


# BMJ Open Knowledge translation in Anglo-American paramedicine: a scoping review

Ashley Hanson ,<sup>1,2</sup> Christopher Burton<sup>1</sup>

**To cite:** Hanson A, Burton C. Knowledge translation in Anglo-American paramedicine: a scoping review. *BMJ Open* 2025;**15**:e087836. doi:10.1136/bmjopen-2024-087836

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<https://doi.org/10.1136/bmjopen-2024-087836>).

Received 21 May 2024

Accepted 01 November 2024



© Author(s) (or their employer(s)) 2025. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

<sup>1</sup>Canterbury Christ Church University, Canterbury, UK

<sup>2</sup>North Devon District Hospital, Barnstaple, UK

## Correspondence to

Ashley Hanson;  
ah974@canterbury.ac.uk

## ABSTRACT

**Objective** To map what is currently known about knowledge translation (KT) in Anglo-American paramedicine. The review focuses on reported barriers and facilitators to the implementation of new knowledge, and the use of models, theories and frameworks to guide implementation practice.

**Design** Scoping review reported as per both the Joanna Briggs Institute and Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews reporting guidelines.

**Data sources** CINAHL (EBSCO Host) and Medline (OVID interface) were searched from January 2000 to May 2023. Reference lists of all included papers were reviewed, and several key professional journals were hand-searched.

**Eligibility criteria for selecting studies** Primary sources that focused on KT models, theories or frameworks, or barriers and facilitators to KT implementation, involving paramedics or Emergency Medical Technicians (Paramedic in America) working in an out-of-hospital, Anglo-American Emergency Medical Service (EMS) system were eligible for inclusion.

**Data extraction and synthesis** One reviewer used a data extraction template developed for this review and 10% of the papers were checked by the second author. Findings were summarised in tables and synthesised both quantitatively and qualitatively.

**Results** The search yielded 1268 primary sources, of which 48 were included in the review. Thirty-two papers examining KT interventions and 16 papers examining the barriers and facilitators to KT were found. Only one randomised controlled trial was found, and only one paper made explicit use of any KT framework. Overall, eight themes describing barriers and facilitators to KT arose from the qualitative literature, with clinicians' perception of the evidence being the dominant theme. All 32 papers describing KT interventions included some form of educational intervention.

**Conclusions** Overall, there is little depth and breadth in the literature, with many papers focusing on trauma and airway management. There are large gaps in the evidence surrounding the use of KT theories and frameworks in Anglo-American EMS. Further research is needed to identify appropriate KT models and frameworks that are contextualised to EMS to ensure that paramedic-led research finds its way to the clinicians needing to use it.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This review used a best-practice approach to scoping review methodology, following the guidance from the Joanna Briggs Institute and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews.
- ⇒ Papers from all Anglo-American Emergency Medical Service systems were gathered to reduce geographical bias.
- ⇒ The lack of inclusion of non-English papers may have excluded some relevant research (eg, from Canada).
- ⇒ Only one randomised controlled trial and one paper using explicit knowledge translation theory were found.

## BACKGROUND

It is well documented that much of the evidence generated in healthcare is not effectively used in practice (known as the 'know-do' gap).<sup>1</sup> Knowledge translation (KT) aims to reduce this *research waste* through the development and implementation of strategies to move knowledge into practice. While many definitions exist for KT,<sup>2</sup> the WHO modified the original Canadian Institute of Health Research KT definition<sup>3</sup> to read:

Knowledge translation is defined as the synthesis, exchange, and application of knowledge by relevant stakeholders to accelerate the benefit of global and local innovation in strengthening health systems and improving health systems and improving people's health.<sup>4</sup>

Paramedicine has historically been considered to have two main operating models: the physician-led *stay and play* Franco-German and the paramedic-led *load and go* Anglo-American model.<sup>5</sup> The primary difference in the Anglo-American model is the increased autonomy afforded to paramedics—a model mainly found in the United Kingdom (UK), Ireland, North America, Canada, South Africa, Australia, New Zealand and much



of the Middle East.<sup>6</sup> More recently, the addition of the prehospital emergency medicine curriculum as a subspecialty in medicine has resulted in a greater number of physician-led prehospital vehicles in the UK,<sup>7</sup> blurring these geographical distinctions within the 'load and go' model. The Anglo-American model has been recently subdivided to recognise the organisational differences between the *directive* systems found in North America and Canada, and the *professionally autonomous* systems of the UK, Australia and New Zealand.<sup>8</sup> This is a recent piece of work and is not reflected currently in the wider body of literature.

Despite advances in the literature with regard to KT in healthcare, KT in Anglo-American paramedicine is relatively underdeveloped. Recommendations were made as early as 2007<sup>9 10</sup> to establish an Emergency Medical Service (EMS)-specific evidence and translation base but few projects currently exist.<sup>11</sup> Within the UK, the Joint Royal Colleges Ambulance Liaison Committee Clinical Guidelines exist as a nationalised set of guidelines to disseminate evidence,<sup>12</sup> but this is not seen across other countries with similar operating models. Several authors have called for a move away from Emergency Medicine evidence being disseminated into paramedicine<sup>10 13</sup> but this has yet to manifest itself in paramedic-specific KT models, theories and frameworks.

In many countries with an Anglo-American EMS system, paramedics are considered Allied Health Professionals (AHPs).<sup>14–18</sup> Despite this, the two KT models recently developed for allied health did not include paramedicine in either the development or testing of the model. Translating Allied Health Knowledge (TAHK), developed in Victoria, Australia,<sup>19</sup> included many registered AHPs, but not paramedics. Allied Health Translating Research into Practice,<sup>20</sup> from Queensland, Australia, was primarily developed and tested with occupational therapists. It is acknowledged that context is important in the success of KT<sup>19 21 22</sup> and the lack of paramedic input to the models, combined with the differences between paramedicine and other AHPs,<sup>23</sup> results in models that may not be suitable for EMS KT.

Medline, the Cumulative Index of Nursing and Allied Health Literature (CINAHL), Google Scholar and Proscuro were searched for existing reviews and evidence syntheses on KT and many were found for nurses, physicians and other AHPs.<sup>24–29</sup> Where AHPs or combined healthcare reviews were found, EMS data were notably missing, highlighting a void in profession-specific literature. A scoping review is the most appropriate next step as there is little known about paramedic KT, and few articles have been written discussing it. A scoping review is also more appropriate as there is unlikely to be a large body of high-quality literature on an underdeveloped subject.<sup>30</sup>

## Review questions

The overarching objective of this scoping review is to describe and map what is currently known about

paramedic KT in Anglo-American EMS. As such, the aims of this review are to:

1. Determine the extent of current KT strategies and interventions implemented in Anglo-American EMS.
2. Describe the KT models, theories and frameworks used to guide implementation in Anglo-American EMS.
3. Map the factors that impact the success of KT effects in Anglo-American EMS.

## Inclusion criteria

### Participants

This review considered studies of KT that included paramedics and Emergency Medical Technicians Paramedics (EMT-Ps, including but not limited to Intensive Care Paramedics, Mobile Intensive Care Paramedics, Helicopter EMS Paramedics and Critical Care Paramedics) working in an out-of-hospital response system. Where studies included other healthcare staff or professionals (eg, ambulance nurses, prehospital doctors, EMTs or Ambulance Technicians), they were considered only if paramedic-specific data could be isolated.

### Concept

This review considered studies that explored KT models, theories and frameworks, and studies that identified barriers and facilitators to KT. KT interventions considered included, but were not limited to, training, seminars, workshops, educational materials, champions, pamphlets and visual aids<sup>24</sup> that were designed to embed new or evidence-based paramedicine practices.

### Context

This review considered studies where the paramedic/EMT-P was working in an out-of-hospital service in countries with an Anglo-American EMS model as defined by Makrides *et al.*<sup>31</sup> This includes the UK, Ireland, Canada, North America, Australia, New Zealand, much of the Middle East and South Africa. Within paramedic EMS, there are two systems: the physician-led Franco-German services and the paramedic-led Anglo-American system. The autonomy afforded to paramedics operating in the Anglo-American system results in paramedic-driven research and paramedic-led interventions.<sup>32</sup> Both the *directive* and *professionally autonomous* models of the Anglo-American EMS were considered appropriate for this review.

### Types of sources

Primary studies that have been peer-reviewed, including but not limited to experimental, quasiexperimental and nonexperimental designs, were eligible for inclusion. Studies published before 2000 were excluded. This represents the point of professional registration for UK paramedics<sup>33</sup> and the increase in the move from vocational educational training (also known as in-house training) to degree level education in both the UK<sup>34</sup> and Australasia.<sup>35</sup>

## METHODS

This scoping review was conducted in accordance with the JBI methodology for scoping reviews<sup>36</sup> and in line with the PRISMA-ScR.<sup>37</sup> A completed PRISMA-ScR checklist is included in online supplemental file.

### Search strategy

Medline (OVID interface) and CINAHL (EBSCO Host) were searched from inception to May 2023 using the search string shown in online supplemental file. This was derived from a published search strategy looking at KT effectiveness in AHPs in Canada.<sup>24</sup> As no MeSH heading currently exists for *paramedic*, the sensitive search string for paramedic developed by Olausen *et al*<sup>38</sup> was used in place of Scott's AHP search string. As a hand-search has been shown to be 92–100% effective in identifying all sources compared with 80% for a Cochrane Highly Sensitive Search Strategy,<sup>39</sup> the following key journals were hand-searched from 2000 to the present:

- ▶ *Journal of Paramedic Practice*
- ▶ *British Paramedic Journal*
- ▶ *Australasian Journal of Paramedicine* (formally known as *Journal of Emergency Primary Healthcare*)
- ▶ *International Paramedic Practice*
- ▶ *Irish Journal of Paramedicine*
- ▶ *BMC Emergency Medicine*

Reference lists of all included sources were also scanned for additional articles. Owing to limitations associated with translator access, studies were excluded if not published in English.

### Study/source of evidence selection

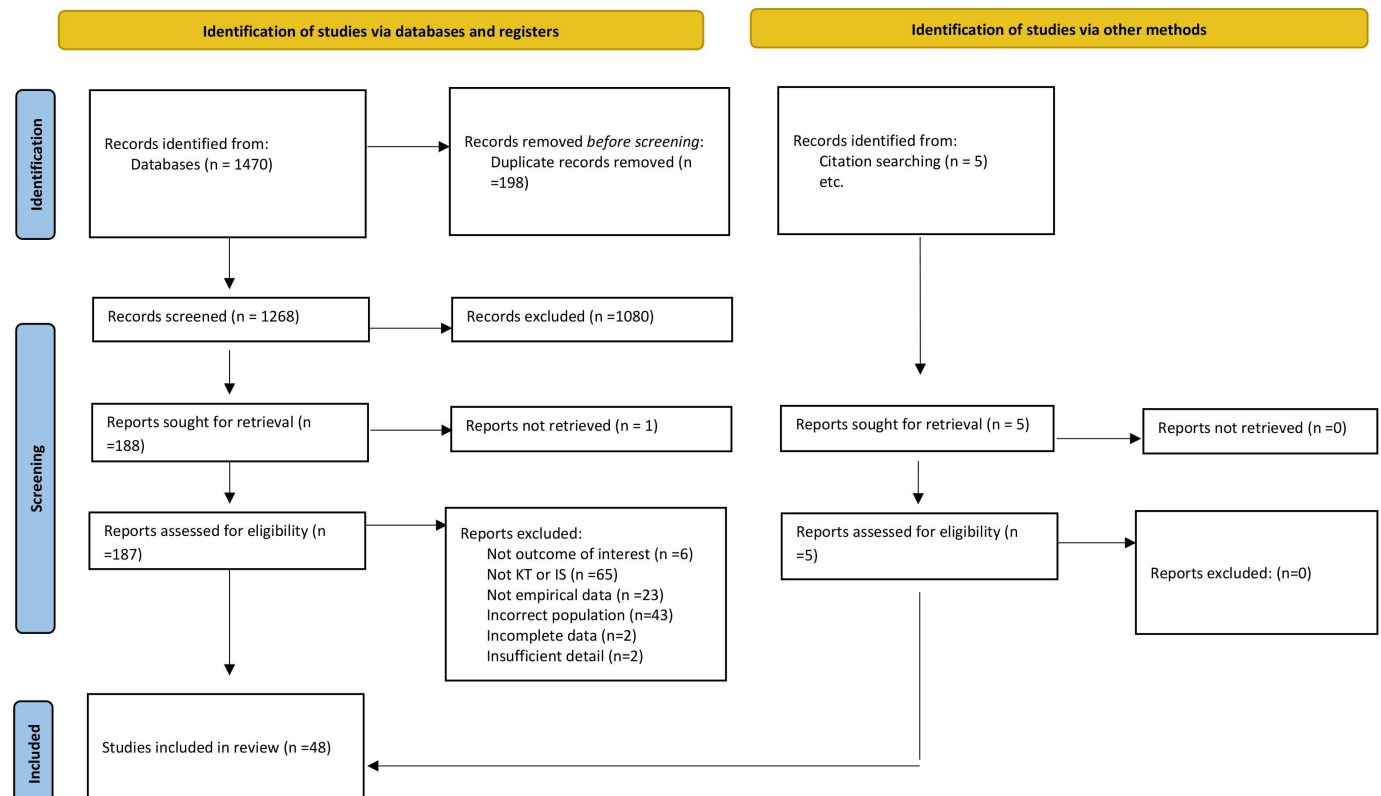
Following the search, all identified records were collated and uploaded to Mendeley (Elsevier, 2023), and duplicates were removed. Titles and abstracts were screened against the review criteria by one author (AH), and a 10% 'sense-check' was conducted by the second author (CB). Potentially relevant papers were retrieved in full. Full-text studies that did not meet the inclusion criteria were excluded, and the reasons for their exclusion are detailed in figure 1.

### Data extraction

To limit subjective bias associated with multiple authors undertaking the process, data were extracted by a single author (AH), with the use of a data extraction tool developed by both authors. Data extracted included specifics about literature characteristics (type of source, year of publication, authors, areas of interest, country of origin and sample size/type), barriers and facilitators to KT, and the type and categorisation of the KT intervention. Following initial data extraction, 10% of the work was checked by the second author (CB).

### Data analysis and presentation

The process for article selection is presented as a flow chart as per the recommendations of the PRISMA Consort consensus statement for scoping review reporting.<sup>37</sup> Characteristics of the included papers are presented both narratively and as descriptive statistics (frequency and percentage) in graphs and charts. Implementation



**Figure 1** Search results and study selection and inclusion process.<sup>36</sup>



interventions are classified using the Effective Practice and Organisation of Care (EPOC) Taxonomy of Health Interventions.<sup>40</sup> Braun and Clarke's reflexive, six-stage, thematic analysis approach<sup>41</sup> was used to analyse the barriers and facilitators to KT.

### Public and patient involvement

No patients were involved in the design or conduct of this scoping review.

## RESULTS

### Study inclusion

Following the application of date and language filters, the database interrogation yielded 1470 potential articles for inclusion in the scoping review. After deduplication, this left 1268 articles to screen. Following an initial screening of titles and abstracts, 1080 articles were removed, leaving 188 articles for full-text reading. Five additional articles were identified from a hand-search of key journals. Following full-text reading, 149 were excluded, resulting in 43 articles from online databases and all five from the hand-search for inclusion in the scoping review (see figure 1).

The characteristics of the included studies are presented in table 1. Of the 48 included articles, two-thirds were North American in origin, with the remaining papers originating from the UK (n=5), Canada (n=4), South Africa (n=2), multinational (n=1) and one each from Australia, New Zealand and Norway. Two-thirds of articles used a quantitative methodology to explore specific KT interventions, and of those 85% were North American or Canadian in origin.

Just over one-third (n=17) of the articles looked at the implementation of guidelines or protocols that would contribute to the reporting of the Ambulance Clinical Outcome (AmbCo) national dataset in the UK.<sup>42</sup> Just over one-quarter of the articles (n=13) looked at topics related to airway management and trauma, and the remaining 18 articles looked at analgesia (n=4), geriatric education (n=2), general treat-and-refer guidelines (n=2), autonomic dysfunction (n=1), standing field treatment protocols (n=1), hospital handovers (n=1) and palliative care provision (n=1).

The methodological characteristics of the included studies are presented in table 2. Of the 16 studies using a qualitative methodology, approximately two-thirds originated from either the UK or the USA with the remaining five papers coming from Canada, Australia and South Africa. Of the 32 quantitative papers, 80% used a prospective design and 75% of all quantitative papers were of a before-and-after design. There was only one randomised controlled trial (RCT) among the 32 papers identified, highlighting the paucity of high-quality evidence of the effectiveness of KT interventions in paramedicine.

Half of the qualitative papers used a focus-group methodology, with the remaining papers using surveys, written

**Table 1** Characteristics of included studies

Characteristics	Number (n=48)	Percentage (%)
Publication year		
2000–2005	6	12.5
2005–2010	16	33.3
2010–2015	11	22.9
2015–November 2022	15	31.3
Country of origin		
USA	31	64.5
UK	6	12.5
Canada	4	8.3
Multinational	2	4.2
South Africa	2	4.2
Australia	1	2.1
New Zealand	1	2.1
Norway	1	2.1
Topic under examination		
OHCA	9	18.8
STEMI	6	12.5
RSI	6	12.5
C-spine immobilisation	5	10.4
Analgesia	4	8.2
COPD/asthma	3	6.2
General guidelines	3	6.2
Geriatric education	2	4.2
Treat and refer	2	4.2
TBI	2	4.2
Stroke care	1	2.1
Autonomic dysfunction	1	2.1
Sepsis	1	2.1
Handovers	1	2.1
SFTP	1	2.1
Palliative care	1	2.1

COPD, Chronic Obstructive Pulmonary Disease ; OHCA, Out-of-Hospital Cardiac Arrest; RSI, Rapid Sequence Induction; SFTP, Standing Field Treatment Protocol; STEMI, ST-Elevation Myocardial Infarction; TBI, Traumatic Brain Injury.

statements, interrupted time series, interviews, and mixed-methods observational and deliberative dialogues.

### Interventions by EPOC classification

The interventions used in the 32 quantitative papers were stratified by EPOC taxonomy.<sup>43</sup> While there is currently no specific taxonomy for the classification of KT or implementation interventions, and EPOC is more commonly used in systematic reviews of effectiveness,<sup>44</sup> it was considered appropriate to classify the intervention types identified in this scoping review as it has been used in previous reviews of KT interventions in AHPs.<sup>24</sup>

**Table 2** Methodology of included studies

Methodology	Number (n=48)	Percentage (%)
Prospective		
Before and after	21	43.7
Consecutive case series	1	2.1
Pilot training programme (unspecified)	1	2.1
Audit (unspecified)	1	2.1
Randomised controlled trial	1	2.1
Questionnaire	1	2.1
Retrospective		
Before and after	4	8.3
Cohort analysis	1	2.1
Case series	1	2.1
Qualitative		
Focus groups	8	16.6
Survey	3	6.2
Written statements	1	2.1
Interrupted time series	1	2.1
Interviews	1	2.1
Mixed methods observational	1	2.1
Deliberative dialogues	1	2.1

All 32 papers reported some use of professional interventions (see online supplemental file 2), with just over two-thirds (n=20) using multiple professional interventions. The use of financial, organisational and structural interventions was never in isolation, with one-third of papers using a mix of professional and organisational, professional and financial, and professional and structural intervention.

### Factors' impact on the success of KT interventions

Eight themes arose from the 16 papers looking at barriers and facilitators to KT in Anglo-American EMS (see online supplemental file 3). Half of the themes were examined in 50% or more of papers: clinicians' perception of the evidence (n=16), training and education (n=9), equipment and costs (n=8) and multidisciplinary team working (n=8). The remaining four themes were explored in approximately one-third of the papers or fewer.

#### Clinicians' perception of the evidence

Focus groups with paramedics examining the barriers to the implementation of the UK treat-and-refer guidelines concluded that *buy in* from staff was key to the success of any intervention.<sup>45</sup> This sentiment was echoed in works by Jones Rhodes *et al*<sup>46</sup> and Sasson *et al*.<sup>47</sup> The effect was more often seen in the implementation of *controversial* guidelines.<sup>48</sup> In contrast, Carter *et al*<sup>49</sup> found that 70% of paramedics were on board with the intervention investigated as they perceived that it reflected best practice.

#### Training and education

Across authors of nine papers, there was no consensus as to which educational intervention (if any) was best to implement change with Biggam *et al*,<sup>50</sup> concluding that a *cycle of training* was optimal. Most authors<sup>46 51–55</sup> agreed that a single method of educational delivery was ineffective for driving change, with the size of the guidelines book,<sup>55</sup> lack of simulation<sup>53</sup> and the didactic nature of ambulance training<sup>53</sup> cited as some of the largest barriers. Conversely, Haskell *et al*<sup>56</sup> posited that many paramedics found it sufficient to be presented with the guidelines and required no additional training when looking at the implementation of a new paediatric advanced life support guidelines. Jensen *et al*<sup>57</sup> concluded that for evidence to be successfully implemented moving forwards, there needed to be education around research literacy in undergraduate paramedic degrees.

#### Equipment and costs

When looking to purchase or upgrade equipment to enable adherence to new protocols or guidelines, several American authors<sup>46 48 56 58</sup> found that the financial burden slowed the rate of implementation, with the cost burden having a more profound effect on public EMS systems.<sup>58</sup> Similarly, in the UK, costs for updating databases<sup>49</sup> and an increase in the volume of equipment that would need to be carried into the 'job'<sup>52</sup> limited the full uptake of new evidence-based guidelines.

#### Multidisciplinary team working

Working relationships within multidisciplinary teams demonstrated the ability to either enhance or hamper KT success. Where working relationships were less well defined between medical directors, paramedics and undertakers, the new termination of resuscitation guidelines could not be appropriately adhered to in the community.<sup>51</sup> Snooks *et al*<sup>45</sup> found that a lack of sustained working relationships precluded safe discharge on the scene with a new treat-and-refer guidelines, and one-quarter of authors reported conflicts occurring between emergency department physicians and paramedics hindering guidelines implementation.<sup>46 53 59 60</sup> Good communication between departments<sup>60</sup> and the *breaking down of silos*<sup>49</sup> was found to positively influence KT interventions.

#### 'One size fits no one'

Just over one-third of papers looked at KT interventions designed to span either healthcare or geographical boundaries. Complications were acknowledged by EMS leaders and stakeholders interviewed by Frenzl *et al*<sup>58</sup> and Sasson *et al*<sup>47</sup> when looking at STEMI and ToR pathways, respectively. Many of these complications were attributed to regional healthcare and legal differences. Snooks *et al*<sup>45</sup> found this to be most profound in guidelines underpinning *grey areas of decision-making*, a feeling echoed in Carter *et al*'s<sup>49</sup> protocol for palliative care in the community. However, when looking at national guidelines implementation in South Africa, McCaul *et al*<sup>48</sup> noted that



paramedics preferred a single national policy, as it was felt to *draw systems together*.

### Management attitudes and communication

Just under one-third of papers (n=5) looked at the impact of managers' attitudes and the influence of communication choices on the implementation of new knowledge. Bigham *et al*<sup>50</sup> found that how changes were communicated and influenced staff adherence to new evidence and this was supported by Carter *et al*<sup>49</sup> who cited that informal interorganisational communication needed to focus on *teamness* to empower paramedics to follow the palliative care guidance and make difficult decisions. Additionally, many paramedics felt that autocratic systems *bulldozed* ideas that were expected to be followed<sup>48</sup> and that *being left out of the loop* in the early stages of adoption resulted in staff being less likely to follow new evidence.<sup>55</sup>

### Local champions

Although only explored in 25% of papers (n=4), all four authors agreed that local champions could increase the adoption of new knowledge and were beneficial to KT strategies.<sup>48-50 54</sup> When examining their impact on the implementation of a new pain management guidelines, Adelgais *et al*<sup>54</sup> found that many champions were academics and students who drove the project forwards while they were seconded to the EMS unit. However, once the champion left, implementation faltered and sometimes failed. McCaul *et al*<sup>48</sup> suggested that champions are most effective when they are *industry respected personnel*, who already command the respect of paramedics working with the intervention, a feeling echoed by paramedics interviewed by Carter *et al*<sup>49</sup> who felt that promotion by *30year veteran[s]* would enable the intervention to become *part of culture*. Interviews undertaken by Bigham *et al*<sup>50</sup> concluded that *opinion leaders sharing success stories* (champions) were key to the success of the implementation of the 2005 AHA guidelines.

### Patient and public expectations/culture

A total of 25% (n=4) of the papers explored the impact of public and patient expectations on the success of KT interventions.<sup>45 47 49 60</sup> All papers found that patients could influence clinician decision-making and subsequent adherence to best practice guidelines, directly influencing the success of implementation. Sasson *et al*<sup>47</sup> noted that public expectations of response/conveyance decisions do not consider the differences in rural and urban EMS services, where the distance to definitive care can vastly vary. When attending to patients in cardiac arrest, this difference in understanding results in paramedics *shying away* from terminating resuscitation on the scene, electing instead to convey the decedent to the hospital.<sup>47</sup> Carter *et al*<sup>49</sup> suggested that for palliative care guidelines to be successfully implemented, it is important to understand the anxieties of patients and ensure transparency in explaining what could and could not be delivered by paramedics involved in the intervention.

Paramedics interviewed by both Snooks *et al*<sup>45</sup> and Shaw and Siriwardena<sup>60</sup> commented on the tendency of British public expectations to favour a conveyance model of prehospital care, whereby calling 999 results in a transfer to the hospital. For the implementation of new treat-and-refer protocols, Snooks *et al*<sup>45</sup> found that conflict arose when paramedics adopted the protocol and made a community referral. When examining the success of the implementation of asthma management guidelines, Shaw and Siriwardena<sup>60</sup> found that patients' lack of knowledge surrounding their health condition, combined with a lack of understanding regarding alternative care pathways, resulted in conflict and unmet expectations if paramedics adopted the guidelines.

## DISCUSSION

This scoping review represents the first such undertaken, which maps what is known about KT in Anglo-American EMS systems and paramedicine. Much of the work (approximately 75%) has been conducted within the more 'directive' EMS systems found in Canada and the USA. As these systems use the medical directorate to assist decision-making, resulted in reduced paramedic autonomy,<sup>61</sup> it is likely that some of the contextual issues related to 'management attitudes' and 'clinical perception of the evidence' would be less relevant in the paramedic-led services that dominate the UK and Australia/New Zealand. The volume of publications has doubled between 2005 and 2010 but plateaued over the last decade. Most notably, there is a void in the literature exploring theory-informed KT interventions<sup>49</sup> and RCTs.<sup>62</sup> Most of the studies explore implementation strategies for either guidelines or protocols, and the dominant focus is on the use of professional interventions in the form of educational meetings (63%).

Professional interventions, such as educational meetings, distribution of educational materials, audit/feedback and reminders, are the only recognised methods in healthcare to achieve change,<sup>63 64</sup> but they dominate the current body of literature. Where multifaceted interventions have been trialled in the 32 identified qualitative papers, educational interventions always feature. Where single interventions have been trialled, these too are always educational.<sup>65-69</sup> This is common across other identified systematic reviews of KT in AHPs<sup>24 28 70</sup> and nursing.<sup>71 72</sup>

Despite the over-reliance on educational interventions as a means to drive change, Sasson *et al*,<sup>51</sup> Murphy *et al*,<sup>53</sup> Siriwardena *et al*,<sup>52</sup> Jones Rhodes *et al*,<sup>46</sup> Adelgais *et al*<sup>54</sup> and McCaul *et al*<sup>55</sup> all posited that a single educational intervention alone is ineffective in facilitating change. This finding is similarly echoed in Scott *et al*'s<sup>24</sup> review of KT interventions in therapy AHPs, although the authors believe that education *may represent a necessary ingredient as a first step in the process of change*. Furthermore, a recently updated Cochrane review<sup>27</sup> of 215 papers examining the effectiveness of KT interventions across healthcare found

that education alone was ineffective in driving change (although it was found to be slightly more effective than no intervention at all). Caution in translation to paramedicine should be applied however, as no EMS studies were included in the review, serving to further highlight the paucity of evidence on this subject.

The lack of theory-informed KT interventions pervades healthcare literature for many professions.<sup>25 26</sup> In a review of KT interventions in midwifery, Dadich *et al*<sup>25</sup> found that theory-informed studies made up only 14 of the 158 papers reviewed (4%). Furthermore, when theory was used to inform the intervention in these 14 papers, it had a limited reach and did not permeate the design stage of the study. However, where the Consolidated Framework for Implementation Research (CFIR) was used in an EMS implementation study,<sup>49</sup> the authors found that the use of theory enhanced their ability to envisage the scale-up and spread of their palliative care programme.

Of the 35 extant implementation theories identified in a widely cited work by Nilsen,<sup>73</sup> none were developed with an AHP focus. The lack of contextually specific AHP KT theories has limited theory-driven implementation practice and research in EMS. Several authors cite that contextual factors are important facilitators in the success of KT interventions within paramedicine, including the clinician's perception of the evidence,<sup>45–60</sup> management attitudes,<sup>48–50 54 55</sup> and patient and public expectations and culture.<sup>45 47 60</sup> This is further supported by Squires *et al*<sup>74</sup> who posited that KT theory should be contextually appropriate, and Wensing and Grof<sup>75</sup> who identified the need for a KT intervention to be *fit for purpose*. These findings were precursors to the fledgling TAHK<sup>19</sup>, a KT theory designed specifically for the translation of allied health knowledge, including paramedicine.

In comparison with other medical professions, Anglo-American paramedicine is still evolving its own identity,<sup>76</sup> especially in the research domain. This is reflected in the narrow scope of topics examined across the papers found (17 papers looking at AmbCo outcomes and 13 papers looking at trauma guidelines/protocols). Similar findings can be seen in a recent review of paramedic research by Cavanagh *et al*,<sup>77</sup> where 10 topics make up to three-fourths of all citations identified (including resuscitation, airway management, trauma care and myocardial infarction). The profession is maturing, resulting in many paramedics delivering more complex interventions and undertaking more complex interventions as part of their role,<sup>34</sup> which will necessitate content-specific research.<sup>78</sup> The contextually lacking *one size fits all* guidelines that have often been derived from physician-led research in emergency medicine<sup>12</sup> are found to be a barrier to implementation in paramedicine,<sup>45 47–49 51 58</sup> reflecting the need for theory-driven, contextually appropriate, multifaceted interventions, a finding that is not limited to the paramedic literature.<sup>79 80</sup>

The latest iteration of the Medical Research Council framework for developing and evaluating complex interventions<sup>81</sup> emphasises the importance of context in

complex interventions. This highlights the significance of the observed barriers to KT in paramedicine with regard to alignment with patient expectations, costs, equipment, MDT working, and management attitudes and communication. Until now, these contextual factors have not been examined in any depth in the paramedicine literature, precluding evidence-based work to tailor KT interventions to specific barriers and enablers.

As with any scoping review, this review also has its limitations. One reviewer screened the studies and extracted the data (with a 10% check from a second reviewer). Ideally, this would have been undertaken by two reviewers and disputes resolved by a third person. With additional resources, it would have been possible to include papers in languages other than English, especially as this may have excluded some relevant Canadian papers. However, as the majority of the Anglo-American EMS systems exist in English-speaking countries,<sup>5</sup> this is unlikely to have affected the results significantly. It is plausible that restricting the papers by country of origin may similarly have excluded some relevant resources; however, it is believed that this effect is also likely to be minimal. Only two databases were used to run the searches, but it was felt to be appropriate to limit the search to Medline and CINAHL, as CINAHL is specific and specialised to AHP research,<sup>82</sup> and a combination of Medline and other databases achieves a high level of accuracy in systematic reviews.<sup>83</sup> However, caution should be applied as there are known difficulties with searching for KT literature in CINAHL.<sup>84</sup> Furthermore, owing to the limited number of hand journals searched (n=6), there is a possibility that smaller, more local KT studies may have been missed. This review only focused on the application of KT at a 'role-based' level in paramedicine and, as such, papers that looked at system-based literature would have been excluded from the search criteria but may have yielded relevant results. Similarly, specific definitions and criteria used to run the searches could affect the nature of the results, and there is a risk that some papers could have been missed.

## Conclusions

Despite two decades of literature around KT in medicine, nursing and allied health, KT in paramedicine remains novel and relatively underdeveloped. There is a lack of depth and breadth in the available literature, evidenced by the narrow range of topics investigated, the scarcity of RCTs and the single use of a KT framework. In this isolated paper that made use of a framework (the CFIR), it has not yet been contextualised to paramedicine. As with much of the identified KT literature in health, there is a dominant focus on educational interventions as the biggest driver for change. This is despite there being evidence of education being previously shown to be ineffective in isolation, a finding mirrored in the paramedic literature identified for this review.

Alongside several important meso-level factors that affect implementation and KT success, including MDT



working and management support, lack of context and lack of buy-in from clinicians on the road were identified as the most common factors that inhibited the success of KT, highlighting the importance of this subject area as new research will find its way to patients if the clinicians delivering the care do not believe that it represents the patient's best interests. The importance of this is further exemplified by the lack of evidence originating from the professionally autonomous Anglo-American EMS systems of the UK, Australia and New Zealand, whereby much of the 'day-to-day' clinical decision-making originates from paramedics 'in the field', without the direct oversight or SFTP from medical advisors found in the more directive systems of Canada and the USA.

### Implications for research

Further research should focus on the contextualisation of existing KT theories, models and frameworks to paramedic practice to ensure that profession-specific knowledge is delivered to clinicians, which ultimately finds its way to patients. As clinicians' perception and public and patient impression of the health service appear to affect the success of KT, future projects should focus on the views and impressions of clinicians and patients to develop a paramedic-specific model of KT. As the main body of the current research has been conducted in systems where paramedic decision-making is often assisted by physicians, further translation research on the paramedic-led systems found in Australia and the UK would provide greater contextual knowledge around decision-making and professional empowerment.

X Ashley Hanson @AshHanson8

**Contributors** AH is the study guarantor and conceived the study, developed the search strategy, extracted and interpreted the data, and drafted and revised the manuscript. CB contributed towards the design of the study and critically reviewed and revised the draft manuscript.

**Funding** The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not applicable.

**Ethics approval** Not applicable.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data sharing not applicable as no datasets generated and/or analysed for this study.

**Supplemental material** This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is

properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

### ORCID iD

Ashley Hanson <http://orcid.org/0000-0001-7015-226X>

### REFERENCES

- Leggat FJ, Wadey R, Day MC, *et al*. Bridging the Know-Do Gap Using Integrated Knowledge Translation and Qualitative Inquiry: A Narrative Review. *Qual Res Sport Exerc Health* 2023;15:188–201.
- Straus SE, Tetroe J, Graham I. Defining knowledge translation. *CMAJ* 2009;181:165–8.
- Research CI of H. Knowledge Translation - Definition. Priority Areas - Knowledge Mobilization, 2016. Available: <https://cihr-irsc.gc.ca/e/29418.html#2>
- Pan American Health Organization. Evidence and Intelligence for Action in Health, Available: <https://www.paho.org/en/evidence-and-intelligence-action-health/knowledge-translation-and-evidence#:~:text=Knowledge>
- Dick WF. Anglo-American vs. Franco-German emergency medical services system. *Prehosp Disaster Med* 2003;18:29–35.
- Makrides T, Ross L, Gosling C, *et al*. From stretcher bearer to practitioner: A brief narrative review of the history of the Anglo-American paramedic system. *Australas Emerg Care* 2022;25:347–53.
- Mackenzie R. Brief history of Pre-Hospital Emergency Medicine. *Emerg Med J* 2018;35:146–8.
- Makrides T, Ross L, Gosling C, *et al*. Exploring the structure and characteristics of the Anglo-American paramedic system in developed countries: a scoping review. *IJES* 2022;11:248–62.
- Cone DC. Knowledge translation in the emergency medical services: a research agenda for advancing prehospital care. *Acad Emerg Med* 2007;14:1052–7.
- Wood K. Into Paramedic Practice: Current Trends and Influences. *J Paramed Pract* 2009;4.
- Jensen JL, Petrie DA, Travers AH, *et al*. The Canadian prehospital evidence-based protocols project: knowledge translation in emergency medical services care. *Acad Emerg Med* 2009;16:668–73.
- Lovegrove Obe M, Davis J. The Peep Report. 2013;1–85. Available: <https://www.collegeofparamedics.co.uk/downloads/PEEP-Report.pdf>
- Bigham B, Welsford M. Applying Hospital Evidence to Paramedicine: Issues of Indirectness, Validity and Knowledge Translation. *CJEM* 2015;17:281–5.
- Narayan K, Kar S. Paramedics to Allied Health Professionals: Landscaping the Journey and Way Forward Public Health Foundation of India 2012;1–218. Available: <http://www.mohfw.nic.in/WriteReadData/1892s/NIAHS Report.pdf>
- Catterall M. The role of paramedics with extended practice: exploring the healthcare context. *J Paramedic Pract* 2012;4:569–75.
- Health D of. Northern Island Paramedics get formal recognition as Allied Health Professionals (AHP). Workforce Development, Available: <https://www.health-ni.gov.uk/news/northern-ireland-paramedics-get-formal-recognition-allied-health-professionals-ahp>
- Workforce HA. Paramedicine - The A to Z of Allied Health, Available: <https://ahpworkforce.com/a-z-of-allied-health/paramedicine/>
- Givati A, Markham C, Street K. The bargaining of professionalism in emergency care practice: NHS paramedics and higher education. *Adv Health Sci Educ Theory Pract* 2018;23:353–69.
- Hitch D, Pepin G, Lhuede K, *et al*. Development of the Translating Allied Health Knowledge (TAHK) Framework. *Int J Health Policy Manag* 2019;8:412–23.
- Young AM, Cameron A, Meloncelli N, *et al*. Developing a knowledge translation program for health practitioners: Allied Health Translating Research into Practice. *Front Health Serv* 2023;3:1103997.
- Greenhalgh T. Knowledge to Action: there is no tooth fairy. Centre for Evidence Based Medicine (CEBM), Available: <https://www.cebm.ox.ac.uk/news/views/knowledge-to-action-there-is-no-tooth-fairy>
- Metzler MJ, Metz GA. Translating knowledge to practice: an occupational therapy perspective. *Aust Occup Ther J* 2010;57:373–9.
- Australasian College of Paramedicine. Paramedicine: recognition as a standalone profession. consultation paper. 2023. Available: [https://paramedics.org/storage/news/consultation\\_paper\\_paramedicine\\_recognition\\_as\\_a\\_standalone\\_profession\\_230315.pdf](https://paramedics.org/storage/news/consultation_paper_paramedicine_recognition_as_a_standalone_profession_230315.pdf)
- Scott SD, Albrecht L, O'Leary K, *et al*. Systematic review of knowledge translation strategies in the allied health professions. *Implement Sci* 2012;7:70.
- Dadich A, Piper A, Coates D. Implementation science in maternity care: a scoping review. *Impl Sci* 2021;16:16.



- 26 Thürlimann E, Verweij L, Naef R. The Implementation of Evidence-Informed Family Nursing Practices: A Scoping Review of Strategies, Contextual Determinants, and Outcomes. *J Fam Nurs* 2022;28:258–76.
- 27 Forsetlund L, O'Brien MA, Forsén L, *et al.* Continuing education meetings and workshops: effects on professional practice and healthcare outcomes. *Cochrane Database Syst Rev* 2021;9:CD003030.
- 28 Hakkennes S, Dodd K. Guideline implementation in allied health professions: a systematic review of the literature. *Qual Saf Health Care* 2008;17:296–300.
- 29 Baker R, Camosso-Stefinovic J, Gillies C, *et al.* Tailored interventions to overcome identified barriers to change: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev* 2010;CD005470.
- 30 Munn Z, Peters MDJ, Stern C, *et al.* Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol* 2018;18.
- 31 Makrides T, Ross L, Gosling C, *et al.* The Structure and Characteristics of Anglo-American Paramedic Systems in Developed Countries: A Scoping Review Protocol. *Aust J Paramed* 2020;17:1–4.
- 32 Makrides T, Ross L, Gosling C, *et al.* Defining two novel sub models of the Anglo-American paramedic system: A Delphi study. *Aust Emerg Care* 2022;25:229–34.
- 33 Newton A, Psm DH. The College of Paramedics: 10 years on since its formation. *J Paramedic Pract* 2012;4:57–8.
- 34 Eaton G. Addressing the challenges facing the paramedic profession in the United Kingdom. *Br Med Bull* 2023;148:70–8.
- 35 Brooks IA, Grantham H, Spencer C, *et al.* A Review of the Literature: The Transition of Entry-Level Paramedic Education in Australia from Vocational to Higher Education (1961–2017). *Aust J Paramed* 2018;15:1–11.
- 36 Peters MDJ, Godfrey CM, Khalil H, *et al.* Guidance for conducting systematic scoping reviews. *Int J Evid Based Healthc* 2015;13:141–6.
- 37 Tricco A, Zarin LE, O'Brien K, *et al.* Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist section, Available: <http://www.prisma-statement.org/Extensions/ScopingReviews>
- 38 Olausson A, Semple W, Oteir A, *et al.* Paramedic literature search filters: optimised for clinicians and academics. *BMC Med Inform Decis Mak* 2017;17:146.
- 39 Hopewell S, Clarke MJ, Lefebvre C, *et al.* Handsearching versus electronic searching to identify reports of randomized trials. *Cochrane Database Syst Rev* 2007;2007:MR000001.
- 40 Effective Practice and Organisation of Care (EPOC). *The EPOC taxonomy of health systems interventions. EPOC resources for review authors.* Oslo: Norwegian Knowledge Centre for the Health Services, 2016.
- 41 Braun V, Clarke V. One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qual Res Psychol* 2021;18:328–52.
- 42 NHS England. Ambulance Quality Indicators: Clinical Outcomes specification for data from April 2018 Section 1 Introduction, Available: [www.england.nhs.uk/statistics/statistical-work-areas/ambulance-quality-indicators](http://www.england.nhs.uk/statistics/statistical-work-areas/ambulance-quality-indicators)
- 43 EPOC. EPOC Taxonomy – topics list. 2015;1–11.
- 44 Slaughter SE, Zimmermann GL, Nuspi M, *et al.* Classification schemes for knowledge translation interventions: a practical resource for researchers. *BMC Med Res Methodol* 2017;17:161.
- 45 Snooks HA, Kearsley N, Dale J, *et al.* Gaps between policy, protocols and practice: a qualitative study of the views and practice of emergency ambulance staff concerning the care of patients with non-urgent needs. *Qual Saf Health Care* 2005;14:251–7.
- 46 Jones Rhodes W, Steinbruner D, Finck L, *et al.* Community Implementation of a Prehospital Spinal Immobilization Guideline. *Prehosp Emerg Care* 2016;20:792–7.
- 47 Sasson C, Forman J, Krass D, *et al.* A qualitative study to identify barriers to local implementation of prehospital termination of resuscitation protocols. *Circ Cardiovasc Qual Outcomes* 2009;2:361–8.
- 48 McCaul M, Young T, Buijns SR, *et al.* Strengthening prehospital clinical practice guideline implementation in South Africa: a qualitative case study. *BMC Health Serv Res* 2020;20:1–12.
- 49 Carter AJE, Harrison M, Kryworuchko J, *et al.* Essential Elements to Implementing a Paramedic Palliative Model of Care: An Application of the Consolidated Framework for Implementation Research. *J Palliat Med* 2022;25:1345–54.
- 50 Bigham BL, Aufderheide TP, Davis DP, *et al.* Knowledge translation in emergency medical services: a qualitative survey of barriers to guideline implementation. *Resuscitation* 2010;81:836–40.
- 51 Sasson C, Forman J, Krass D, *et al.* A Qualitative Study to Understand Barriers to Implementation of National Guidelines for Prehospital Termination of Unsuccessful Resuscitation Efforts. *Prehosp Emerg Care* 2010;14:250–8.
- 52 Siriwardena AN, Shaw D, Essam N, *et al.* The effect of a national quality improvement collaborative on prehospital care for acute myocardial infarction and stroke in England. *Implement Sci* 2014;9:17.
- 53 Murphy A, Barrett M, Cronin J, *et al.* A qualitative study of the barriers to prehospital management of acute pain in children. *Emerg Med J* 2014;31:493–8.
- 54 Adelgais KM, Sholl JM, Alter R, *et al.* Challenges in Statewide Implementation of a Prehospital Evidence-Based Guideline: An Assessment of Barriers and Enablers in Five States. *Prehosp Emerg Care* 2019;23:167–78.
- 55 McCaul M, Hendricks L, Naidoo R. Prehospital providers' perspectives for clinical practice guideline implementation and dissemination: Strengthening guideline uptake in South Africa. *PLoS One* 2019;14:e0219761.
- 56 Haskell SE, Kenney MA, Patel S, *et al.* Awareness of guidelines for use of automated external defibrillators in children within emergency medical services. *Resuscitation* 2008;76:354–9.
- 57 Jensen J, Blanchard I, Bigham B, *et al.* The Canadian National EMS Research Agenda: Impact and Feasibility of Implementation of Previously Generated Recommendations. *CJEM* 2015;17:484–90.
- 58 Frendl DM, Palmeri ST, Clapp JR Jr, *et al.* Overcoming barriers to developing seamless ST-segment elevation myocardial infarction care systems in the United States: recommendations from a comprehensive Prehospital 12-lead Electrocardiogram Working Group. *J Electrocardiol* 2009;42:426–31.
- 59 Iledema R, Ball C, Daly B, *et al.* Design and trial of a new ambulance-to-emergency department handover protocol: "IMIST-AMBO". *BMJ Qual Saf* 2012;21:627–33.
- 60 Shaw D, Siriwardena AN. Identifying barriers and facilitators to ambulance service assessment and treatment of acute asthma: a focus group study. *BMC Emerg Med* 2014;14:1–9.
- 61 O'Meara P, Wingrove G, Nolan M. Clinical leadership in paramedic services: a narrative synthesis. *IJHG* 2017;22:251–68.
- 62 Jaeger A, Dudley N, Holsti M, *et al.* Impact of an Offline Pain Management Protocol on Prehospital Provider Self-Efficacy: A Randomized Trial. *Pediatr Emerg Care* 2017;33:388–95.
- 63 Davis D, Davis N. Selecting educational interventions for knowledge translation. *CMAJ* 2010;182:E89–93.
- 64 LaRocca R, Yost J, Dobbins M, *et al.* The effectiveness of knowledge translation strategies used in public health: a systematic review. *BMC Public Health* 2012;12:751.
- 65 Watts DD, Hanfling D, Waller MA, *et al.* An evaluation of the use of guidelines in prehospital management of brain injury\*1. *Prehosp Emerg Care* 2004;8:254–61.
- 66 Sayre MR, Cantrell SA, White LJ, *et al.* Impact of the 2005 American Heart Association Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Guidelines on Out-of-Hospital Cardiac Arrest Survival. *Prehosp Emerg Care* 2009;13:469–77.
- 67 Shah MN, Swanson PA, Nobay F, *et al.* A novel internet-based geriatric education program for emergency medical services providers. *J Am Geriatr Soc* 2012;60:1749–54.
- 68 Nassif A, Ostermayer DG, Hoang KB, *et al.* Implementation of a Prehospital Protocol Change For Asthmatic Children. *Prehosp Emerg Care* 2018;22:457–65.
- 69 Tolles J, Bosson N, Kaji AH, *et al.* The Effect of Implementation of the American Heart Association Mission Lifeline PreAct Algorithm for Prehospital Cardiac Catheterization Laboratory Activation on the Rate of "False Positive" Activations. *Prehosp Disaster Med* 2020;35:388–96.
- 70 Menon A, Korner-Bitensky N, Kastner M, *et al.* Strategies for rehabilitation professionals to move evidence-based knowledge into practice: a systematic review. *J Rehabil Med* 2009;41:1024–32.
- 71 Cummings GG, Olivo SA, Biondo PD, *et al.* Effectiveness of knowledge translation interventions to improve cancer pain management. *J Pain Symptom Manage* 2011;41:915–39.
- 72 Yost J, Ganann R, Thompson D, *et al.* The effectiveness of knowledge translation interventions for promoting evidence-informed decision-making among nurses in tertiary care: a systematic review and meta-analysis. *Impl Sci* 2015;10:98.
- 73 Nilsen P. Making sense of implementation theories, models and frameworks. *Impl Sci* 2015;10:53.
- 74 Squires JE, Graham ID, Hutchinson AM, *et al.* Understanding context in knowledge translation: a concept analysis study protocol. *J Adv Nurs* 2015;71:1146–55.
- 75 Wensing M, Grol R. Knowledge translation in health: how implementation science could contribute more. *BMC Med* 2019;17:88.



- 76 Williams B, Jennings PA, Fielder C, *et al.* Next generation paramedics, agents of change, or time for curricula renewal? *Adv Med Educ Pract* 2013;4:245–50.
- 77 Cavanagh N, Blanchard IE, Weiss D, *et al.* Looking back to inform the future: a review of published paramedicine research. *BMC Health Serv Res* 2023;23:108.
- 78 Dryden-Palmer KD, Parshuram CS, Berta WB. Context, complexity and process in the implementation of evidence-based innovation: a realist informed review. *BMC Health Serv Res* 2020;20:81.
- 79 Sibley KM, Bentley DC, Salbach NM, *et al.* A theory-based multi-component intervention to increase reactive balance measurement by physiotherapists in three rehabilitation hospitals: an uncontrolled single group study. *BMC Health Serv Res* 2018;18:724.
- 80 Squires JE, Graham I, Bashir K, *et al.* Understanding context: A concept analysis. *J Adv Nurs* 2019;75:3448–70.
- 81 Skivington K, Matthews L, Simpson SA, *et al.* A new framework for developing and evaluating complex interventions: update of Medical Research Council guidance. *BMJ* 2021;374:n2061.
- 82 Wright K, Golder S, Lewis-Light K. What value is the CINAHL database when searching for systematic reviews of qualitative studies? *Syst Rev* 2015;4:104.
- 83 Bramer WM, Rethlefsen ML, Kleijnen J, *et al.* Optimal database combinations for literature searches in systematic reviews: a prospective exploratory study. *Syst Rev* 2017;6:245.
- 84 Lokker C, McKibbon KA, Wilczynski NL, *et al.* Finding knowledge translation articles in CINAHL. *Stud Health Technol Inform* 2010;160:1179–83.