

# BMJ Open What works for and what hinders deimplementation of low-value care in emergency medicine practice? A scoping review

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## ABSTRACT

**Objectives** Low-value care can harm patients and healthcare systems. Despite a decade of global endeavours, low value care has persisted. Identification of barriers and enablers is essential for effective deimplementation of low-value care. This scoping review is an evidence summary of barriers, enablers and features of effective interventions for deimplementation of low-value care in emergency medicine practice worldwide.

**Design** A mixed-methods scoping review was conducted using the Arksey and O'Malley framework.

**Data sources** Medline, CINAHL, Embase, EMCare, Scopus and grey literature were searched from inception to 5 December 2022.

**Eligibility criteria** Primary studies which employed qualitative, quantitative or mixed-methods approaches to explore deimplementation of low-value care in an EM setting and reported barriers, enablers or interventions were included. Reviews, protocols, perspectives, comments, opinions, editorials, letters to editors, news articles, books, chapters, policies, guidelines and animal studies were excluded. No language limits were applied.

**Data extraction and synthesis** Study selection, data collection and quality assessment were performed by two independent reviewers. Barriers, enablers and interventions were mapped to the domains of the Theoretical Domains Framework. The Mixed Methods Appraisal Tool was used for quality assessment.

**Results** The search yielded 167 studies. A majority were quantitative studies (90%, 150/167) that evaluated interventions (86%, 143/167). Limited provider abilities, diagnostic uncertainty, lack of provider insight, time constraints, fear of litigation, and patient expectations were the key barriers. Enablers included leadership commitment, provider engagement, provider training, performance feedback to providers and shared decision-making with patients. Interventions included one or more of the following facets: education, stakeholder engagement, audit and feedback, clinical decision support, nudge, clinical champions and training. Multifaceted interventions were more likely to be effective than single-faceted interventions. Effectiveness of multifaceted interventions was influenced by fidelity of the intervention facets. Use of behavioural change theories such as the Theoretical Domains Framework in the published studies

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This scoping review is a comprehensive synthesis of emergency medicine (EM) literature about barriers, enablers and effective interventions to deimplement low-value care.
- ⇒ The use of the mixed-methods approach has yielded an integrated evidence synthesis to inform ongoing deimplementation endeavours of EM clinicians, researchers and policy-makers.
- ⇒ The analysis is informed by the Theoretical Domains Framework which is associated with enhanced systematic uptake and success of deimplementation interventions.
- ⇒ This scoping review may have limited relevance to non-emergency medicine settings as deimplementation endeavours need to be context specific.

appeared to enhance the effectiveness of interventions to deimplement low-value care.

**Conclusion** High-fidelity, multifaceted interventions that incorporated education, stakeholder engagement, audit/feedback and clinical decision support, were administered daily and lasted longer than 1 year were most effective in achieving deimplementation of low-value care in emergency departments. This review contributes the best available evidence to date, but further rigorous, theory-informed, qualitative and mixed-methods studies are needed to supplement the growing body of evidence to effectively deimplement low-value care in emergency medicine practice.

## INTRODUCTION

Low-value care is ineffective, inefficient or unwanted care that is unlikely to benefit patients given the harms, cost, available alternatives or patient preferences.<sup>1</sup> Low-value care is a global health problem with an estimated prevalence of 10%–30% of all health-care expenditure.<sup>1–3</sup> Low-value care leads to physical, psychological and financial harm to patients and accounts for an estimated

US\$270 billion in healthcare resource wastage annually in the USA alone.<sup>2</sup>

The Choosing Wisely campaign has endeavoured to address low-value care globally since 2012 through recommendations from specialist medical societies.<sup>4</sup> Despite the campaign gaining traction in 25 countries across 5 continents,<sup>5</sup> recent studies have highlighted the persistence of low-value care.<sup>6–8</sup> This persistence suggests that Choosing Wisely recommendations in isolation are unlikely to deimplement low-value care.<sup>9</sup> Identification of barriers and enablers is a prerequisite for designing interventions to effectively deimplement low-value care.<sup>10 11</sup>

Context-specific knowledge of multilevel barriers and enablers,<sup>11–14</sup> frontline clinician engagement,<sup>15</sup> use of rigorous outcome data,<sup>15</sup> routine hospital data-driven monitoring of overusers and costs to feedback to clinicians,<sup>16–18</sup> multifaceted interventions,<sup>13 14 19 20</sup> patient involvement<sup>21</sup> and use of behavioural change theories<sup>22</sup> has been noted by literature reviews to date as key considerations in deimplementation of low-value care. Low-value care persists in EM practice as evidenced by the lumbar spine radiograph utilisation rate of 34.7% in adults with atraumatic back pain in the USA<sup>8</sup> and the chest radiograph utilisation rate of 30% in infants with bronchiolitis in Canada.<sup>23</sup> A comprehensive literature review of barriers, enablers and effective interventions to deimplement low-value EM care is unavailable. Such a review is necessary to navigate context-specific emergency department (ED) challenges of overcrowding,<sup>24</sup> diagnostic uncertainty,<sup>25</sup> limited-information,<sup>26</sup> ambulant patient populations,<sup>27 28</sup> high staff turnover<sup>27 28</sup> and time constraints.<sup>27 28</sup> A literature review focused on EM has the potential to augment deimplementation efforts in EDs servicing large sections of the global population including those in the USA (130 million ED visits/year),<sup>29</sup> UK (17.4 million ED visits/year),<sup>30</sup> Canada (11.7 million ED visits/year)<sup>31</sup> and Australia (8.8 million ED visits/year).<sup>32</sup> The objective of this review was to synthesise the literature to provide a systematic collation of barriers, enablers and interventions to deimplement low-value care in EM practice with a view to inform clinicians, researchers and policy-makers.

## METHODS

### Protocol registration and publication

This was a mixed-methods scoping review, conducted using the enhanced Arksey and O'Malley framework<sup>33–37</sup> and analysed using the Theoretical Domains Framework (TDF). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for Scoping Reviews framework<sup>38</sup> was used to report the scoping review. The review protocol has been registered with Open Science Framework Registry ([osf.io/bp8fa](https://osf.io/bp8fa)) and its detailed methods published.<sup>39</sup> Key methodological processes are summarised below.

### Identification of research question

The scoping review question was 'What is known from existing literature about barriers to, enablers of and interventions for deimplementation of low-value care in EM practice'?

### Identification of relevant studies

Primary studies which employed qualitative, quantitative, or mixed-methods approaches to explore deimplementation of low-value care in an EM setting and reported barriers, enablers or interventions were included. Reviews, protocols, perspectives, comments, opinions, editorials, letters to editors, news articles, books, chapters, policies, guidelines and animal studies were excluded. No date or language limits were applied.

### Study selection

Medline, CINAHL, Embase, EMCare and Scopus were searched from inception using keyword and Medical Subject Heading synonyms of 'low-value', 'de-implementation' and 'emergency medicine' (online supplemental appendix 1). A database search was initially performed on 20 February 2022 and updated on 5 December 2022. Grey literature was identified through Grey Matters tool,<sup>40</sup> Google Scholar, relevant websites and consultation with content experts. Two reviewers (VG, ND) independently performed title and abstract screening followed by a full-text review. Disagreements were resolved by a third reviewer (KC or RE). Reference lists of included articles and relevant excluded reviews were screened to identify additional eligible articles. Google Translate was used to translate non-English articles. Endnote V.20.0 was used to manage references.<sup>41</sup>

### Data charting

Two reviewers (VG, ND) independently charted data using a standard template. Disagreements were resolved by a third reviewer (KC). Authors of included studies were contacted for further data or clarification if indicated.

### Collating, summarising and reporting results

Data were subjected to quantitative and qualitative analyses. The analyses were structured around the barriers, enablers and interventions. The quantitative analysis covered descriptive statistics to summarise barriers, enablers and interventions in terms of trends across time, geography, economies, design and quality. During quantitative analysis, studies of intervention were noted to vary in their use of process and outcome measures. To enable comparison between studies with disparate process and outcome measures, two reviewers (VG, ND) independently categorised the effectiveness of interventions based on the reported outcome measure of deimplementation of low-value care target/s. Interventions that were successful in deimplementing low-value care were defined as effective whereas interventions that were unsuccessful were defined as ineffective. Interventions were defined as variably effective if their reported success varied across sites or low-value care targets. The qualitative analysis mapped

barriers, enablers and interventions to the 14 domains of the TDF (online supplemental appendix 2). NVivo data management software was used to facilitate qualitative data analysis.<sup>42</sup>

### Quality assessment

Quality assessment was performed by two independent reviewers (VG, ND) using the Mixed Methods Appraisal Tool (MMAT, online supplemental appendix 3)<sup>43</sup> to ensure methodologically rigorous synthesis of the results. The MMAT rates the methodological quality of studies using ‘Yes-No-Can’t tell responses’ to five unique sets of criteria for five study designs.<sup>43</sup> MMAT discourages calculation of an overall score, instead advising detailed presentation of criterion ratings to better inform quality assessment of included studies.<sup>43</sup> MMAT also discourages exclusion of low-quality studies and encourages a sensitivity analysis where results of studies are contrasted based on their quality.<sup>43</sup> Studies that scored a ‘Yes’ response on all five criteria were considered higher quality compared with those which did not. The quality of description of effective interventions was analysed using the Template for Intervention Description and Replication (TIDieR) checklist.<sup>44</sup>

### Inter-rater reliability, sensitivity and specificity

Inter-reviewer reliability was calculated using proportion of agreement between coders, Cohen’s kappa<sup>45</sup> and

prevalence and bias adjusted kappa.<sup>46</sup> Sensitivity of the search strategy was calculated as ratio of the number of included studies indexed in Medline that were retrieved by the search strategy to the number of included studies indexed in Medline.<sup>47</sup> Specificity of the search strategy was calculated as the ratio of number of included studies indexed in Medline that were retrieved by the search strategy to the number of studies initially retrieved by the search strategy.<sup>47</sup>

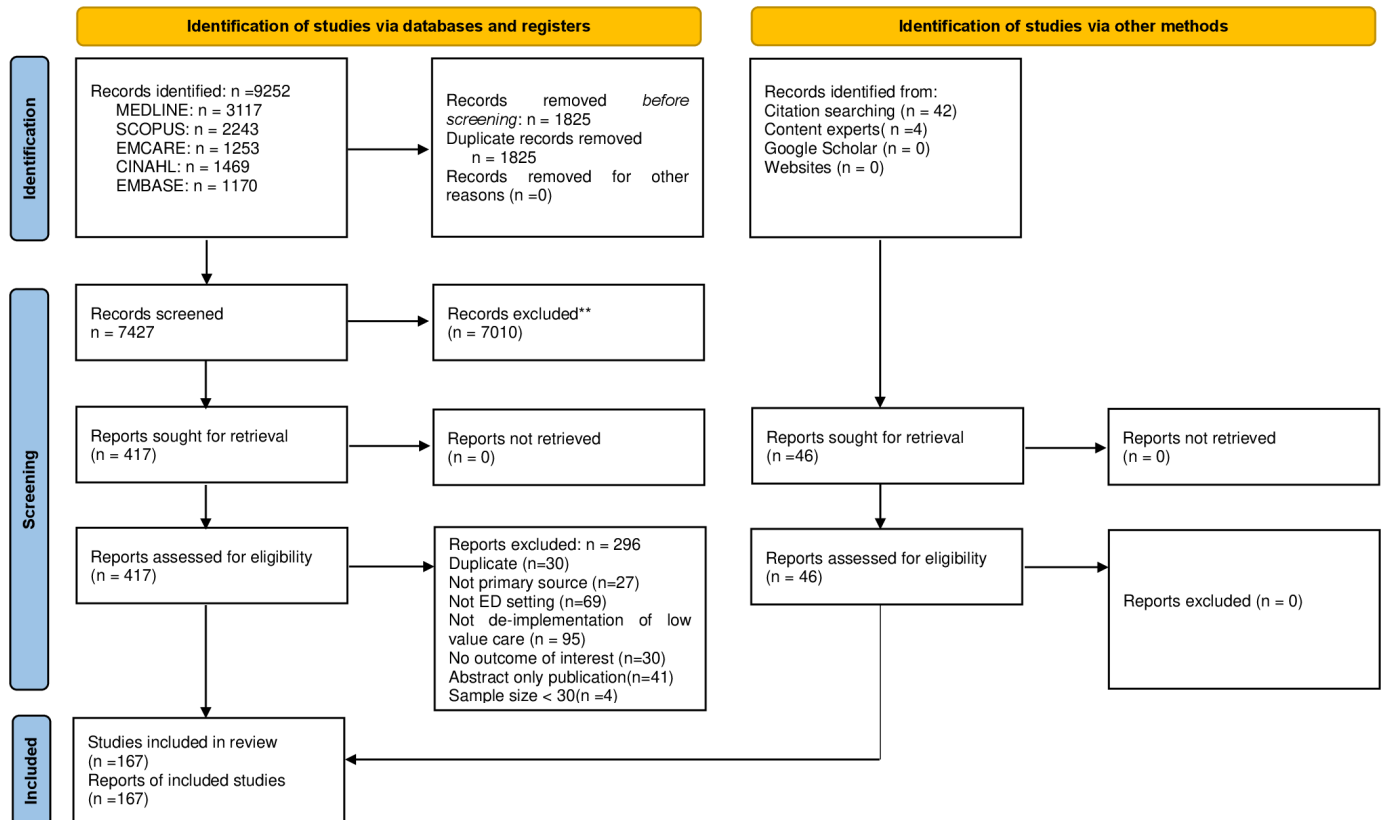
### Patient and public involvement

Patients and public were not involved in the design or conduct of this scoping review. The findings of this scoping review will inform public consultations in planned subsequent projects as part of research being pursued by the lead author.

## RESULTS

### Search results

The database search yielded 9252 records. Following removal of duplicates and title/abstract screening, 417 records were selected for full text review out of which 121 articles met eligibility criteria. The grey literature search yielded a further 46 studies resulting in a total of 167 inclusions. **Figure 1** shows the PRISMA flow chart. Search strategies (database, grey literature) and excluded studies



**Figure 1** Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart of study inclusion.

**Table 1** Summary of characteristics of included studies

Characteristics	Values	Number (%) of studies
Year of publication	1990–2000	4 (2.4)
	2001–2010	10 (6)
	2011–2020	123 (73.6)
	2021–2022	30 (18)
Continent of conduct	North America	116 (69.4)
	South America	1 (0.6)
	Europe	19 (11.4)
	Asia	9 (5.4)
	Oceania	22 (13.2)
Design	Non-randomised uncontrolled	115 (68.8)
	Randomised controlled trials	20(12)
	Non-randomised controlled	8 (4.7)
	Cross-sectional survey	8 (4.7)
	Qualitative	12 (7.2)
	Mixed methods	4 (2.4)
Type of low-value care	Laboratory/Imaging test	84 (50.3)
	Medical treatment	53 (31.7)
	Medical procedure	8 (4.7)
	Combination	15(9)
	Non-specific	7 (4.2)
Outcomes	Interventions	143 (85.6)
	Barriers and/or enablers	24 (14.4)

are presented in online supplemental appendices 4–6, respectively.

### Summary of included studies

A total of 167 studies, evaluating over 1 091 677 participants from 20 countries, met eligibility criteria. Of these studies, 151 were quantitative, 12 qualitative and 4 mixed-methods approaches. Key summary characteristics are presented in [table 1](#) and detailed in online supplemental appendix 7. A majority of included studies were published after 2011 (91.6%, 153/167) and originated in high-income countries (97.6%, 163/167). The outcomes of interest were effectiveness of interventions to deimplement low-value care in 85.6% (143/167) of studies and barriers/enablers of deimplementation of low-value care in 14.4% (24/167) of studies. A minority of studies (16.2%, 27/167) reported the use of behavioural change theories to inform intervention design or identification of barriers/enablers. The major barriers, enablers and interventions explored in the included studies are detailed below.

### Barriers and enablers

Barriers and enablers were the focus of 12 qualitative,<sup>48–59</sup> 8 quantitative<sup>60–67</sup> and 4 mixed-methods studies.<sup>68–71</sup>

Studies of barriers and enablers explored testing/treatment in infant bronchiolitis,<sup>54 55 68</sup> antibiotic stewardship,<sup>53 56 57 62 70</sup> cranial CT scans in minor head injury,<sup>49 52</sup> guideline implementation in chest pain<sup>51</sup> and syncope,<sup>69</sup> urinalysis,<sup>56 67</sup> urinary catheter insertion,<sup>50</sup> lumbar radiographs in back pain,<sup>48</sup> respiratory viral testing,<sup>54</sup> potentially inappropriate medications in older patients<sup>58</sup> and perspectives about low-value care.<sup>59 60 64–66 71</sup>

Barriers and enablers were reported at the level of emergency providers, patients or systems. Limited provider abilities,<sup>48 53 55</sup> patient expectations,<sup>66</sup> diagnostic uncertainty,<sup>53 55 69</sup> insufficient provider insight,<sup>72</sup> habit,<sup>57</sup> conflict between guidelines and clinical judgement,<sup>52 68 69</sup> time constraints,<sup>48 53 55 68 70</sup> perceived benefits of defensive practice<sup>59</sup> and fear of litigation<sup>60</sup> emerged as key barriers.

Provider training,<sup>48 65 71</sup> provider feedback,<sup>65 68 69</sup> patient education,<sup>69</sup> leadership commitment,<sup>69 71</sup> frontline clinician engagement<sup>71</sup> and framing deimplementation in terms of patient outcomes<sup>49</sup> were the major enablers. Mapping of key barriers and enablers to the domains of the TDF is presented in [table 2](#) and detailed in online supplemental appendix 8.

### Interventions

Deimplementation interventions were the focus of 143 quantitative studies. Low-value care targets included laboratory/imaging tests (n=84), medical treatments (n=51) and medical procedures (n=8) employed in the management of infections, injuries, pain and coagulopathies. The most frequently studied low-value care targets were bronchiolitis tests/therapies, urine cultures, cranial CT, CT pulmonary angiography, antimicrobials, opioids and urinary catheters. A complete list of targets and conditions is presented in the online supplemental appendix 9.

Education,<sup>73–77</sup> audit and feedback,<sup>78–82</sup> stakeholder engagement,<sup>24 83–86</sup> clinical decision support,<sup>87–91</sup> nudge,<sup>92–96</sup> clinical champions,<sup>97–101</sup> training<sup>102–106</sup> and incentives<sup>79 107</sup> were the component facets of interventions. Interventions were multifaceted in 79% (113/143) of studies and single faceted in 21% (30/143) of studies. Multifaceted studies ranged from two to five facets. The median duration of postintervention follow-up was 10 months (IQR 5 months–15 months, range 1 day–10 years).

### Intervention effectiveness

Interventions were reported to be effective in deimplementing low value care in 86% (123/143) of studies, ineffective<sup>82 103 108–118</sup> in 9.8% (14/143) studies and variably effective<sup>89 102 119–122</sup> in 4.2% (6/143) studies. The effectiveness of interventions in studies was similar across sample sizes, (86.3% (63/73) if n<1000 vs 97% (66/68) if n>1000), participant sites (87.7% (50/57) in multisite vs 92% (79/86) in single site) and documented use of behavioural change theories (93.7% (15/16) when present vs 94.5% (120/127) when absent). In comparison, intervention effectiveness was more varied across study designs (90.5% (105/116) uncontrolled vs 66.7% (18/27) controlled) and intervention facets (94.7% (107/113) multifaceted vs 73.3% (22/30) single faceted).

**Table 2** Barriers and enablers of deimplementation of low-value care for providers (Pr), patients (Pt) or systems (Sy) mapped to the Theoretical Domains Framework (TDF)

Domains* of TDF	Barriers†	Enablers†
Knowledge	▶ Lack of awareness/knowledge <sup>48 57</sup> (Pr)	▶ Availability and consistency of patient education materials to set expectations <sup>70</sup> (Pt)
Skills	▶ Lack of clinical competence and confidence <sup>55 57</sup> (Pr)	▶ Provide assessment and reassurance <sup>48 119</sup> (Pr) ▶ Assess risks, benefits and harms <sup>71</sup> (Pr).
Social/professional role and identity	▶ Mixed messages from different clinicians <sup>53 69</sup> (Pr) ▶ Group norms that encourage defensive practice <sup>59</sup> (Sy) ▶ Requests by admitting specialties <sup>49 57</sup> (Sy)	▶ Engaging multidisciplinary team <sup>48 71</sup> (Sy) ▶ Positive relationships between clinicians and willingness to seek advice <sup>55</sup> (Pr) ▶ Role modelling deimplementation <sup>51</sup> (Pr)
Beliefs about capabilities	▶ Attitude and adaptation to deimplementation where providers trust training, intuition and judgement over guidelines <sup>49 52 53 68 69</sup> (Pr)	▶ Patient trust in provider <sup>48</sup> (Pt)
Beliefs about consequences	▶ Discomfort with diagnostic uncertainty <sup>53 57 69 119</sup> (Pr) ▶ Fear of missing pathology <sup>52 55</sup> (Pr) ▶ Fear of litigation <sup>57 69</sup> (Pr) ▶ Criticism/scrutiny/censure of practice <sup>59</sup> (Pr)	▶ Support for avoiding/delaying tests if no suspicion of pathology <sup>48</sup> (Pt) ▶ Patient harm from testing <sup>55</sup> (Pr) ▶ Harmful consequences of defensive practice <sup>59</sup> (Pr)
Goals	▶ Third party requirements from work and insurance companies <sup>48</sup> (Pt)	▶ Need for validation of symptoms, reassurance and diagnosis <sup>48 54 70</sup> (Pt)
Memory, attention and decision processes	▶ Limited involvement in/disagreement with/insistence on decision making <sup>48</sup> (Pt)	
Environmental context and resources	▶ Hectic environment not conducive to learning and reflection <sup>49 52 68</sup> (Sy) ▶ Time pressures/constraints <sup>48 49 53 55 57 70</sup> (Sy) ▶ Hospital bed availability and patient flow <sup>49</sup> (Sy) ▶ Reduced after-hours support to junior staff <sup>55</sup> (Pr)	▶ Compatibility of deimplementation with values and perceived needs <sup>49</sup> (Sy) ▶ Adaptability of deimplementation to local context and resources <sup>49 71</sup> (Sy)
Social influences	▶ Patient or family expectations <sup>48 52 53 55 69 70</sup> (Pr) ▶ Limited patient–provider communication <sup>69 70</sup> (Pt) ▶ Emphasis on ED performance targets <sup>49 52</sup> (Sy)	▶ Shared decision-making <sup>48</sup> (Pr) ▶ Visible leadership commitment <sup>49 71</sup> (Sy) ▶ Engagement of frontline clinicians <sup>49 69 71</sup> (Sy)
Behavioural regulation	▶ Habit: lack of motivation to change behaviour or lapsing into behavioural patterns <sup>54 57 70</sup> (Pr)	▶ Active monitoring and feedback <sup>70 71</sup> (Sy)

\*Barriers and enablers have been assigned to one predominant behavioural domain. Some barriers and enablers mapped to more than one domain. Elements of the domains of optimism, intentions and emotion were noted in some barriers and enablers.  
†Barriers 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 a single level (Provider (Pr) or Patient (Pt) or System (Sy)) or multiple levels.

Effectiveness of multifaceted interventions did not vary significantly with the number of facets: 92% (49/53) of two-faceted, 97.4% (39/40) of three-faceted, 90% (10/11) of four-faceted and 100% (9/9) of five-faceted studies achieved deimplementation of low-value care. The seven intervention facets mapped to the following six domains of the TDF: knowledge (education), behavioural regulation (audit and feedback), environmental context and resources (stakeholder engagement, nudge), memory, attention and decision processes (clinical decision support), social influences (clinical champion), skills (training) and reinforcement (incentives). The proportional representation of intervention facets, TDF domains

and intervention effectiveness among included studies is presented in online supplemental appendix 10.

A detailed summary of the effective intervention characteristics in randomised and high-quality non-randomised studies is presented in [table 3](#) using the TIDieR checklist.<sup>44</sup> In a nutshell, high-fidelity, multifaceted interventions that included education, stakeholder engagement, audit/feedback and clinical decision support, were administered daily and lasted longer than 1 year were most effective in achieving deimplementation of low-value care in EDs.

Adverse outcomes of interventions were reported in 3 (1.8%) studies.<sup>87 92 123</sup> The adverse outcomes were



**Table 3** Effective intervention components in selected studies (randomised (n=14), and higher quality non-randomised studies (n=19))

Intervention characteristics*	Tests		Treatments						
	Imaging (n=13)	Lab (n=4)	Bronchiolitis caret† (n=5)	Opioids (n=5)	Antibiotics (n=4)	PIM (n=1)	Procedures (n=1)		
What‡									
Education	85 86 90 102 121 129 133 138 167	135 142 144 146	124 131 132 136	72 130	74 145 186	128	137		
Stakeholder engagement	84–86 90 102 167	146	124 131 132						
Audit and feedback	102 138 167	135 146	124 131 136 140	72 127 130 159	74 186		137		
Clinical decision support	84 86 90 121 125 129 133 139 141	135 146		126 127		128			
Nudge		142 144	132		145 160				
Clinical champion	121 133	146	124				137		
Training	102 133		124						
Who§									
Doctors	84–86 90 102 121 125 129 133 138 139 141 167	135 142 144 146	124 131 132 136 140	72 126 127 130 159	74 145 160 186	128	137		
PANP/PT	90 102	135		72 130					
Nurses	102	135 144					137		
How¶									
Intensity									
Multifaceted	84–86 90 102 121 129 133 138 167	135 142 144 146	124 131 132 136	72 127 130	74 145 186	128	137		
Single faceted	125 139 141		140	126 159	160				
Dose									
Once	85 86 90 102 121 133 167	135 146	124 131 136	72 127 159	74 160 186				
Daily	84–86 90 102 121 125 129 133 139 141 167	135 142 144 146	124 131	126 127	145	128	137		
Weekly			131						
Monthly	102 138	135	124 131 132	130	186				
Quarterly			131 140						
Half-yearly		146							
Yearly			131						
Duration									
< 4 weeks			136	159					
1–11 months	85 102 125 129 167	142 144	124	72 126 130	186		137		
≥1 year	84 86 90 121 133 138 139 141	135 146	131 132 136 140	127	74 145 160	128			
How well**									
Planned	84–86 90 102 121 125 129 133 138 139 141 167	135 142 144 146	124 131 132 136 140	72 126 127 130 159	74 145 160 186	128	137		
Delivered	129	144	124 132	159		128			

\*Interventions were not tailored (personalised/itrated/adapted) or modified during the course of the study except in one study.<sup>144</sup>  
 †Variable combination of respiratory viral testing, chest radiograph, salbutamol, epinephrine, glucocorticoids and antibiotics.  
 ‡Facets of intervention.  
 §Clinicians targeted by intervention.  
 ¶Details of delivery of intervention: intensity—number of facets; dose—how often; duration—how long.  
 \*\*Planning and delivery (ie, fidelity) of intervention (Was fidelity assessed? How? By whom? Strategies to maintain/improve fidelity?).  
 NP, nurse practitioner; PA, physician assistant; PIM, potentially inappropriate medications; PT, physiotherapist.

**Table 4** Quality assessment of included studies using Mixed Methods Assessment Tool<sup>43</sup>

Design (number)	Quality criteria	Results
Quantitative randomised (20)	Appropriateness of randomisation; comparability of groups at baseline; completeness of outcome data; blinding of outcome assessors; participant adherence to assigned intervention	Outcome data were incomplete in one study. <sup>72</sup> Blinding of outcome assessors could not be established in nine studies <sup>72 74 103 118 124 127 159 167 168</sup> and was absent in two studies. <sup>86 160</sup> Studies adequately addressed other criteria.
Quantitative non-randomized (123)	Representativeness of participants; appropriateness of measurements; completeness of outcome data; accounting for confounders; administration of intervention/exposure as intended	Accounting for temporal confounding was absent in 103 studies. Studies adequately addressed other criteria.
Quantitative descriptive (8)	Relevance of sampling strategy; representativeness of participants; appropriateness of measurements; risk of non-response bias; appropriateness of statistical analysis	Four studies were at risk of non-response bias. <sup>60 61 63 67</sup> Studies adequately addressed other criteria.
Qualitative (12)	Appropriateness of qualitative approach; adequacy of data collection methods; adequate derivation of findings from data; sufficient substantiation of interpretation by data; coherence between data sources, collection, analysis and interpretation	Studies adequately addressed criteria.
Mixed methods (4)	Adequacy of rationale; effective integration of components; adequate interpretation of the integrated components; adequate addressal of divergences and inconsistencies between components; adherence to quality criteria of component study designs	Suboptimal adherence to the quality criteria of quantitative component was noted in three studies. <sup>69-71</sup> Studies adequately addressed other criteria .

a family complaint about non-performance of a rapid streptococcal test in a child with sore throat, a paediatric revisit with clinically important traumatic brain injury and a missed paediatric appendicitis.

### Quality assessment

Of the included studies, 60% (12/20) of quantitative randomised,<sup>82 102 108 110 118 124-130</sup> 16.3% (20/123) of quantitative non-randomised,<sup>84 85 90 121 131-146</sup> 62.5% (5/8) of quantitative descriptive,<sup>61 62 64-66</sup> 100% (12/12) of qualitative<sup>48-57</sup> and 25% (1/4) of mixed methods studies<sup>68</sup> were assessed as being of higher quality. Among studies evaluating interventions, 21% (30/143) were of higher quality. Effective deimplementation of low-value care was reported by 86.7% (26/30) of higher quality studies and 87.6% (99/113) of lower quality studies. Similar proportions of higher and lower quality studies reported effective deimplementation of low-value care when evaluating multifaceted interventions (87% (20/23) vs 96.6% (87/90)) and single-faceted interventions (71.4% (5/7) vs 74% (17/23)). The results of quality assessment are summarised in [table 4](#) and detailed in online supplemental appendix 11.

### Inter-rater reliability, sensitivity and specificity

There was substantial agreement between the two independent reviewers during title/abstract screening (proportion of agreement 96.2%, Cohen's kappa 0.52, prevalence and bias-adjusted kappa 0.92) and full-text review (proportion of agreement 95.6%, Cohen's kappa 0.90, prevalence and bias-adjusted kappa 0.91). Sensitivity

and specificity of the search strategy were 36% (55/153) and 1.8% (55/3117), respectively.

## DISCUSSION

EM low-value care literature is dominated by quantitative studies evaluating interventions to deimplement low-value care in high-income countries. There has been an exponential growth in studies exploring low-value care in EM practice in recent years. There has also been a gradual refocussing of the line of enquiry pursued by EM studies from interventions<sup>104 125 133 147</sup> to identification of barriers and enablers<sup>48 50 51 53</sup> over the past decade. This refocussing aligns with accumulating evidence regarding the persistence of low-value care in EM practice<sup>8 148</sup> and has been accompanied by a growth in EM studies informed by behavioural change theories.<sup>55 57 69</sup> The evidence regarding barriers, enablers and effectiveness of interventions is synthesised below.

### Barriers and enablers

Major themes of barriers and enablers were clinical capabilities, risk aversion, peer/senior practice (provider level), patient-provider interaction, expectations, trust (patient level), ED environment, culture, leadership, interdisciplinary interaction and change management (system level). Barriers and enablers identified by this scoping review share similarities with previous reviews of determinants of deimplementation of low-value care across multiple settings by Augustsson *et al*<sup>149</sup> and Leigh *et al*.<sup>150</sup>

Barriers to deimplementation were specifically associated with certain low-value care targets in some studies. Fear of litigation resulted in low-value cranial CT imaging in minor head injury<sup>60</sup> while patient/family expectations prevented appropriate antibiotic use in sinusitis and imaging for low back pain.<sup>66</sup> Perceived risk/benefit ratio was a barrier for antibiotic stewardship<sup>61</sup> whereas concern for serious diagnosis limited appropriate use of CTPA (Computed Tomography Pulmonary Angiography) for patients with normal D-dimer.<sup>66</sup> Inaccurate provider self-awareness/insight was reported by Michael *et al* as a barrier to opioid deprescription<sup>72</sup> while inertia was a barrier for antibiotic stewardship.<sup>57</sup> Inertia—failure to act despite awareness—was also noted as a barrier to deprescription of potentially inappropriate medication in primary care in a systematic review by Anderson *et al*.<sup>151</sup> However, specific association of barriers and low-value targets was not a consistent finding across studies. This inconsistency was illustrated by studies which enumerated limited provider knowledge/skills/experience,<sup>48 53 55 57</sup> habit,<sup>57 62 70</sup> diagnostic uncertainty,<sup>53 55 57 69</sup> conflict between guidelines and clinical judgement,<sup>52 68 69</sup> patient expectations<sup>48 52 68–70</sup> and time constraints<sup>48 53 55 68 70</sup> as barriers that straddled several types of low-value care. This variable association between low-value care targets and barriers/enablers suggests that endeavours to deimplement low-value care in EM settings may need to be tailored to barriers specific to the low-value care target of interest. Elucidation of such target-specific barriers could better inform design of barrier-specific interventions and enhance the likelihood of successful deimplementation. The need for elucidation of target-specific barriers is reinforced by a systematic review by Hiscock *et al* which reported that deimplementation interventions were more likely to be effective when they targeted individual imaging or pathology tests.<sup>20</sup>

Enablers of deimplementation can help overcome specific barriers. Provider education and training using flexible, user-friendly, evidence-based, clinical pathways<sup>52 69 71</sup> enhances provider ability to conduct thorough patient assessments.<sup>48</sup> Thorough and well-reasoned provider assessments could also foster patient trust in providers and influence patient decisions to avoid low-value care.<sup>48</sup> Patient education during assessment appears to set up realistic expectations for tests, reduces anxiety<sup>69</sup> and satisfies the desire for an explanation of symptoms.<sup>70</sup> The importance of patient involvement in deimplementation was reaffirmed in a scoping review which found shared decision-making and patient educational materials enhanced provider–patient interactions.<sup>152</sup> Provider tolerance of diagnostic uncertainty can be nurtured by deliberate clinical inertia, that is, reframing the act of doing nothing (ie, avoiding low-value care) as a positive clinical decision.<sup>25</sup> Provider insight into low-value care practice can be increased by timely, clear and concise feedback about test-ordering metrics.<sup>72</sup> The enabling effect of feedback in improving provider insight is reinforced by another systematic review of deprescription of potentially inappropriate medications in primary care among adult

patients.<sup>151</sup> Engaging providers in data-driven deimplementation<sup>15</sup> and framing deimplementation in terms of improving patient outcomes<sup>49</sup> can overcome provider reservations about reducing low-value care and strengthen provider resolve to change their practices. ED leaders can support deimplementation through role modelling practice change,<sup>68</sup> iterative messaging about the rationale for deimplementation and demonstrating organisational commitment.<sup>69 71</sup> Van Dulmen *et al* reiterate that change in provider behaviour is easier to achieve when supported by organisational leadership.<sup>11</sup> Barriers can thus be navigated by pragmatic use of enablers.

## Interventions

Effectiveness of interventions was similar across study sizes (smaller<sup>24 153–156</sup> vs larger<sup>106 135 138 157 158</sup>), locations (single-site<sup>73 159–162</sup> vs multisite<sup>85 124 163–165</sup>), quality (lower<sup>72 74 75 83 166</sup> vs higher<sup>127 128 139–141</sup>) and designs (uncontrolled<sup>79 104 105 107 133</sup> vs controlled<sup>86 125 126 167 168</sup>). Multifaceted interventions were more likely to be effective than single-faceted interventions. The findings from this review were reflected in a 2021 systematic review of interventions which reported comparable intervention effectiveness in controlled/uncontrolled studies and higher likelihood of success with multicomponent interventions.<sup>14</sup> However, the evidence for multifaceted interventions is conflicting, with some reviews reporting a higher likelihood of success<sup>11 13 169</sup> while others remaining inconclusive.<sup>170 171</sup>

Variable effectiveness of multifaceted interventions highlights potential challenges with deimplementation. Partial effectiveness in multisite studies<sup>89 121 122</sup> may be due to differences in situation-specific contextual and cultural factors that have been postulated as vital for successful deimplementation.<sup>11 13</sup> Inconsistent intervention effectiveness across imaging and treatment modalities<sup>102 119 120</sup> suggests that interventions may need to be tailored to the specific low-value test, treatment and procedure of interest. The ambiguity of the evidence for multifaceted interventions also suggests that conception, planning and implementation—also called fidelity<sup>172</sup>—of an intervention is likely to be more important than the number and types of facets. The importance of intervention fidelity to successful deimplementation has been validated by other reviews.<sup>14 170</sup>

Our findings on multicomponent interventions with clinical decision support, education and feedback being the most successful strategies are consistent with a 2015 systematic review of studies in multiple healthcare settings.<sup>19</sup> The characteristics of individual facets in the studies that effectively deimplemented low-value care in our review provide insight into intervention fidelity. Education was more likely to be effective when iterative,<sup>173</sup> one-on-one, targeted and delivered during a clinical shift.<sup>174</sup> Training is best considered a distinct facet during intervention design as effective interventions will need to enhance provider knowledge and skills in deimplementation.<sup>105</sup> Seamless workflow integration of nudge—influencing



clinician judgement/choice/behaviour by modifying social/physical environments without actively restricting options<sup>175 176</sup>—can enhance intervention acceptability to clinicians.<sup>177</sup> Clinical decision support and nudge have complementary features<sup>94 95</sup> which can be leveraged in resource-limited settings where electronic clinical decision support might not be an option and nudge might suffice. Feedback worked best when it was immediate,<sup>178</sup> specific,<sup>73</sup> detailed,<sup>179</sup> case-based,<sup>180 181</sup> individualised with peer group comparison<sup>159 182</sup> and accompanied by deep engagement with clinicians.<sup>136</sup> Engagement of multidisciplinary stakeholders in development of priorities, identification of barriers and design of interventions led to effective deimplementation.<sup>81 183 184</sup> Clinical champions—frontline clinicians who advocate for change—can be potent and versatile mediators of deimplementation by embracing and disseminating the deimplementation message<sup>137</sup> while simultaneously providing nudge, education and feedback.<sup>77 124</sup> Attention to the granular details of intervention facets could thus be critical in the design of high-fidelity interventions to effectively deimplement low-value care in EM practice as illustrated by studies<sup>124 128 129 132 144 159</sup> in this review.

The use of behavioural change theories was associated with a higher likelihood of intervention effectiveness in studies included in this scoping review. Although a causative link cannot be established, use of behavioural change theories in the design of complex health interventions is recommended by UK Medical Research Council.<sup>185</sup> The TDF was successfully deployed by several studies<sup>55 68 86 124</sup> in this review to achieve effective deimplementation of low-value care.

### Limitations

This scoping review has limitations. The search strategy was comprehensive but could have missed eligible articles. This is unlikely to have altered the findings of the review due to the large number of included studies spanning study designs and sample sizes. The possibility of publication bias cannot be excluded as the majority of intervention studies were reported as successful. The majority of intervention studies employed a non-randomised study design which is a source of bias due to potential confounding. The consistency of results between randomised and non-randomised studies minimises this bias. The findings of this review may not apply to low and middle income countries due to the small number of included studies from these settings. However, the mapping of barriers, enablers and interventions to the TDF could provide a framework for behavioural change interventions in such settings.

### Implications for practice

To our knowledge, this compilation of deimplementation interventions, barriers and enablers in emergency care is the first one of its kind to date. The variety of interventions, target practices, target conditions and components presented here can be used as reference for

future design and evaluation of effective deimplementation interventions in the ED setting. The more credible evidence derived from randomised controlled trials and high-quality non-randomised studies, and the nuances uncovered in the qualitative studies further enhance the utility of this scoping review. Acknowledging that both the causes and solutions of low-value care practice are associated with system, providers and patients, any future deimplementation intervention should ideally involve consumer and clinician codesign, be implemented by multidisciplinary teams, be supported by organisational leadership and obtain dedicated funding.

### Evidence gaps and future research

This scoping review confirms the worldwide recognition of the low-value care problem, growing interest in finding solutions, and the feasibility of introducing remedial actions. It also reveals gaps in literature exploring deimplementation of low-value care in EM practice. Qualitative and mixed-methods approaches were uncommon, emphasising the need for such studies to better understand, in greater depth, the complexities and challenges of deimplementation of low-value care in EDs. Use of behavioural change theories was infrequent but resulted in promising outcomes. This highlights the need for theory-informed studies which can successfully deimplement low-value care. Additional areas for research not covered in this review could include cost implications of low-value care in EDs and the cost savings of systemic deimplementation practices.

### CONCLUSION

High-fidelity, multiple facets, daily administration and incorporation of stakeholder engagement, education, audit/feedback and clinical decision support were features of interventions that most effectively deimplemented low-value care in EM practice. Success requires navigation of provider, patient and system-level barriers. Interventions that are grounded in behavioural change theories can enhance the likelihood of successful deimplementation. This scoping review has mapped the EM low-value care literature about barriers, enablers and interventions to the domains of the TDF. This mapping is anticipated to inform the design of interventions targeted to specific behavioural domains of EM providers to enable effective deimplementation of low-value care. There is a need for methodologically rigorous, theory-informed studies of barriers, enablers and interventions to encourage and support deimplementation of low-value care in EM practice.

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