Y	M
Alcorn ²¹	2018	Australia	QNR	S	39	Antibiotics	Community Acquired Pneumonia	I	Y	M
Andruchow ²²	2021	Canada	QR	M	225	CT head, CTPA	Minor head Injury, Pulmonary Embolism	I	N	M
Arora ²³	2021	US	QNR	S	1535	CT head	Minor head injury	I	Y	M
Ashurst ²⁴	2014	US	QNR	M	60	X-ray foot and ankle	Acute isolated ankle or foot trauma	I	N	S
Auleley ²⁵	1997	France	QR	M	1911	Ankle X-ray	Acute ankle trauma	I	Y	M
Bachhuber ²⁶	2021	US	QR	M	21,331	Opioids	Acute pain	I	N	S

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Bairstow ²⁷	2010	Australia	QNR	S	1061	Imaging	Suspected pulmonary embolism, ankle injury, suspected renal colic or non-traumatic acute abdominal pain.	I	Y	M
Baker ²⁸	2020	US	QNR	S	445	CT cervical spine	Acute neck trauma	I	Y	M
Ballard ²⁹	2019	US	QNR	M	3859	CT head	Minor head injury	I	Y	S
Beno ³⁰	2022	Canada	QNR	S	359	CT abdomen	Acute appendicitis	I	Y	M
Berg ³¹	2020	US	QNR	M	13063	Rapid RSV, CXR, Blood culture, bronchodilators, antibiotics, systemic corticosteroids	Bronchiolitis	I	Y	M
Blecher ³²	2017	Australia	QNR	M	324	CT Urography	Suspected Renal Colic	I	Y	S

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Blokzijl ³³	2021	Australia	Q	M	12	X-ray lumbar spine	Acute low back pain	BE	NA	
Booker ³⁴	2016	US	QNR	S	412	CTPA	Suspected pulmonary embolism	I	N	M
Bookman ³⁵	2017	US	QNR	M	NR	CT head, CT cervical spine, CTPA	Minor head injury, acute neck trauma, suspected pulmonary embolism	I	V	S
Bosch ³⁶	2016	Australia	Q	M	42	CT head, PTA screening	Minor head injury	BE	NA	
Boutis ³⁷	2013	Canada	QNR	M	2151	Ankle X-ray	Acute ankle trauma	I	Y	M
Buckmaster ³⁸	2005	Australia	QNR	M	663	CXR	Asthma	I	Y	S
Buehrle ³⁹	2021	US	QNR	S	312	Antibiotics	Infections	I	Y	M

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Carter ⁴⁰	2016	US	Q	M	102	Urinary Catheter	Multiple UC	BE	NA	
Chan ⁴¹	2019	Singapore	Q	S	9	Antibiotics	URTI	BE	NA	
Chandra ⁴²	2019	Canada	QNR	M	37	X-ray lumbar spine Multiple including coagulation profile and D-dimer	Acute low back pain	I	N	S
Chu ⁴³	2013	Australia	QNR	S	50,228		Multiple	I	Y	M
Coombs ⁴⁴	2021	Australia	QR	M	269	Lumbar spine imaging	Low back pain	I	V	M
Coughlin ⁴⁵	2020	US	QNR	M	32437	Urine culture	Urinary Tract Infection	I	Y	M
Crilly ⁴⁶	2020	Australia	Q	S	9	IMPACT protocol	Chest pain	BE	NA	

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Curran ⁴⁷	2013	Canada	Q	M	8	CT head	Minor head injury	BE	NA	
Dayan ⁴⁸	2017	US	QNR	M	19029	CT head	Minor head trauma	I	V	M
de Wit ⁴⁹	2018	Canada	MM	M	301	Non-specific	Non-specific	BE	NA	
Dearden ⁵⁰	2015	UK	QNR	S	1420	X-ray -spine	Acute blunt nek injruy	I	N	M
Demonchy ⁵¹	2014	France	QNR	M	912	Antibiotic	Urinary Tract Infection	I	V	M
Dinh ⁵²	2017	France	QNR	S	1349	Antibiotics	Infections	I	Y	M
Donaldson ⁵³	2017	Australia	QNR	S	30	Opioids	Acute pain	I	Y	M

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Dowling ⁵⁴	2020	Canada	QNR	S	3883	CXR, Respiratory viral test, Salbutamol, Steroids, Adrenaline	Bronchiolitis	I	Y	M
Dowling ⁵⁵	2019	Canada	QD	M	115	CT head	Minor head injury	BE	NA	
Drescher ⁵⁶	2011	US	QNR	S	404	CTPA	Suspected pulmonary embolism	I	Y	M
Drescher ⁵⁷	2017	US	QNR	S	1925	CTPA	Suspected pulmonary embolism	I	Y	M
Dunn ⁵⁸	2020	US	QNR	S	3834	Salbutamol	Bronchiolitis	I	Y	M
Dutta ⁵⁹	2021	US	QNR	M	337	Tetanus vaccination	Tetanus	I	Y	S
Dyc ⁶⁰	2011	US	QNR	S	30	Urinary catheter	Multiple UC	I	N	S

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Ehrlichman ⁶¹	2017	US	QNR	S	5552	CT	Multiple	I	Y	S
Elkharrat ⁶²	1999	France	QNR	S	848	Tetanus vaccination	Tetanus	I	Y	M
Ellena ⁶³	2020	US	QNR	S	180	Antibiotics	UTI	I	Y	M
Emerson ⁶⁴	2018	US	QNR	S	265	Respiratory viral test	Bronchiolitis	I	Y	M
Engineer ⁶⁵	2021	US	QNR	M	227	CT head	Minor head trauma	I	Y	M
Fagan ⁶⁶	2014	Norway	QNR	M	4744	Antibiotics	UTI(cystitis)	I	Y	M
Fakih ⁶⁷	2014	US	QNR	M	13,215	Urinary catheter	Multiple UC	I	Y	M

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Ferguson ⁶⁸	2017	US	QNR	S	2391	AXR	Constipation	I	Y	M
FerrerasAmez ⁶⁹	2017	Spain	QNR	S	1105	Coagulation studies	Multiple CS	I	Y	M
Fox ⁷⁰	2013	US	QNR	M	678	Opioids	Acute pain	I	Y	M
Fralick ⁷¹	2017	Canada	QNR	M	8000	Coagulation studies	Multiple CS	I	Y	M
Frazier ⁷²	2021	US	QNR	S	12120	CXR	Bronchiolitis	I	Y	M
Gandhi ⁷³	2021	Canada	QNR	S	31	Urine culture , Rib X-ray	UTI, Trauma	I	Y	M
Gaydos ⁷⁴	2019	US	QR	S	254	Antibiotics	Sexually transmitted infections	I	Y	S

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Geeting ⁷⁵	2016	US	QNR	S	2275	CTPA	Suspected pulmonary embolism	I	N	S
Gokula ⁷⁶	2007	US	QNR	S	100	Urinary catheter	Multiple UC	I	Y	M
Greene ⁷⁷	2018	US	QNR	M	1607	Urinary catheter	Multiple UC	I	Y	M
Greene ⁷⁸	2015	US	QD	M	228	CT head, wound cultures, antibiotics, oral rehydration, urinary catheters	Multiple	BE	NA	
Hampers ⁷⁹	1999	US	QNR	S	5395	Blood culture, urine culture and 20 others	Multiple	I	Y	M
Haran ⁸⁰	2020	US	QNR	M	1360	Antibiotic CXR, Salbutamol, Glucocorticoids, Adrenaline, Antibiotics	Non-purulent Skin and Soft tissue infections	I	Y	M
Haskell ⁸¹	2021	ANZ	MM	M	42		Bronchiolitis	BE	NA	

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Haskell ⁸²	2021	ANZ	QR	M	11730	CXR, salbutamol, antibiotics, glucocorticoids and adrenaline	Bronchiolitis	BE	NA	M
Haskell ⁸³	2020	ANZ	Q	M	20	CXR, salbutamol, Glucocorticoids, Adrenaline	Bronchiolitis	I	Y	
Haskell ⁸⁴	2021	ANZ	QD	M	1958	CXR, salbutamol, antibiotics, glucocorticoids and adrenaline	Bronchiolitis	I	Y	M
Hawkins ⁸⁵	2018	Australia	QNR	S	4173	Peripheral Intravenous Cannulation	Multiple PIVC	I	Y	M
Hecker ⁸⁶	2014	US	QNR	S	600	Antibiotic	UTI(Cystitis)	I	Y	M
Hendrickson ⁸⁷	2018	US	QNR	M	327	CT abdomen	Acute appendicitis	I	V	M
Hess ⁸⁸	2018	US	QR	M	971	CT head	Minor head injury	I	N	M

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Himelfarb ⁸⁹	2019	Canada	QNR	S	63	CT KUB	Ureteric Colic	I	Y	M
Holzer ⁹⁰	2019	US	QNR	M	6404	Amylase	Acute pancreatitis	I	Y	M
Houлинд ⁹¹	2020	Denmark	QNR	S	60	Multiple potentially inappropriate medications	Multiple indications	I	Y	M
Huang ⁹²	2019	US	Q	S	34	Viral testing	Bronchiolitis	BE	NA	
Huang ⁹³	2021	Singapore	QD	S	130	Antibiotic	URTI	BE	NA	
Hyuksool ⁹⁴	2017	Korea	QNR	S	14244	AXR	Multiple not specified/reported	I	Y	M
Ip ⁹⁵	2015	US	QNR	S	1302	CT head	Minor head injury	I	Y	S

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Jain ⁹⁶	2015	US	QNR	M	51450	CT head, CXR, IV antibiotics, ondansetron	Asthma, bronchiolitis, head injury, fever, gastroenteritis-like illness	I	Y	S
James ⁹⁷	2019	US	QNR	S	268	Antibitotics	UTI	I	Y	M
Jennings ⁹⁸	2017	US	QNR	S	1346	CT head	Minor head injury	I	Y	M
Jiménez ⁹⁹	2015	Spain	QNR	S	1363	CTPA	Suspected pulmonary embolism	I	Y	S
Jimenez Garcia ¹⁰⁰	2019	Spain	QNR	S	241	Salbutamol, adrenaline, hypertonis saline	Bronchiolitis	I	Y	M
Jones ¹⁰¹	2010	UK	QNR	M	290	D-dimer, Ventilation Perfusion scan	Suspected pulmonary embolism	I	Y	M
Kalsi ¹⁰²	2020	Australia	QNR	S	600	Coagulation studies	Multiple	I	Y	M

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Kanaan ¹⁰³	2013	US	QNR	S	200	CTPA	Suspected pulmonary embolism	I	N	S
Kanzaria ¹⁰⁴	2015	US	QD	M	435	Advanced diagnostic imaging	Multiple	BE	NA	
Kelley ¹⁰⁵	2014	US	QNR	S	1636	Antibiotics	UTI	I	Y	M
Kerr ¹⁰⁶	2005	Australia	QNR	S	211	C-spine Xray	Acute neck trauma	I	Y	S
Kharbanda ¹⁰⁷	2016	US	QNR	M	2803	CT abdomen	Acute appendicitis	I	Y	M
Kim ¹⁰⁸	2021	US	QNR	S	697	CT head	Minor head injury	I	Y	M
Klein ¹⁰⁹	2017	US	QD	S	69	Antibiotics	Upper Respiratory Tract Infection	BE	NA	

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Kline ¹¹⁰	2014	US	QR	M	550	All tests that result in radiation-exposure Abdominal radiograph, Urinary Catheter, Treatment limitation	acute coronary syndrome and pulmonary embolism	I	Y	S
Laan ¹¹¹	2021	Netherlands	QNR	M	805		Non-critically ill who can void, Abdominal pain	I	N	S
Lavingia ¹¹²	2021	US	QNR	M	5367	Opioids	Acute pain in extremity fracture and skin abscess drainage	I	Y	M
Lee ¹¹³	2021	US	QNR	M	7357	Imaging	Low back pain	I	Y	M
Lee ¹¹⁴	2020	US	QNR	S	299	Blood cultures , CRP and others	Uncomplicated skin and soft tissue infections	I	Y	M
Lee ¹¹⁵	2022	US	Q	S	28	PIM in older patients	Multiple	BE	NA	
Li ¹¹⁶	2020	US	MM	M	36	Syncope guideline	Syncope	BE	NA	

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Lim ¹¹⁷	2020	Australia	QNR	S	380	Peripheral Intravenous Cannulation	Multiple PIVC	I	Y	M
Lin ¹¹⁸	2018	US	QD	M	305	CT head, chest and abdomen	Multiple	BE	NA	
Lin ¹¹⁹	2017	US	QD	M	765	Non-specific	Non-specific	BE	NA	
Liu ¹²⁰	2019	Taiwan	QNR	S	911	Potentially Inappropriate Medications	Multiple indications	I	Y	M
Louie ¹²¹	2020	US	QNR	S	576	CT head	Minor head injury	I	Y	M
Madaras-Kelly ¹²²	2021	US	QNR	M	67987	Antibiotics	Uncomplicated acute respiratory tract infections	I	Y	M
Madran ¹²³	2019	Turkey	QNR	S	351	Antibiotics	Upper Respiratory Infection	I	Y	M

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Malmgren ¹²⁴	2019	Sweden	QNR	S	476	Antibiotics	Acute tonsillitis and otitis media	I	Y	M
Mathura ¹²⁵	2022	Canada	QNR	S	4704	Urea	Suspected renal impairment	I	Y	M
May ¹²⁶	2014	US	MM	M	150	Antibiotics	Non-specific	BE	NA	
May ¹²⁷	2021	US	QNR	M	583	Antibiotics	Skin and Soft Tissue Infections	I	V	M
McIntosh ¹²⁸	2011	Australia	QNR	M	1383	Antibiotics	Community Acquired Pneumonia	I	Y	M
Metlay ¹²⁹	2007	US	QR	M	3160	Antibiotics	URTI	I	Y	M
Michael ¹³⁰	2018	US	QR	M	109	Opioids	Acute pain	I	Y	M

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Miller ¹³¹	2017	US	QNR	M	Not reported	CT head	Multiple	I	Y	M
Mills ¹³²	2018	US	QNR	M	787	CTPA	Suspected pulmonary embolism	I	Y	S
Min ¹³³	2017	Canada	QNR	S	4562	Imaging	Low Back Pain	I	Y	M
Montejo ¹³⁴	2021	Spain	QNR	S	1878	Salbutamol, adrenaline, steroids	Bronchiolitis	I	Y	M
Moriel ¹³⁵	2020	US	QNR	S	5084	AXR	Constipation	I	Y	M
Moss ¹³⁶	2016	US	QNR	S	2684	Potentially Inappropriate Medications	Multiple indications	I	Y	M
Munigala ¹³⁷	2018	US	QNR	S	6499	Urinalysis	UTI	I	Y	S

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Mussman ¹³⁸	2018	US	QNR	M	5078	Viral testing, CXR, bronchodilators, antibiotics, steroids,	Bronchiolitis	I	Y	M
Navathe ¹³⁹	2022	US	QR	M	263	Opioids	Acute pain	I	Y	M
Nazerian ¹⁴⁰	2019	Italy	QNR	S	123130	Multiple	Multiple indications	I	Y	M
Negaard ¹⁴¹	2022	US	QNR	S	1378	Multivitamin infusion	Acute ethanol intoxication	I	Y	M
Nigrovic ¹⁴²	2015	US	QNR	S	6851	CT head	Minor head injury	I	Y	M
Noel ¹⁴³	2022	France	QNR	S	145	Peripheral intravenous infusion	Multiple indications	I	Y	S
Osborn ¹⁴⁴	2017	US	QNR	S	34	Opioids	Acute pain	I	Y	M

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Pagels ¹⁴⁵	2019	US	QNR	M	171546	Antibiotics	Acute bronchitis	I	Y	M
Percival ¹⁴⁶	2015	US	QNR	S	350	Antibiotics	UTI	I	Y	M
Poeran ¹⁴⁷	2019	US	QNR	S	27549	CT and MRI	Multiple indications	I	Y	M
Pradhan ¹⁴⁸	2021	Nepal	QNR	S	139	CT head	Minor head injury	I	Y	S
Prevedello ¹⁴⁹	2013	US	QNR	S	2891	CTPA	Suspected pulmonary embolism	I	Y	S
Puffenbarger ¹⁵⁰	2019	US	QNR	S	556	CT head	Minor head injury	I	Y	M
Raja ¹⁵¹	2015	US	QR	S	2167	CTPA	Suspected Pulmonary embolism	I	N	M

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Ramarajan ¹⁵²	2009	US	QNR	S	407	CT Abdomen	Acute appendicitis	I	Y	M
Rathlev ¹⁵³	2016	US	QR	M	40	Opioids	Acute pain	I	Y	S
Redwood ¹⁵⁴	2018	US	Q	S	5	Urine MCS CXR, hypertonic saline, bronchodilators, antibiotic, corticosteroid.	UTI	BE	NA	
Reiter ¹⁵⁵	2018	Israel	QNR	M	505		Bronchiolitis	I	Y	M
Ries ¹⁵⁶	2022	Australia	Q	M	17	Defensive practice in low- value care	Multiple non- specific	BE	BA	
Ringwalt ¹⁵⁷	2015	US	QR	M	411	Opioids	Acute pain	I	Y	M
Roy ¹⁵⁸	2009	France	QR	M	2871	CTPA	Suspected pulmonary embolism	I	Y	M

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Russell ¹⁵⁹	2013	US	QNR	S	166	CT abdomen	Acute appendicitis	I	Y	M
Sanchez ¹⁶⁰	2021	Ecuador	QNR	S	444	Antibiotics	URTI	I	Y	M
Sapadin ¹⁶¹	2022	US	QNR	S	432	Thoracic and lumbar spine radiographs	Acute back pain	I	Y	M
Shah ¹⁶²	2016	US	QNR	S	840	CT abdomen	Acute appendicitis	I	Y	M
Sharma ¹⁶³	2021	Australia	QNR	S	337	Imaging	Low back pain	I	Y	S
Sharma ¹⁶⁴	2021	Australia	QR	M	418	Imaging	Low back pain	I	Y	M

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Sharp ¹⁶⁵	2018	US	QNR	M	44947	CT Head	Minor head injury	I	Y	M
Sieber ¹⁶⁶	2016	Switzerland	QNR	S	4312	Oxygen	Multiple	I	Y	M
Sloane ¹⁶⁷	2016	US	QNR	S	230	Complete Blood Count and blood cultures	uncomplicated SSTI's	I	Y	S
Smalley ¹⁶⁸	2020	US	QNR	M	80,209	Opioids	Acute pain	I	Y	M
Srivastava ¹⁶⁹	2021	US	QNR	S	143	CT head	Acute psychosis	I	Y	M
Stagg ¹⁷⁰	2018	US	QNR	S	1,605	Urine	UTI	I	Y	M
Stair ¹⁷¹	1998	US	QNR	S	500	Multiple	Multiple	I	Y	S

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Stefan ¹⁷²	2020	US	Q	M	17	Antibiotics	Acute asthma	BE	NA	
Stevens ¹⁷³	2017	US	QNR	M	33010	Multiple	Multiple	I	Y	M
Stiell ¹⁷⁴	2009	Canada	QR	M	11824	CT head	Minor head injury	I	Y	M
Suffoletto ¹⁷⁵	2020	US	QR	S	74	Opiod	Acute pain	I	Y	S
Tawadrous ¹⁷⁶	2021	Canada	QNR	M	93128	INR and aPTT	Multiple CS	I	Y	M
Tejedor-Sojo ¹⁷⁷	2019	US	QNR	M	11488	CXR, Respiratory viral test, Salbutamol, Steroids, Adrenaline	Bronchiolitis	I	Y	M
Terrell ¹⁷⁸	2009	US	QR	S	63	9 PIMs	Multiple	I	Y	M

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Tunc ¹⁷⁹	2021	US	QNR	M	1874	CT abdomen	Acute appendicitis	I	Y	M
Van Horrik ¹⁸⁰	2022	Netherlands	QD	M	221	Urine cultures	Urinary tract infection	BE	NA	
Vanstone ¹⁸¹	2021	Canada	QNR	S	52	Urine drug screen	Routine screening in psychiatric patients	I	Y	M
Yadav ¹⁸²	2019	US	QR	M	292	Antibiotics	Acute Respiratory Infection	I	N	M
Zalmanovich ¹⁸³	2021	Israel	QNR	S	427	Antibiotics	UTI	I	Y	M
Zhang ¹⁸⁴	2017	US	QNR	S	136	Antibiotics	UTI	I	Y	M

QD-Quantitative descriptive, QR-Quantitative randomized, QNR- Quantitative nonrandomized, Q-Qualitative, MM mixed-methods, M-Multiple, S-single
T- Test, Tr-treatment, P-procedure,

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PIM: Potentially inappropriate medication

NS-Non-specific

Multiple UC(Urinary Catheter): Urinary retention, accurate measurement in critically ill, Assist healing of pressure ulcers, Improve comfort for end-of-life care, Need for prolonged immobilization

Multiple Coagulation Studies(CS): including anticoagulants,serious infections, bleeding disorders, venous/arterial thromboembolism,severe polytrauma, preoperative, liver disease, vitamin K deficiency,

I-Intervention, BE-Barrier/Enabler

Y-Yes, N-No, V-Variable, NA-Not applicable

*Effectiveness was defined based on de-implementation of low value care target/s as detailed in the methods section of the manuscript.

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Appendix 8. Barriers and Enablers of de-implementation of low-value care in emergency medicine practice mapped to the Theoretical Domains Framework.

<u>Domain^{1,2}: definition</u>	<u>Barrier³</u>	<u>Enabler³</u>
Knowledge: An awareness of the existence of something	Patient-level - Limited understanding/knowledge of risks, benefits and harms of care. Provider-level - Lack of awareness/knowledge.	System-level - Local knowledge production via multifaceted repetitive education including lectures, simulations, podcasts, blogs, videos, infographics, faculty meetings, everyday conversations, journal clubs, bedside teaching and morbidity-mortality meetings - Presence, reach, accessibility, acceptability, clarity and flexibility of guidelines/ resources/ policies/protocols. - Strength of evidence for risks, benefits and harms of change. Patient-level - Availability and consistency of patient education materials to set expectations and reduce anxiety/fear/distress.
Skills: An ability or proficiency acquired through practice		Provider-level Provision of evidence-based information about diagnosis, prognosis, management and alternative options.

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		• Provide a thorough and well explained assessment, documentation, information, and reassurance to educate and convince patients • Be aware of and apply guideline recommendations in patients on a spectrum of complexity and severity • Assess risks, benefits and harms of assessment/management decisions. • Employ good clinical judgement/ gestalt
Social/professional role and identity: A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting	Provider level • Role modelling/group practice • Navigating misalignment in decisions • Mixed messages from different clinicians System-level • Requests by admitting specialties • Complexity of gaining consensus across specialties about management pathways/protocols; • Fragmentation of care between specialties; • Uncertainty/perceived absence of patient follow-up facilities • Group norms that encourage defensive practice	Provider level • Collegial discussion about appropriate assessment and management System-level • Communication between medical and nursing staff. • Nurses' ability to question/influence doctors' decision making • Multidisciplinary collaboration in clinical care provision. • Engagement of a multidisciplinary implementation team of providers, educators, researchers and policymakers in discussions to question, share and co-design de-implementation strategies.
Beliefs about capabilities:	Provider-level	Patient level

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Acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use	• Attitude and adaptation to de-implementation: Trust training and intuition over guidelines Patient-level • Potential for negative test results decrease families' trust in providers	• Trust in provider
Beliefs about Consequences: Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation	Provider-level • Discomfort with diagnostic uncertainty • Fear or worry of missing pathology/injury • Fear of not providing timely and appropriate treatment • Fear of litigation/malpractice claim/jeopardizing medical license • Prevent potential deterioration of patients' illness due to risk factors including age, co-morbidities and social support. • Performing a test is easy and provides a perception of doing something • Habit/Clinical inertia/Lack of motivation to change behaviour of following test order-sets or lapsing into patterns of prescription • Risk of radiation • Criticism/scrutiny/censure of practice Patient-level	Patient-level • Support for avoiding/delaying tests if no suspicion of pathology; Provider-level

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	Reluctance to delay tests if persistent or worsening symptoms, suspicion of serious pathology or current episode difference from previous episodes	- Patient harm from testing - Harmful consequences of defensive practice
Reinforcement: Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus	System-level Incentives for de-implementation	
Goals: Mental representations of outcomes or end states that an individual wants to achieve	Patient-level - Third party requirements from work and insurance companies - Inability to afford private health care	Patient-level - Beliefs and expectations from care; - Need for validation of symptoms, reassurance and diagnosis; - Need for explanation for symptoms rather than a specific test/treatment/procedure.
Memory, attention and decision processes: The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives	Patient-level Limited involvement in/ disagreement with/ insistence on decision making.	

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Environmental context and resources: Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour	System-level • Time pressures/constraints; • Limited tools for rapid diagnosis; • Inadequate diagnostic testing capabilities • Limited access to information about prior testing • Trade-offs between spending time to educate patients on appropriate care and acceding to demands to allow more time with other patients. • Little organizational slack; • Time-based emergency access and disposition targets • Hospital bed availability and patient flow • Information on safe decision making in suboptimal situations • High staff turnover resulting in constant loss of tacit knowledge • Constantly changing team-structure making team-based learning challenging; • Accountability metrics are driven by finances; • Financial systems focus on local costs rather entire patient care journey through the system • Rise of consumerism leading to a conflict between organizational focus on patient satisfaction • Timeline of change: 'Process fatigue' with prolonged implementation of de-implementation • Lack of coordination between quality systems; • Complexity of de-implementation in terms of awareness, clarity, ease of recall, ease of access,	System-level • Emergency Department perceived as open to change and to have a positive culture; • Prevalent cultural norms; • System for organizing and communicating de-implementation • Compatibility of de-implementation with different information technology systems • Embedment of de-implementation in electronic health systems; user-friendly integrated electronic pathways to assess compliance and outcomes. • Repetitive messaging about de-implementation via daily briefs, meetings, huddles, e-mails, newsletters, multifaceted education and corridor conversations • Integration of de-implementation into quality improvement • Compatibility of de-implementation with values and perceived needs • Adaptability of de-implementation to local context and resources; • Visibility of de-implementation to enhance and sustain motivation, commitment and momentum; • Clear and unambiguous advantage of change over current practice; • Provider commitment and efficacy("Tension") for de-implementation
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	and ease of point-of-care application including automation • Availability of adequate resources (money, expertise, time) for adoption and sustainability of de-implementation • Reactive approaches to problem solving; • Challenges in ensuring guideline compliance by medical staff who are trained and programmed to work independently and make autonomous decisions • Stretched and hectic environment not conducive to learning and reflection • High volume of patients affects ability to educate clinicians and influence practice	• Accountability for de-implementation via performance benchmarking, linkage to professionalism and feedback that is clear, concise, and easily understood.
Social influences: Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours	Provider-level • Difficult conversations and challenging communications with patients on a spectrum of cognitive abilities, literacy and health education. • Lack of ongoing therapeutic relationship • Patient or family emotions/ pressures/ demands/ expectations/ complaints arising from a need for information/reassurance, lack of awareness of potential harms and unrealistic beliefs of potential benefits Patient-level	Provider-level • Shared decision making System-level • Visible multidisciplinary and multilevel leadership (management leaders , clinical champions/leads and implementation science experts • Respected leaders; • Leaders' Influence within social networks • Leadership support for change adoption

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	- Limited patient-provider communication; System-level - Emphasis on ED performance targets	- Demonstration of successful adoption by leaders - Engage frontline clinicians in development of protocols and feedback mechanisms - Set, communicate, reinforce and follow through expectations of frontline clinicians - Education and modelling by opinion leaders - Emphasis on improving patient outcomes/experiences - Regular communication with frontline clinicians; - Anticipate reasons for potential disengagement; - Endorsement of change by professional organizations
Behavioural regulation: Anything aimed at managing or changing objectively observed or measured actions	System-level Punitive feedback	System-level Active monitoring and feedback
¹ Barriers and enablers have been assigned to one predominant behavioural domain. Some barriers and enablers mapped to more than one domain. ²Elements of the following behavioural domains were noted in some of the barriers/enablers: Optimism(The confidence that things will happen for the best or that desired goals will be attained); Intentions(A conscious decision to perform a behaviour or a resolve to act in a certain way); Emotions(A complex reaction pattern by which the individual attempts to deal with a personally significant matter or event). ³Barriers and enablers demonstrated overlap in their function and level. A barrier could function as an enabler(or vice versa) in the right context. A barrier/enabler could function at the level of patients, providers and systems		

Appendix 9. Target low-value care and conditions.

<u>Low-value care targets</u>	<u>Conditions targeted</u>
Coagulation studies, ^{69 102}	Suspected coagulopathy, ^{69 102}
Blood cultures, ^{79 113 167} Antimicrobials, ^{51 52 80 86} 93 185	Suspected sepsis ^{79 167}
Urine cultures, ^{45 73 79 137 170}	Suspected urinary tract infection ^{45 51}
Respiratory viral tests ^{31 55 79 177}	Suspected upper respiratory tract infections ^{122 123}
Cranial CT ^{23 29 48 54 65 88}	Minor head injury ^{148 150}
CT cervical spine ^{28 186}	Acute neck trauma ^{28 186}
CT urinary tract ^{27 32 89}	Ureteric colic ^{32 89}
CT abdomen ^{87 107 159 162 179}	Suspected acute appendicitis ^{87 187}
CTPA ^{34 56 75 99 103}	Suspected pulmonary embolism ^{34 110}
Ankle radiographs ^{25 37}	Acute ankle trauma ^{25 37}

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Lumbar spine ^{42 161} radiographs	Low back pain ^{42 161}
Abdominal radiographs ^{68 94 111 135}	Constipation ^{68 135}
Opioids ^{26 53 70 112 130}	Acute pain ^{26 53}
Potentially inappropriate medications in older patients ^{120 178 188}	Geriatric polypharmacy ^{120 188}
Salbutamol, ^{55 84 134 177} adrenaline, ^{55 84 134 177} glucocorticoids ^{55 84 134 177} , chest radiographs ^{20 38 55 72 84}	Infant bronchiolitis ^{20 189}
Urinary catheters ^{60 67 76 77 111}	Acute urinary retention ^{60 67} .
Peripheral intravenous cannulae ^{85 117}	

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Appendix 10. Proportional representation of intervention facets, TDF domains and effectiveness of included studies(n = 143)

Intervention facets	Domains of the Theoretical Domains Framework	Studies of single-faceted interventions (n =30): Number	Studies of effective single-faceted interventions (n=23): Number(%)	Studies of multifaceted interventions (n = 113): Number	Studies of effective multifaceted interventions (n =107) ^a Number(%)
Education	Knowledge	12	7(58.3)	102	98(96.1)
Audit and feedback	Behavioural regulation	3	3(100)	53	49(92.5)
Stakeholder Engagement	Environmental context and Resources	0	0	44	43(97.7)
Clinical Decision Support	Memory, attention and decision processes	10	9(90)	40	38(95)
Nudge	Environmental context and Resources	5	4(80)	36	34(94.4)
Clinical Champions	Social influences	0	0	25	23(92)
Training	Skills	0	0	7	6(85.7)
Incentives	Reinforcement	0	0	2	2(100)

^a Six studies reported variable effectiveness of interventions in de-implementation across sites(different EDs⁵¹), settings (Paediatric vs Community ED⁸⁷, Paediatric vs General ED⁴⁸) and low value care targets(Opioids vs lumbar imaging⁴⁴, different classes of antibiotics¹²⁷, CT head vs CT cervical spine vs CTPA¹⁸⁶)

Appendix 11. Quality assessment of included studies using Mixed Methods Appraisal Tool

	1. QUALITATIVE STUDIES					2. RANDOMIZED CONTROLLED TRIALS					3. NON-RANDOMIZED STUDIES					4. QUANTITATIVE DESCRIPTIVE STUDIES					5. MIXED METHODS STUDIES				
	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	4.1	4.2	4.3	4.4	4.5	5.1	5.2	5.3	5.4	5.5
Abhilash											Y	Y	Y	N	Y										
Ahluwalia											Y	Y	Y	N	Y										
Akenroye											Y	Y	Y	Y	Y										
Alcorn											Y	Y	Y	N	Y										
Andruchow						Y	Y	Y	Y	Y															
Arora											Y	Y	Y	N	Y										
Ashurst											Y	Y	Y	N	Y										
Auleley						Y	Y	Y	C	Y															
Bachhuber						Y	Y	Y	Y	Y															
Bairstow											Y	Y	Y	N	Y										
Baker											Y	Y	Y	N	Y										
Ballard											Y	Y	Y	N	Y										
Beno											Y	Y	Y	N	Y										
Berg											Y	Y	Y	Y	Y										
Blecher											Y	N	N	N	Y										
Blokzijl	Y	Y	Y	Y	Y																				
Booker											Y	Y	Y	N	Y										
Bookman											Y	Y	Y	N	Y										
Bosch	Y	Y	Y	Y	Y																				
Boutis											Y	Y	Y	Y	Y										
Buckmaster											Y	Y	Y	N	Y										

Buehrle											Y	Y	Y	Y	Y						
Carter	Y	Y	Y	Y	Y																
Chan	Y	Y	Y	Y	Y																
Chandra											Y	Y	Y	N	Y						
Chu											Y	Y	Y	N	Y						
Coombs						Y	Y	Y	Y	Y											
Coughlin											Y	Y	Y	Y	Y						
Crilly	Y	Y	Y	Y	Y																
Curran	Y	Y	Y	Y	Y																
Dayan											Y	Y	Y	N	Y						
de Wit																	Y	Y	Y	Y	N
Dearden											Y	Y	Y	N	Y						
Demonchy											Y	Y	Y	N	Y						
Dinh											Y	Y	Y	N	Y						
Donaldson											Y	Y	Y	N	Y						
Dowling 2020											Y	Y	Y	Y	Y						
Dowling 2019																Y	Y	Y	N	Y	
Drescher 2011											Y	Y	Y	N	Y						
Drescher 2017											Y	Y	Y	N	Y						
Dunn											Y	Y	Y	N	Y						
Dutta											Y	Y	Y	N	Y						
Dyc											Y	Y	Y	N	Y						
Ehrlichman											Y	Y	Y	N	Y						
Elkharrat											Y	Y	Y	N	Y						

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Ellena											Y	Y	Y	N	Y
Emerson											Y	Y	Y	N	Y
Engineer											Y	Y	Y	N	Y
Fagan											Y	Y	Y	N	Y
Fakih											Y	Y	Y	N	Y
Ferguson											Y	Y	Y	N	Y
FerrerasAm ez											Y	Y	Y	N	Y
Fox											Y	Y	Y	N	Y
Fralick											Y	Y	Y	N	Y
Frazier											Y	Y	Y	N	Y
Gandhi											Y	Y	Y	N	Y
Gaydos			Y	Y	Y	N	Y								
Geeting											Y	Y	Y	N	Y
Gokula											Y	Y	Y	N	Y
Greene 2018											Y	Y	Y	N	Y
Greene 2015															Y Y Y N Y
Hampers											Y	Y	Y	N	Y
Haran											Y	Y	Y	N	Y
Haskell 2021(QR)			Y	Y	Y	C	Y								
Haskell 2020	Y	Y	Y	Y	Y										
Haskell 2021(MM)															Y Y Y Y Y
Haskell 2021(QNR)											Y	Y	Y	N	Y

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Hawkins										Y	Y	Y	Y	Y						
Hecker										Y	Y	Y	N	Y						
Hendrickson										Y	Y	Y	N	Y						
Hess				Y	Y	Y	C	Y												
Himelfarb										Y	Y	Y	N	Y						
Holzer										Y	Y	Y	N	Y						
Houlind										Y	Y	Y	N	Y						
Huang 2021																Y	Y	Y	Y	Y
Huang 2019	Y	Y	Y	Y	Y															
Hyuksool										Y	Y	Y	Y	Y						
Ip										Y	Y	Y	Y	Y						
Jain										Y	Y	Y	Y	Y						
James										Y	Y	Y	N	Y						
Jennings										Y	Y	Y	N	Y						
Jiménez										Y	Y	Y	N	Y						
Jimenez																				
Garcia										Y	Y	Y	N	Y						
Jones										Y	Y	Y	N	Y						
Kalsi										Y	Y	Y	N	Y						
Kanaan										Y	Y	Y	N	Y						
Kanzaria																Y	Y	Y	Y	Y
Kelley										Y	Y	Y	N	Y						
Kerr										Y	Y	Y	N	Y						
Kharbanda										Y	Y	Y	Y	Y						
Kim										Y	Y	Y	N	Y						
Klein																Y	Y	Y	N	Y

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[illegible]

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Moriel									Y	Y	Y	N	Y
Moss									Y	Y	Y	N	Y
Munigala									Y	Y	Y	Y	Y
Mussman									Y	Y	Y	N	Y
Navathe			Y	Y	Y	Y	Y						
Nazerian									Y	Y	Y	N	Y
Negaard									Y	Y	Y	N	Y
Nigrovic									Y	Y	Y	N	Y
Noel									Y	Y	Y	N	Y
Osborn									Y	Y	Y	N	Y
Pagels									Y	Y	Y	N	Y
Percival									Y	Y	Y	N	Y
Poeran									Y	Y	Y	Y	Y
Pradhan									Y	Y	Y	N	Y
Prevedello									Y	Y	Y	N	Y
Puffenbarger									Y	Y	Y	N	Y
Raja			Y	Y	Y	C	Y						
Ramarajan									Y	Y	Y	N	Y
Rathlev			Y	Y	Y	Y	Y						
Redwood	Y	Y	Y	Y	Y								
Reiter J									Y	Y	Y	N	Y
Ries	Y	Y	Y	Y	Y								
Ringwalt			Y	Y	Y	C	Y						
Roy			Y	Y	Y	Y	Y						
Russell									Y	Y	Y	N	Y

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Sanchez								Y	Y	Y	N	Y
Sapadin								Y	Y	Y	N	Y
Shah								Y	Y	Y	N	Y
Sharma 2021(QNR)								Y	Y	Y	Y	Y
Sharma 2021(QR)		Y	Y	N	C	Y						
Sharp								Y	Y	Y	Y	Y
Sieber								Y	Y	Y	N	Y
Sloane								Y	Y	Y	N	Y
Smalley								Y	Y	Y	N	Y
Srivastava								Y	Y	Y	N	Y
Stagg								Y	Y	Y	Y	Y
Stair								Y	Y	Y	N	Y
Stefan	Y	Y	Y	Y	Y							
Stevens								Y	Y	Y	N	Y
Stiell		Y	Y	Y	N	Y						
Suffoletto		Y	Y	Y	C	Y						
Tawadrous								Y	Y	Y	N	Y
Tejedor-Sojo								Y	Y	Y	N	Y
Terrell		Y	Y	Y	Y	Y						
Tunc								Y	Y	Y	N	Y
van Horrik								Y	Y	Y	N	Y
Vanstone								Y	Y	Y	N	Y
Yadav		Y	Y	Y	Y	Y						
Zalmanovich								Y	Y	Y	N	Y
Zhang								Y	Y	Y	N	Y

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Y=yes, N=no, C-can't tell

QR-Quantitative randomized, QNR- Quantitative nonrandomized, MM mixed-methods,

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