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Extended Scope Physiotherapists are Effective and Safe in the Emergency Department: A Systematic Review and Meta-Analysis

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Abstract

Purpose: Extended scope physiotherapists (ESPs) are an innovative approach to service delivery that have emerged in response to increasing pressures on emergency departments (EDs). While previous systematic reviews have suggested that ESPs have a positive impact on ED outcomes, clinical practice recommendations based on limited evidence highlight a pressing need for evaluation studies to truly determine their effectiveness and safety in this setting. Therefore, the objective of this systematic review and meta-analysis was to evaluate the clinical effectiveness and safety of ESPs when delivering services in EDs. **Method:** Systematic literature searches were conducted using the online databases: Medline (Ovid), CINAHL (EBSCOhost), Scopus, PEDro, Cochrane Library and Informit in October, 2019. Randomised controlled trials (RCTs) or cohort studies investigating the clinical effectiveness and safety of ESPs in EDs in comparison with usual ED medical care providers were eligible for inclusion. Data extraction was completed using a form specifically developed for the study. The quality of each study was assessed using the Crowe Critical Appraisal Tool (CCAT) as well as a subjective assessment of bias, and the level of evidence was graded using the National Health and Medical Research Council (NHMRC) evidence hierarchy. Random-effects model meta-analyses were conducted using Stata (version 16.1). **Results:** Eleven studies met the inclusion criteria for the systematic review. These studies provided III-1 to III-3 evidence, with quality scores ranging from 50% to 93%. Consistent positive results were found regarding ESP clinical effectiveness and safety with meta-analyses demonstrating significant reductions in wait time (Cohen's *d* effect size: -0.54; 95% confidence interval [CI]: -0.64 to -0.45) and length of stay (Cohen's *d* effect size: -0.79; 95% CI: -0.86 to -0.72) for patients managed by ESPs. Although, confounding of results by treatment urgency made it difficult to establish a clear causal link between ESP services and outcomes. **Conclusion:** Although it was not able to be suggested that ESPs are an appropriate substitute for usual ED medical care due to the presence of bias and confounding, the results highlighted that ESPs, as an additional staff member in EDs, improve throughput and access to care for patients in lower urgency triage categories.

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ABSTRACT

Purpose: Extended scope physiotherapists (ESPs) are an innovative approach to service delivery that have emerged in response to increasing pressures on emergency departments (EDs). While previous systematic reviews have suggested that ESPs have a positive impact on ED outcomes, clinical practice recommendations based on limited evidence highlight a pressing need for evaluation studies to truly determine their effectiveness and safety in this setting. Therefore, the objective of this systematic review and meta-analysis was to evaluate the clinical effectiveness and safety of ESPs when delivering services in EDs. **Method:** Systematic literature searches were conducted using the online databases: Medline (Ovid), CINAHL (EBSCOhost), Scopus, PEDro, Cochrane Library and Informit in October 2019. Randomised controlled trials (RCTs) or cohort studies investigating the clinical effectiveness and safety of ESPs in EDs in comparison with usual ED medical care providers were eligible for inclusion. Data extraction was completed using a form specifically developed for the study. The quality of each study was assessed using the Crowe Critical Appraisal Tool (CCAT) as well as a subjective assessment of bias, and the level of evidence was graded using the National Health and Medical Research Council (NHMRC) evidence hierarchy. Random-effects model meta-analyses were conducted using Stata (version 16.1). **Results:** Eleven studies met the inclusion criteria for the systematic review. These studies provided III-1 to III-3 evidence, with quality scores ranging from 50% to 93%. Consistent positive results were found regarding ESP clinical effectiveness and safety with meta-analyses demonstrating significant reductions in wait time (Cohen's *d* effect size: -0.54; 95% confidence interval [CI]: -0.64 to -0.45) and length of stay (Cohen's *d* effect size: -0.79; 95% CI: -0.86 to -0.72) for patients managed by ESPs. Although, confounding of results by treatment urgency made it difficult to establish a clear causal link between ESP services and outcomes. **Conclusion:** Although it was not able to be suggested that ESPs are an appropriate substitute for usual ED medical care due to the presence of bias and confounding, the results highlighted that ESPs, as an additional staff member in EDs, improve throughput and access to care for patients in lower urgency triage categories.

Keywords: physiotherapy, physical therapy, extended scope of practice, emergency department, ED, effectiveness, safety

INTRODUCTION

Emergency departments (EDs) across Australia and worldwide are under enormous pressure to effectively assess, treat and discharge or admit an increasing number of patients in a reduced amount of time and with limited resources and funding.[1,2] Considering that Australian EDs reported an 11% increase in the number of presentations between 2013-14 and 2017-18, but limited to no increase in funding or the average number of hospital beds, the demand for healthcare is unable to be met by the physical, staffing, and financial capacity of EDs.[3-5] Demand for healthcare that is disproportionate to capacity has been found to contribute to overcrowding and access block; one of the greatest contemporary challenges facing emergency care.[5-7]

Access block refers to the inability of patients to leave the ED within a reasonable timeframe due to delays in access to care.[8] In Australia, access block occurs when a patient's length of stay (LOS) in the ED exceeds eight hours.[8] In response to evidence that increased demand for hospital admission and inpatient bed shortages are causing access block to worsen, and to prevent the adverse events and poor outcomes that are associated with delayed access to care, Australia has implemented a four-hour National Emergency Access Target (NEAT) in which 90% of patients should be discharged from the ED.[7,9] As it has been found that only 71% of Australian ED visits are completed within this time and some patients require specialist care for a longer duration due to increased complexity or acuity of presentation, more innovative approaches to addressing access block, such as the introduction of extended scope physiotherapists (ESPs), have been suggested.[4,5,9]

Extended scope physiotherapists are primary contact practitioners who have undertaken further training to independently manage patients from triage to discharge without routine consultation with ED physicians or nurse practitioners.[10,11] Aside from their primary contact status, the major defining feature of ESPs from their secondary contact physiotherapist counterparts is their participation in role enhancement and role substitution.[12] The Australian Physiotherapy Association support this definition, suggesting that ESPs perform tasks beyond their traditional scope of physiotherapy practice, with the potential to substitute usual ED medical care.[12]

Previous systematic reviews on this topic have suggested that ESPs have a positive impact on ED outcomes such as wait time, LOS, and the proportion of patients discharged within ED time targets, however have based their conclusions on limited evidence[13] or have reviewed lower quality studies investigating both ESPs and secondary contact physiotherapists.[14] Previous studies have also reported contradictory findings with regards to ESP safety and adverse events.[15-18] Therefore, an accurate evaluation of the effectiveness and safety of ESPs, as the sole treating profession, has not yet been conducted; "[bringing] into question the rapid … [implementation] of roles without [adequate and definitive] evidence" to support them.[19(p240)]
The research question for this study was: Are ESPs clinically effective and safe when delivering services in EDs and do they reduce access block?

METHOD

Identification and Selection of Studies

The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement was used to guide the research.[20] The method was prospectively specified and published in a protocol on the International Prospective Register of Systematic Reviews (PROSPERO) which can be accessed with the registration number: CRD42019145755.

A comprehensive literature search was conducted using the online databases: Medline (Ovid), CINAHL (EBSCOhost), Scopus, PEDro, Cochrane Library and Informit on October 12th, 2019. The search included search terms relevant to physiotherapy, EDs, extended scope of practice, randomised controlled trials (RCTs) and cohort studies, and is outlined in Appendix 1. While these search terms were reflective of the "population," "intervention of interest," and "study design" components of the PICOS criteria, search terms reflective of "comparators" and "outcomes of interest" were intentionally excluded to prevent the restriction of studies due to variations in terminology. No limits were applied to the search strategy as the eligibility of all studies was determined manually.

Studies were eligible for inclusion if they met the inclusion criteria presented in Figure 1. Systematic reviews, literature or narrative reviews and studies with access to a poster presentation or abstract only were excluded. In addition to satisfying the criteria for inclusion in the systematic review, studies quantitatively synthesised in the meta-analysis were required to demonstrate minimal statistical and clinical heterogeneity and provide a summary measure for each outcome.

Study eligibility

Population

- ESPs working in a primary contact capacity who were physically located in the ED

Intervention of interest

- Extension of scope of practice through role enhancement and role substitution

Comparators

- Usual ED medical care (care provided by ED physicians, ED nurse practitioners, or secondary contact physiotherapists following assessment and referral by an ED physician) or ED outcomes when the ESP was not present

Outcomes of interest

- Wait time
- LOS
- Access block
- Adverse events

Study design

- RCTs or cohort studies

Report eligibility

- English language
- Full text
- Published in a peer-reviewed journal from database inception to the date of the literature search
- Any level of quality

ED, emergency department; ESP, extended scope physiotherapist; LOS, length of stay; RCT, randomised controlled trial

Figure 1. Inclusion Criteria

Following the literature search, the returned studies were exported into EndNote X8 where the title, date and reference type of each study was compared, and duplicate studies were removed. The titles, key terms and abstracts of the remaining studies were then screened for relevance to the topic by the primary researcher (BS). Bidirectional citation searching was performed to identify further relevant studies. Full-text assessment for eligibility was conducted by the primary researcher (BS), with studies satisfying the criteria cross-examined by a second researcher (AJ) during quality appraisal. Neither of the researchers were blinded to certain aspects of the studies.

Assessment of Study Characteristics

Quality

The quality of each study was assessed and summarised by two independent researchers (BS and AJ) using the Crowe Critical Appraisal Tool (CCAT).[21] The CCAT was primarily chosen due to its ability to enable direct comparison of a wide range of research designs.[21] While the CCAT assisted in the assessment of within-study bias, considering that summary numerical scores of bias have been suggested as misleading and superficial, a subjective assessment of bias was also conducted.[22] Studies were not excluded on the basis of quality or identified bias, however, these factors were taken into account when interpreting results and making recommendations. The included studies were also ranked according to their level of evidence as assessed by the National Health and Medical Research Council (NHMRC) evidence hierarchy.[23]

Population

Demographics of patients (sample size, age, sex, diagnosis, and Australasian Triage Scale (ATS) category) and ESPs (number, education/training and hours of work in the ED) were documented to assist in the identification of heterogeneity. Evidence of primary contact practice, in the form of autonomous or independent patient management from triage to discharge, and the setting of care were also recorded in order to assess the similarity of included studies.

Intervention of Interest
The role and scope of practice of the ESPs and usual ED medical care providers in each study were recorded to determine whether the studies were directly comparable.

Outcomes of Interest
Wait time (the time in minutes from first contact to first service delivery),[24] LOS (the time in minutes between arrival at the ED and discharge),[4] access block and adverse events (missed diagnoses, representations, complaints and reported incidents and injuries)[25] were the outcomes evaluated in this study. As preliminary literature searches highlighted that the proportion of patients seen within Australasian College for Emergency Medicine (ACEM) wait time guidelines[26] and the proportion of patients admitted or discharged within four hours[9] were also common outcome measures directly related to wait time and LOS respectively, these outcomes were also evaluated in this review.

Data Analysis
Data were extracted by the primary researcher (BS) and entered into a Microsoft Excel form that was specifically developed to capture: general information about the studies, the demographics of the patients and ESPs, details of the methodology including the role and scope of practice of the ESPs, and usual ED medical care providers, primary and secondary outcomes, and results. The CCAT total percentage score summarising study quality and the subjective assessment of bias were also entered into this form. The data extraction template is available in Appendix 2. Study authors were contacted via email to acquire data if not clearly reported.

Random-effects model meta-analyses were conducted using the software Stata (version 16.1).[27] Firstly, heterogeneity of the studies was assessed statistically using an I^2 and H^2 value, with significant heterogeneity indicated by an I^2 value ≥30% and a H^2 value >1.[28,29] Where the outcome mean and standard deviation were obtained for both the ESP and usual ED medical care groups, post-intervention standardised mean differences (Cohen's *d* effect sizes), along with the 95% confidence interval (CI), were calculated and reported in a forest plot.[28,29] The weight of each study was then adjusted via the inverse-variance approach and pooling of effect sizes for each outcome was conducted.[28,29] The effect sizes were interpreted according to Cohen[30] where *d*=0.2 was considered small, *d* >0.2 - <0.5 small to medium, *d*=0.5 medium, *d* >0.5 - <0.8 medium to large and *d*=0.8 large.

While it is important to consider the potential ethical concern regarding the further analysis and interpretation of patient data from primary studies in the absence of updated informed consent from the original patients,[31] as this review used publicly available aggregate patient data and had the same objective as the primary studies, it may be suggested to be in concurrence with the Declaration of Helsinki in that the informed consent provided to participate in the original study directly related to this review.[32]

RESULTS
Flow of Studies Through the Review
Following the database searches, 192 studies were identified. An additional 451 studies were identified through bidirectional citation searching. One hundred and sixteen of these 643 studies were removed due to duplication. The remaining studies were screened for relevance, resulting in the exclusion of 505 studies. The full text of the remaining 22 studies were consulted and 11 were excluded due to ineligibility. Eleven studies met the inclusion criteria for the systematic review.[15-18,33-39] Four studies met the inclusion criteria for the meta-analysis.[18,34,36,39] Study flow and reasons for full text study exclusion are depicted in Figure 2.
No further unpublished information was obtained from two of the authors contacted via email. An unpublished thesis by McClellan[40] was obtained from additional contact and, while not included as an additional study, provided further information regarding the study method, patient demographics and outcomes to the McClellan et al[37] study.

Characteristics of Included Studies
Of the 11 studies included in the systematic review, four were prospective cohort,[15,18,34,37] four were retrospective cohort,[17,35,36,38] two were concurrent mixed method,[16,33] with prospective cohort studies as the quantitative component, and one was a prospective non-randomised controlled trial.[39] These studies were of varying levels of evidence, ranging from III-1[39] to III-3[16,34] according to the NHMRC evidence hierarchy.[23]

Quality
The included studies demonstrated moderate to high quality with an average CCAT total percentage score of 78%, ranging between 50%[16] and 93%[36] (Table 1). Design and sampling were two of the weakest aspects of the included studies. With regards to design, 10 out of 11 studies did not randomise patients to groups,[15-18,33-36,38,39] and six out of these 10 studies reported baseline differences between groups.[15,17,33,36,38,39] Nine out of ten studies performed cohort matching without consideration for ATS

category.[15-18,33,35,36,38,39] With regards to sampling, seven studies did not calculate or did not report the calculation of sample size.[15-18,34,36,38] The chosen outcomes were measured similarly between groups in all included studies and 10 of the 11 studies adequately reported all outcomes pre-specified in the protocol regardless of significance.[15,17,18,33-39] Two studies reported that 3%[18] and 5%[34] of patients were withdrawn from time calculations after recruitment.

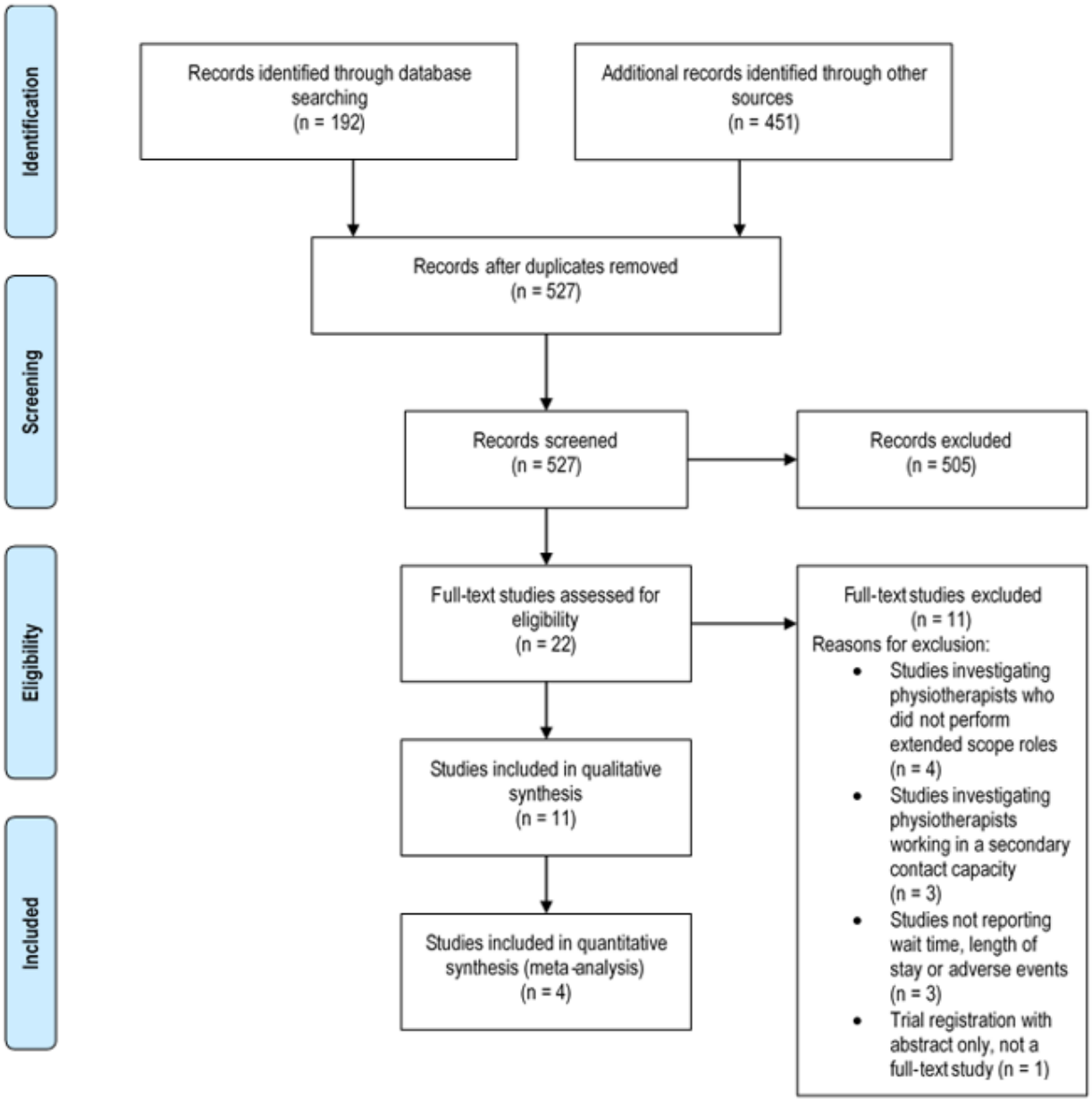

Figure 2. Flow of Studies Through the Review

Table 1. Crowe Critical Appraisal Tool (CCAT) scores of included studies

	CCAT categories								
Study	Preliminaries	Introduction	Design	Sampling	Data collection	Ethical matters	Results	Discussion	Total [%]
Alkhouri et al. (2019)	4	5	3	4	4	4	4	5	**83**
Bird et al. (2016)	5	5	4	5	3	4	4	5	**83**
de Gruchy et al. (2015)	4	5	3	5	4	3	4	4	**75**
Gill & Stella (2013)	4	5	3	4	3	3	4	5	**78**
Goodman et al. (2018)	2	3	2	1	3	3	3	3	**50**
Guengerich et al. (2013)	4	5	4	4	5	5	5	5	**93**
Kinsella et al. (2018)	4	4	3	2	4	4	4	5	**75**
McClellan et al. (2006)	3	5	3	2	3	3	2	4	**63**
Sayer et al. (2018)	4	5	4	4	4	4	4	5	**85**
Sutton et al. (2015)	5	5	4	4	4	4	4	5	**88**
Taylor et al. (2011)	5	5	4	4	3	4	4	5	**85**
								Average	**78**

Population

The review included a total of 303,698 patients, of which ESPs managed approximately 10% (Table 2).[15-18,33-39] Patients were mostly male,[15,17,33,34,36,38,39] had a mean age of 38.1 years[17,18, 33,34,36,38,39] and presented to the ED with musculoskeletal conditions,[15-18,33-39] disorders of the peripheral nervous system,[18,34,38] signs and symptoms of skin and subcutaneous tissue,[18,34] circulatory disorders,[34] as well as migraines, headaches and unspecified abdominal pain.[34] In the nine studies detailing ATS categories, patients were assigned to ATS three,[15-17,33-35,38] four[15-17,33-36,38,39] and five,[15-17,33-36,38,39] with ATS four being the mode.[17,34,36,38,39] Diagnoses of patients within each of the ATS categories were not provided, hence the breadth and acuity of conditions were not able to be examined.

The number of ESPs working in the ED was not well documented, however ESPs were reported to be senior level clinicians[35,36,39] with five to 10 years of clinical experience[15,18,33,35] or prior experience of extended scope services.[39] Four studies suggested that ESPs attained tertiary-level postgraduate qualifications,[15,16,18,39] and two suggested that further experiential, informal education and training was undertaken.[17,37] A work-based assessment of competency was reported in three studies.[15,17,38] Extended scope physiotherapists delivered services in EDs three to seven days per week,[15-18,35-39] for six to 9.5 hours per day.[15-18,35-38] All of the included studies suggested that ESPs autonomously managed patients from triage to discharge, only consulting with ED physicians if required by legislation or local protocol.[15-18,33-39]

Intervention of interest

In all of the included studies, ESPs were reported to perform extended scope roles such as: independent ordering[15-18,33,35-37,39] and interpretation of spinal and peripheral imaging,[15-17,35,39] closed reduction and plastering of fractures,[15-17,33,35,37] relocation of dislocated joints under local or general anaesthesia,[15] autonomous decision-making regarding discharge,[16] coordination of follow-up care[35,36] and direct referral to inpatient teams.[16,35] Assessment and management of analgesia and other medications in consultation with or under the name of ED physicians was discussed by three Australian studies.[17,36,39] The independent prescription of limited medications by ESPs was described by one study conducted in the United Kingdom.[37]

No studies described the role or scope of practice of the usual ED medical care providers, however, the mode providers were ED physicians and ED nurse practitioners who delivered services during ESP working hours.[15,17,18,34-38] Two studies reported that the ED physicians were of any grade, ranging from junior doctors to consultants.[36,37] Interventions were also provided by a mixture of experienced and junior level secondary contact physiotherapists following assessment and referral by an ED physician in three studies.[16,33,39] The intervention in all included studies was provided over one single episode of care.[15-18,33-39]

Outcomes of Interest

Wait time was evaluated in seven studies.[16,33,34,36-39] Three studies measured wait time as the time in minutes from presentation to the ED to the assignment of an electronic clinician time stamp, and investigated the proportion of patients seen within ACEM wait time guidelines.[15,17,35] Length of stay was evaluated in eight studies.[17,18,33,35-39] The proportion of patients admitted or discharged within four hours was investigated in seven studies.[15-17,34,35,38,39] None of the included studies examined the impact of ESPs on access block as an isolated outcome measure. Although, the authors made inferences regarding access block from LOS figures.[15,17,18,33,35,36,38,39] Finally, adverse events were evaluated in eight studies.[15-18,33,36,38,39] These studies measured adverse events by investigating missed diagnoses,[15] complaints,[15,16,18] events, incidents or injuries resulting from intervention,[16,18,36] and representations.[17,18,33,36,38,39]

Table 2. Summary of Included Studies*

Study	Design and NHMRC level of evidence	Population	Intervention	Outcome measures
Alkhouri et al. (2019)	Concurrent mixed method with prospective cohort (III-2)	**ESP group:** n = 626 Mean age (yr) = 36 (SD 20) Sex = 375 M, 251 F Mode ATS = four (52%) Mode diagnosis = soft tissue injury (48%) **Usual ED medical care group:** n = 2,506 (SCP: n = 430; Usual ED medical care during ESP hours: n = 1,000; Usual ED medical care outside of ESP hours: n = 1,076)	**ESP:** Assessment, diagnosis and management of patients without routine involvement of usual ED medical care providers. Able to request diagnostic imaging and manage fractures independently **Usual ED medical care:** Care provided to patients by ED physicians, ED nurse practitioners or secondary contact physiotherapists after assessment and referral from an ED physician	• Wait time = time in min from presentation to the ED to the commencement of service • LOS = time in min from arrival at ED to discharge • Access block = not reported • Adverse events = representations
Bird et al. (2016)	Prospective cohort (III-2 and III-3)	**ESP group:** n = 13,964 Mean age (yr) = 38.7 Sex = 7,233 M, 6,731 F Mode ATS = four (57.6%) **Usual ED medical care group:** n = 256,637 (Usual ED medical care [concurrent]: n = 133,668; Usual ED medical care [historical]: n = 122,969)	**ESP:** Assessment and management of patients, in an extended role, without review by usual ED medical care providers **Usual ED medical care:** Care provided to patients by ED physicians, ED nurse practitioners or secondary contact physiotherapists after assessment and referral from an ED physician	• Wait time = time in min from presentation to the ED to the commencement of service • LOS = not reported • Access block = not reported • Adverse events = not reported

Table 2. Summary of included studies (continued)*

Study	Design and NHMRC level of evidence	Population	Intervention	Outcome measures
de Gruchy et al. (2015)	Prospective cohort (III-2)	**Patients managed by ESPs (used for time calculations without comparison):** n = 1,010 Median age (yr) = 34.1 Sex = 556 M, 454 F Mode ATS = four (76.3%) Mode diagnosis = lumbar pain **ESP group:** n = 321 Mode diagnosis = lumbar pain **Usual ED medical care group:** n = 1,129 Mode diagnosis = lumbar pain	**ESP:** Assessment and treatment of patients in the place of usual ED medical care. Permitted to order and independently interpret peripheral, pelvic and lumbar spine radiographs, perform closed reduction and casting of fractures, and assist with relocating dislocated joints under local or general anaesthesia **Usual ED medical care:** Care provided to patients by ED physicians	• Wait time = time in min from presentation to the ED to assignment of an electronic clinician time stamp • LOS = not reported • Access block = not reported • Adverse events = missed diagnoses and complaints
Gill & Stella (2013)	Retrospective cohort (III-2)	**ESP group (analysed for wait time):** n = 3,862 **Usual ED medical care group (analysed for wait time):** n = 3,670 **ESP group (analysed for LOS):** n = 3,492 **Usual ED medical care group (analysed for LOS):** n = 3,050	**ESP:** Assessment, treatment and organisation of ongoing care for patients instead of usual ED medical care providers. Able to independently manage closed fractures, order and interpret spinal and limb x-rays, coordinate follow-up care and refer to inpatient teams **Usual ED medical care:** Care provided to patients by ED physicians, ED nurse practitioners or secondary contact physiotherapists after assessment and referral from an ED physician	• Wait time = time in min from presentation to the ED to assignment of an electronic clinician time stamp • LOS = time in min from arrival at ED to discharge • Access block = not reported • Adverse events = not reported
Goodman et al. (2018)	Concurrent mixed method with prospective cohort (III-3)	**ESP group:** n = 517 **Usual ED medical care group:** n = unknown	**ESP:** Assessment and management of patients independently. Permitted to order and interpret plain film x-rays, make autonomous discharge decisions, perform simple closed manipulation and plastering,	• Wait time = time in min from presentation to the ED to the commencement of service • LOS = not reported • Access block = not reported

Table 2. Summary of included studies (continued)*

Study	Design and NHMRC level of evidence	Population	Intervention	Outcome measures
			and refer to orthopaedic fracture clinics **Usual ED medical care:** Care provided to patients by secondary contact physiotherapists after assessment and referral from an ED physician (historical control prior to the implementation of the ESP service)	• Adverse events = events and patient complaints
Guengerich et al. (2013)	Retrospective cohort (III-2)	**ESP group:** n = 274 Mean age (yr) = 43.3 (SD 18.9) Sex = 142 M, 132 F Mode ATS = four (81.1%) Mode diagnosis = upper limb non-fracture (29.5%) **Usual ED medical care group:** n = 284 Mean age (yr) = 44 (SD 19.3) Sex = 134 M, 150 F Mode ATS = four (93.3%) Mode diagnosis = lower limb non-fracture (30.3%)	**ESP:** Autonomous selection, assessment and management of patients. Able to order x-rays independently and assess and manage analgesia requirements in consultation with an ED physician **Usual ED medical care:** Care provided to patients by ED physicians	• Wait time = time in min from presentation to the ED to the commencement of service • LOS = time in min from arrival at ED to discharge • Access block = not reported • Adverse events = representations and injuries resulting from intervention
Kinsella et al. (2018)	Retrospective cohort (III-2)	**ESP group:** n = 173 Mean age (yr) = 37.7 (SD 12.7) Sex = 94 M, 79 F Mode ATS = four (78.6%) Mode diagnosis = sprain/strain of the knee (12.1%) **Usual ED medical care group:** n = 652 Mean age (yr) = 42 (SD 14.3) Sex = 332 M, 320 F Mode ATS = three (54.9%)	**ESP:** Autonomous selection and management of patients. Able to work in areas such as radiology, pharmacology and fracture management **Usual ED medical care:** Care provided to patients by ED physicians or ED nurse practitioners	• Wait time = time in min from presentation to the ED to assignment of an electronic clinician time stamp • LOS = time in min from arrival at ED to discharge • Access block = not reported • Adverse events = representations

Table 2. Summary of included studies (continued)*

Study	Design and NHMRC level of evidence	Population	Intervention	Outcome measures
McClellan et al. (2006)	Prospective cohort (III-2)	**ESP group:** n = 16 **Usual ED medical care group:** n = 88 (ENP: n = 38; Usual ED medical care during ESP hours: n = 50)	**ESP:** Independent management of patients from triage to discharge. Permitted to request x-rays, prescribe limited medications and manage fractures **Usual ED medical care:** Care provided to patients by ED physicians	• Wait time = time in min from presentation to the ED to the commencement of service • LOS = time in min from arrival at ED to discharge • Access block = not reported • Adverse events = not reported
Sayer et al. (2018)	Retrospective cohort (III-2)	**ESP group:** n = 360 Median age (yr) = 41 (IQR 30, 53) Sex = 191 M, 169 F Mode ATS = four (82%) **Usual ED medical care group:** n = 729 Median age (yr) = 42 (IQR 31, 54) Sex = 350 M, 379 F Mode ATS = four (60%)	**ESP:** Autonomous selection and management of patients. Able to perform tasks traditionally performed by medical specialists **Usual ED medical care:** Care provided to patients by ED physicians or ED nurse practitioners	• Wait time = time in min from presentation to the ED to the commencement of service • LOS = time in min from arrival at ED to discharge • Access block = not reported • Adverse events = representations
Sutton et al. (2015)	Prospective cohort (III-2)	**Patients managed by ESPs (analysed for adverse events without comparison):** n = 1,320 **ESP group (analysed for LOS):** n = 1,167 Mean age (yr) = 33 (SD 19) **Usual ED medical care group (analysed for LOS):** n = 1,167 Mean age (yr) = 35 (SD 23)	**ESP:** Independent selection and management of patients from triage to discharge. Permitted to refer for diagnostic imaging without consultation with ED physicians **Usual ED medical care:** Care provided to patients by ED physicians or ED nurse practitioners	• Wait time = not reported • LOS = time in min from arrival at ED to discharge • Access block = not reported • Adverse events = representations, complaints and reported incidents
Taylor et al. (2011)	Prospective non-randomised controlled trial (III-1)	**ESP group:** n = 182 Mean age (yr) = 37 (SD 15) Sex = 120 M, 62 F Mode ATS = four (69%) Mode diagnosis = soft tissue injury (79%) **Usual ED medical care group:**	**ESP:** Autonomous assessment and management of patients from triage to discharge. Able to order imaging and prescribe medications under the name of the emergency consultant once approached. Interpretation of imaging conducted in	• Wait time = time in min from presentation to the ED to the commencement of service • LOS = time in min from arrival at ED to discharge • Access block = not reported • Adverse events = representations

Table 2. Summary of included studies (continued)*

Study	Design and NHMRC level of evidence	Population	Intervention	Outcome measures
		n = 124 Mean age (yr) = 47 (SD 21) Sex = 66 M, 58 F Mode ATS = four (76%) Mode diagnosis = soft tissue injury (90%)	consultation with emergency consultant as per protocol **Usual ED medical care:** Care provided to patients by secondary contact physiotherapists after assessment and referral from an ED physician	

*ATS, Australasian Triage Scale; ED, emergency department; ENP, extended scope nurse practitioner; ESP, extended scope physiotherapist; F, female; LOS, length of stay; M, male; n, number; NHMRC, National Health and Medical Research Council; SCP, secondary contact physiotherapist; SD, standard deviation

Effect of Extended Scope Physiotherapists

Wait Time

In comparison with usual ED medical care in three studies,[34,36,39] ESPs resulted in a statistically significant medium to large reduction in wait time (Cohen's *d* effect size: -0.54; 95% CI: -0.64 to -0.45) (Figure 3, also see Figure 4 in Appendix 3 for detailed forest plot). As there was considerable heterogeneity (I^2=39.6; H^2=1.7) between the pooled studies, the results of the remaining included studies investigating wait time were also interpreted. Six out of ten studies were in agreement with the meta-analysis, suggesting that ESPs significantly reduced wait time for all patients in comparison to usual ED medical care providers ($p<0.05$)[33-36,38,39] (Tables 3 and 4). Goodman et al[16] and McClellan et al[37] suggested the presence of a trend towards a greater reduction in wait time when managed by ESPs. Over 90% of patients managed by ESPs were seen within ACEM wait time guidelines in two studies.[17,35] Patients in ATS three did not meet these guidelines in one study.[15]

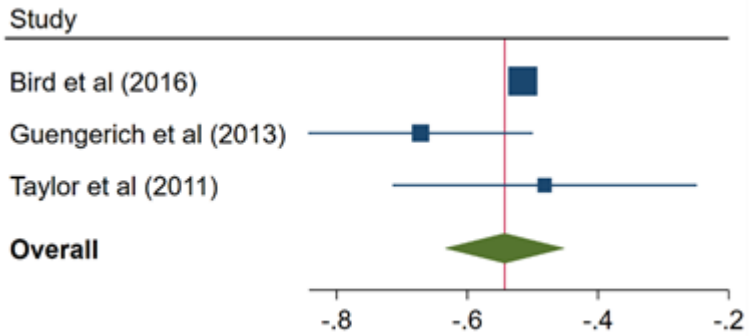

Figure 3. Meta-Analysis of the Effect of ESPs on Wait Time in Comparison with Usual ED Medical Care

Length of Stay

When compared with usual ED medical care in three studies,[18,36,39] ESPs resulted in a statistically significant medium to large reduction in LOS (Cohen's *d* effect size: -0.79; 95% CI: -0.86 to -0.72; I^2=0.00; H^2=1.00) (Figure 4, also see Figure 5 in Appendix 3 for detailed forest plot). Six out of eight studies were in agreement with the meta-analysis, suggesting that ESPs significantly reduced LOS for all patients in comparison to usual ED medical care ($p<0.05$)[18,33,35,36,38,39] (Tables 3 and 4). McClellan et al[37] suggested the presence of a trend towards a greater reduction in LOS when managed by ESPs. Over 90% of patients were admitted or discharged from the ED within four hours in six studies.[15,16,34,35,38,39] Kinsella et al[17] reported that only 86% of patients managed by ESPs met the four-hour LOS target.

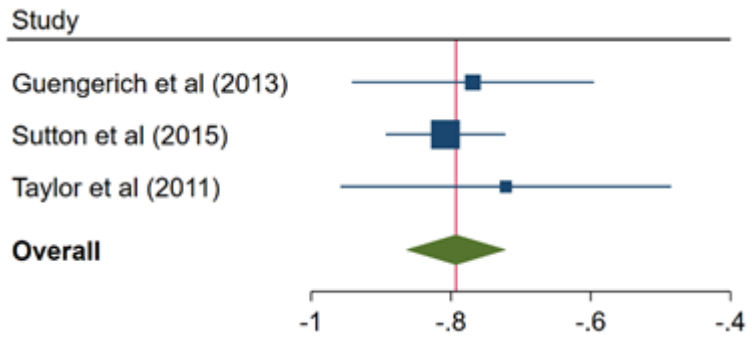

Figure 4. Meta-Analysis of the Effect of ESPs in LOS in Comparison with Usual ED Medical Care

Table 3. Main Results of Included Studies by Outcome Measure (mean)**

Study	Groups		Difference between groups
	ESP [mean (SD)]	Usual ED medical care [mean (SD)]	ESP minus usual ED medical care
Wait time (min)			
Alkhouri et al. (2019)	Not provided	Not provided	-10 (p<0.001)
Bird et al. (2016)	24 (39)	55 (62)	-31 (95% CI: -32 to -30)
Goodman et al. (2018)	19	39	-20
Guengerich et al. (2013)	41 (47)	84 (77)	-43 (p=0.001)
McClellan et al. (2006)	43	80	-37
Taylor et al. (2011)	43.3 (41)	68.3 (64.7)	-25 (95% CI: 12.1 to 38.0)
Length of stay (min)			
Alkhouri et al. (2019)	Not provided	Not provided	-108 (p<0.001)
Guengerich et al. (2013)	131 (72)	205 (115)	-74 (p=0.001)
McClellan et al. (2006)	69	99	-30
Sutton et al. (2015)	103 (65)	185 (128)	-82 (95% CI: 75 to 91)
Taylor et al. (2011)	134.1 (58.4)	193.6 (108.6)	-59.5 (95% CI: 38.4 to 80.6)

**CI, confidence interval; ED, emergency department; ESP, extended scope physiotherapist; SD, standard deviation

Table 4. Main Results of Included Studies by Outcome Measure (median)***

Study	Groups		Difference between groups
	ESP [median (IQR)]	Usual ED medical care [median (IQR)]	ESP minus usual ED medical care
Wait time (min)			
de Gruchy et al. (2015)	19.6 (7.6, 42.6)	Not provided	Not provided
Gill & Stella (2013)			
ATS three	7	13	-6 (ES: 0.36)
ATS four	10	26	-16 (ES: 0.31)
ATS five	9	25	-16 (ES: 0.31)
Guengerich et al. (2013)	22 (8, 57)	63 (19, 132)	-41 (p<0.001)
Kinsella et al. (2018)			
ATS three	8 (5, 17.8)	13 (6, 26)	-5 (p=0.061)
ATS four	9.5 (3.3, 18)	25 (10, 56)	-15.5 (p=0.001)
ATS five	22 (13, 42)	38 (19, 62)	-16 (p=0.536)
Sayer et al. (2018)	13 (5, 32)	32 (15, 66)	-19 (p<0.001)
Length of stay (min)			
Gill & Stella (2013)			
ATS three	140	151	-11 (ES: 0.44)
ATS four	121	141	-20 (ES: 0.42)
ATS four	100	124	-24 (ES: 0.41)

Kinsella et al. (2018)			
ATS three	184.5 (122.6, 266.5)	194 (149, 268)	-9.5 (p=0.33)
ATS four	157.5 (117, 209.8)	198 (147, 253.3)	-40.5 (p<0.001)
ATS five	106.5 (90.5, 123.5)	176 (122, 234)	-69.5 (p=0.51)
Sayer et al. (2018)	141 (99, 195)	175 (117, 239)	-34 (p<0.001)

***ATS, Australasian Triage Scale; ED, emergency department; ES, effect size; ESP, extended scope physiotherapist

Access Block

While none of the included studies investigated access block in isolation, the authors of eight studies suggested that ESPs had the potential to reduce access block by reducing wait time and LOS, improving patient throughput, hastening discharge and reducing ED overcrowding.[15,17,18,33,35,36,38,39]

Adverse Events

Eight studies evaluated the impact of ESPs on patient safety in terms of adverse events[15-18,33,36,38,39] (Table 5). Four out of eight studies found no significant difference in the number of representations to EDs between the ESP and usual ED medical care groups (p>0.05; RR: 1.02; 95% CI: 0.51 to 2.05).[33,36,38,39] No events or patient complaints were associated with management by ESPs in the study by Goodman et al,[16] however Kinsella et al[17] and Sutton et al[18] reported three[17] and 33[18] representations, while de Gruchy et al[15] identified two missed diagnoses.

Table 5. Number of Adverse Events****

Study	Groups		Difference between groups
	ESP	Usual ED medical care	ESP minus usual ED medical care
Alkhouri et al. (2019)	Not provided	Not provided	p>0.05
de Gruchy et al. (2015)	2	Unknown	N/A
Goodman et al. (2018)	0	Unknown	N/A
Guengerich et al. (2013)	31	31	0
Kinsella et al. (2018)	2	1	1
Sayer et al. (2018)	17	70	-53 (p=0.243)
Sutton et al. (2015)	33	Unknown	N/A
Taylor et al. (2011)	18	12	6 (RR: 1.02; 95% CI: 0.51 to 2.05)

****CI, confidence interval; ED, emergency department; ESP, extended scope physiotherapist; N/A, not applicable

DISCUSSION

The results of this systematic review provide evidence from eleven cohort, mixed method, and non-randomised controlled studies involving 303,698 patients that ESPs significantly reduced wait time and LOS in comparison to usual ED medical care, while maintaining equivalent safety of care.[15-18,33-39] Through these effects, ESPs were also suggested to have the potential to reduce access block. While supported by the meta-analyses, these findings must be interpreted with caution due to reduced control over bias and confounding, moderate heterogeneity and reduced precision of results.

While statistically significant reductions in wait time for patients in ATS four and five were extremely supportive of ESPs in the management of lower urgency patients in EDs,[36,39] the inability to meet ACEM wait time guidelines for patients in ATS three[15] may suggest that ESPs do not effectively manage higher urgency patients. Although, on comparison with studies that reported statistically significant reductions in wait time for patients assigned to ATS three, four and five,[33-35,38] the ability of ESPs to meet ACEM wait time guidelines for higher urgency patients may have been limited due to differences in extended scope roles. In addition to the independent ordering and interpretation of radiographic imaging and autonomous management of fractures reported as ESP roles in the studies by Alkhouri et al[33] and Gill and Stella,[35] ESPs in the study by de Gruchy et al[15] were also able to assist in the relocation of dislocated joints under anaesthesia. As joint relocations under anaesthesia are roles typically founded in the field of medicine and take a considerable amount of time to perform,[41] management of these patients by ESPs may have extended the wait time for subsequent patients, contributed to an inability to meet ACEM wait time guidelines and ultimately led to reduced ESP effectiveness. Future research may aim to evaluate the impact that variations in roles have on the effectiveness of ESPs in EDs to determine the optimal role for the provision of effective and quality patient care. Research in this area may also lead to national and/or international consensus regarding the role of ESPs.

Although the meta-analysis found that ESPs resulted in a statistically significant reduction in wait time in comparison to usual ED medical care regardless of role (Cohen's *d* effect size: -0.54; 95% CI: -0.64 to -0.45), it is important to consider that three moderately

heterogeneous studies were pooled,[34,36,39] the precision of the result is likely to be reduced given the broad 95% CIs in the studies by Guengerich et al[36] and Taylor et al,[39] and the true effect of ESPs on wait time is likely to be lower given that post-hoc effect sizes were combined.[42] Further robust studies which adopt a similar methodology to Bird et al,[34] or that of RCTs, and that calculate sample and effect sizes a priori, are therefore required to be combined within a meta-analysis to ensure the provision of valid estimates of ESP effectiveness that are applicable to clinical practice.

The included studies clearly demonstrated a reduction in LOS for patients managed by ESPs; suggesting that ESPs were superior to usual ED medical care.[18,33,35-39] Although discrepancies in LOS were noted, with patients in ATS three and five demonstrating an equivalent LOS when managed by ESPs or usual ED medical care providers,[17] these results may be associated with the invariably short LOS experienced by patients in urgent and non-urgent categories regardless of the managing health professional,[43] study-related factors such as reduced sample size[44] or genuine equivalence between health professionals.

To comply with the NEAT, EDs are required to discharge 90% of patients within four hours.[9] The majority of included studies reported that ESPs met or exceeded this target[15,16,34,35,38,39] and, given that no regional or metropolitan hospital or health institution in Australia has been found to consistently discharge greater than 75% of patients within this four hour timeframe,[4,9] are incredibly supportive of ESPs in EDs in the context of these metrics. When comparing the NEAT compliance rate of ESPs in the study by Kinsella et al,[17] who reported that ESPs underwent informal education and training and a work-based credentialing process prior to employment in the ED, with that of Taylor et al,[39] who investigated ESPs with postgraduate qualifications and prior experience of EDs, discrepancies may have resulted from variations in level of training. Considering that the training requirements for ESPs have not yet been established, future research may aim to evaluate the association between training level and effectiveness and determine the core knowledge and skills required by ESPs to improve ED performance and patient outcomes.[45]

Not unlike the meta-analysis of wait time, the meta-analysis of LOS may also have reduced validity and be inappropriate from which to base recommendations for clinical practice. While no heterogeneity was identified when the three studies were pooled,[18,36,39] it is important to recognise that a large proportion of patients managed by ESPs were withdrawn from the study by Sutton et al,[18] and that there was a large potential for confounding by treatment urgency in the study by Guengerich et al,[36] with the ESP group managing a greater proportion of patients in lower urgency triage categories. Although the results of the systematic review were reflective of that of the meta-analysis, further high-quality studies with limited bias and patient withdrawal are required to be combined within a meta-analysis in order to estimate an accurate effect of ESPs on LOS.

As none of the included studies and no studies at the time of writing investigated the impact of ESPs on access block in EDs using a standardised calculation, the effectiveness of ESPs on this outcome could not be accurately determined, rather, it may only be loosely suggested that by reducing LOS, ESPs have the potential to improve patient throughput, and therefore have the potential to reduce access block.[15,17,18,33,35,36,38,39] Future studies may consider measuring 'total access block time' (the number of minutes in excess of eight hours that the patient remains in the ED prior to admission or discharge)[46] to truly determine the impact of ESPs on this outcome, and to prevent clinical decisions being made from inferences of effectiveness.

Overall, the included studies indicated that ESPs managed their caseloads with equivalent or increased safety compared to usual ED medical care.[15-18,33,36,38,39] While these results are extremely supportive of ESPs, the absence of events and patient complaints in one study seemed unrealistic given the nature of emergency care.[16] As representations have been proposed as one of the most clinically utilised measures for monitoring safety due to their ability to identify adverse events and poor outcomes caused by ED care,[25] failure to measure this outcome may have resulted in the overestimation of safety of care; especially in light of the findings of Sutton et al[18] who investigated incidents, patient complaints, and representations. Although studies that did investigate representations reported the presence of adverse events and supported the notion that safety of care may be overestimated when this outcome is not evaluated,[17,33,36,38,39] vast differences in the number of representations between studies were noted and may have been the result of differences in the definition of this outcome. Representations can be defined as planned (patients who return for a scheduled review), unplanned (patients who return for an unscheduled visit) or both.[47,48] Safety of care is often underestimated in studies that define representations as both planned and unplanned, but is more effectively described when only unplanned representations are measured, considering that unplanned representations are perceived to be premature discharges from the first ED visit or adverse events.[47,48] These findings have implications for future research in that studies will be required to monitor representations,[49] using an internationally accepted definition, in order to make conclusions regarding ESP safety, and reviews should be considerate of overestimation of safety as a plausible explanation for the presented results.

Recent debate regarding the endorsement of independent prescribing rights for ESPs has reached a standstill due to the argument of a potential compromise to safety of the public.[50,51] In the only study investigating the safety of ESPs who were able to

independently prescribe a limited formulary of medications under the name of the emergency consultant in this review, no significant differences in representations between ESPs and usual ED medical care providers were found.[39] While by no means a sufficient amount of evidence to invalidate the safety argument or to inform a clinically safe redefinition of ESPs to include independent prescribing, the results of Taylor et al[39] suggest that ESPs are at least equivalent to usual ED medical care with regards to medication-related representations and may be a precursor to further robust studies evaluating the impact of independent ESP prescribing on patient safety.

Limitations

One of the major limitations of this systematic review was that its conclusions and recommendations were reliant on the quality of the included primary studies, in which the matching of cohorts without consideration of ATS category was one of the main reasons for low CCAT scores. Failure to match the investigated cohorts by ATS category resulted in between-group differences in treatment urgency at baseline, with the patients managed by ESPs of a lower treatment urgency, and likely lower complexity, than those managed by usual ED medical care.[15,17,33,36,38] Therefore, while ESPs were found to improve effectiveness and safety of care, confounding of these results by treatment urgency made it difficult to establish a clear causal link between ESP services and outcomes, and reduced the validity and applicability of the conclusions and recommendations provided.[52] Though it may be premature to suggest the employment of ESPs in EDs as a more effective substitute for usual ED medical care due to the presence of confounding, the findings highlight that ESPs may have a place in EDs as additional staff members, improving throughput and access to care for patients in lower urgency triage categories. Other limitations of the systematic review were related to the inclusion of studies of diverse designs and studies published in the English language only, as well as the independent screening and potential inadvertent exclusion of studies by the primary researcher.[53]

Limitations specific to the meta-analyses included the analysis of aggregate patient data and the combination of post-hoc effect sizes. The analysis of aggregate data as opposed to individual patient data significantly reduced the number of studies able to be combined within the meta-analysis, potentially leading to bias and reduced generalisability.[54] Future studies may consider conducting an individual patient data meta-analysis to ensure the inclusion of data from all relevant studies, not only those with uniform summary measures, and to provide an accurate and precise estimate of the true effectiveness and safety of ESPs.[54] As the meta-analyses combined post-hoc effect sizes, the magnitude of the results should also be treated with caution as the 'true' effect is likely to be lower than the meta-analyses indicate.[42] Unfortunately, given these limitations, the meta-analyses performed in this study should be considered exploratory in nature. While the results may not be applicable or generalisable to clinical practice, they provide plausible estimates of ESP effectiveness, in the context of the results of the remaining included studies, that may guide future evaluation studies.[55]

CONCLUSION

In conclusion, the aims of this systematic review and meta-analysis were to evaluate and estimate the effectiveness of ESPs at delivering services in EDs, to determine the ability of ESPs to reduce access block, to evaluate the safety of ESPs, and to discuss the quality of the available literature, thus providing recommendations regarding the application of ESPs in clinical practice. The included studies agreed that ESPs reduced wait time for patients in lower urgency ATS categories, however, inconsistencies in their ability to meet wait time targets may have been due to variations in the roles ESPs were able to perform. The included studies also clearly demonstrated that ESPs reduced LOS, however their inability to comply with the NEAT in some cases may have been the result of differences in the level of training. The meta-analyses were supportive of the results of the systematic review, although should be considered exploratory in nature and may not be appropriate to guide clinical practice.

Extended scope physiotherapists were reported to have the potential to reduce access block and were not associated with adverse events such as patient complaints, incidents or injuries. Although, it is important to carefully consider the monitoring of representations as well as the definition of this outcome. As ESPs were not found to result in any more medication-related representations than usual ED medical care providers, investigation into independent prescribing rights for ESPs may be warranted. Finally, while confounding was a significant limitation of the included studies, the results may still indicate that although not an appropriate substitute for usual ED medical care, ESPs may have a place in EDs as additional staff members, managing patients in lower urgency triage categories.

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APPENDIX 1: Search Strategy

Database: Medline (Ovid)

1. "exercise therap*".mp.
2. kinesiotherap*.mp.
3. "manual therap*".mp.
4. physiotherap*.mp.
5. "physical therap*".mp.
6. physio.mp.
7. 1 OR 2 OR 3 OR 4 OR 5 OR 6
8. "emergency department".mp.
9. "emergency room".mp.
10. "emergency service".mp.
11. "accident and emergency department".mp.
12. "A and E department".mp.
13. "A&E".mp.
14. "casualty department".mp.
15. "trauma cent*".mp.
16. 8 OR 9 OR 10 OR 11 OR 12 OR 13 OR 14 OR 15
17. advanc*.mp.
18. enhanc*.mp.
19. exp*.mp.
20. ext*.mp.
21. 17 OR 18 OR 19 OR 20
22. practi*.mp.
23. scope.mp.
24. 22 OR 23
25. 21 AND 24
26. "role enhanc*".mp.
27. "role redefin*".mp.
28. "role substitut*".mp.
29. "consultant therapist*".mp.
30. 26 OR 27 OR 28 OR 29
31. 25 OR 30
32. "randomi*ed".mp.
33. RCT.mp.
34. cohort.mp.
35. retrospective.mp.
36. prospective.mp.
37. "cohort analy*".mp.
38. "follow*up".mp.
39. observation*.mp.
40. audit.mp.
41. longitudinal.mp.
42. "cross*sectional".mp.
43. 32 OR 33 OR 34 OR 35 OR 36 OR 37 OR 38 OR 39 OR 40 OR 41 OR 42
44. 7 AND 16 AND 31 AND 43

Databases: CINAHL (EBSCOhost), Scopus, Cochrane library and Informit

1. ("exercise therap*" OR kinesiotherap* OR "manual therap*" OR physiotherap* OR "physical therap*" OR physio)
2. ("emergency department" OR "emergency room" OR "emergency service" OR "accident and emergency department" OR "A and E department" OR "A&E" OR "casualty department" OR "trauma cent*")
3. (((advanc* OR enhanc* OR exp* OR ext*) AND (practi* OR scope)) OR "role enhanc*" OR "role redefin*" OR "role substitut*" OR "consultant therapist*")
4. ("randomi*ed" OR RCT OR cohort OR retrospective OR prospective OR "cohort analy*" OR "follow*up" OR observation* OR audit OR longitudinal OR "cross*sectional")
5. 1 AND 2 AND 3 AND 4

Database: PEDro

"exercise therap*" kinesiotherap* "manual therap*" physiotherap* "physical therap*" physio "emergency department" "emergency room" "emergency service" "accident and emergency department" "A and E department" "A&E" "casualty department" "trauma cent*" advanc* enhanc* exp* ext* practi* scope "role enhanc*" "role redefin*" "role substitut*" "consultant therapist*" "randomi*ed" RCT cohort retrospective prospective "cohort analy*" "follow*up" observation* audit longitudinal "cross*sectional"

APPENDIX 2: Data Extraction Template[1,2]

General Information			Methodology			
Author and date of publication	**Research design and NHMRC level of evidence**	**Country of publication**	**Patient sample and demographics**			
			Total sample size	*Sample size of intervention group*	*Description of the intervention sample (age, sex, diagnosis and ATS)*	*Sample size of control group*

Methodology (continued)						
Patient sample and demographics				**Data collection**		
Description of the control sample (age, sex, diagnosis and ATS)	*Method of sampling*	*Are there baseline differences between the intervention and control groups? Are they statistically significant?*	*Is the sample representative of the target population? If not, how do the populations differ?*	*Method of data collection*	*Setting of data collection (e.g. 'Fast Track' area in the ED, metropolitan vs. regional, public vs. private etc.)*	*Duration of study period*

Methodology (continued)					
Intervention					
What intervention was delivered by the ESPs? (Describe the role/scope of practice of the ESP)	*Demographics of the ESPs (number, education/training in intervention delivery, hours of work in the ED etc.)*	*What was the control? (Describe the role/scope of practice of the provider)*	*Demographics of the providers in the control group (number, education/training in intervention delivery, hours of work in the ED etc.)*	*Duration of intervention (document the start and end dates) (if applicable)*	*Except for the intervention, were both groups treated equally?*

Methodology (continued)						
Risk of bias						
Is the research design appropriate to answer the research question?	*Were patients selected in a way that minimised bias?*	*Were patients exposed to factors other than the intervention?*	*Were the outcomes measured appropriately? Was the same method of measurement used in both groups?*	*Did the authors consider all relevant outcomes?*	*Were all of the patients accounted for at the end of the study period? Were they analysed by intention to treat?*	*Did the authors receive funding to conduct the study? If so, who provided the funding?*

Study Quality	Outcomes				Results		
Critical appraisal result	**Primary outcome(s)**		**Secondary outcome(s)**		**Statistical tests performed**	**Results of the intervention group**	**Results of the control group**
CCAT total score (and CCAT total percentage score)	*Outcome(s) measured*	*Definition of the outcome (how was the outcome measured?)*	*Outcome(s) measured*	*Definition of the outcome (how was the outcome measured?)*			

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APPENDIX 3: Detailed Forest Plots

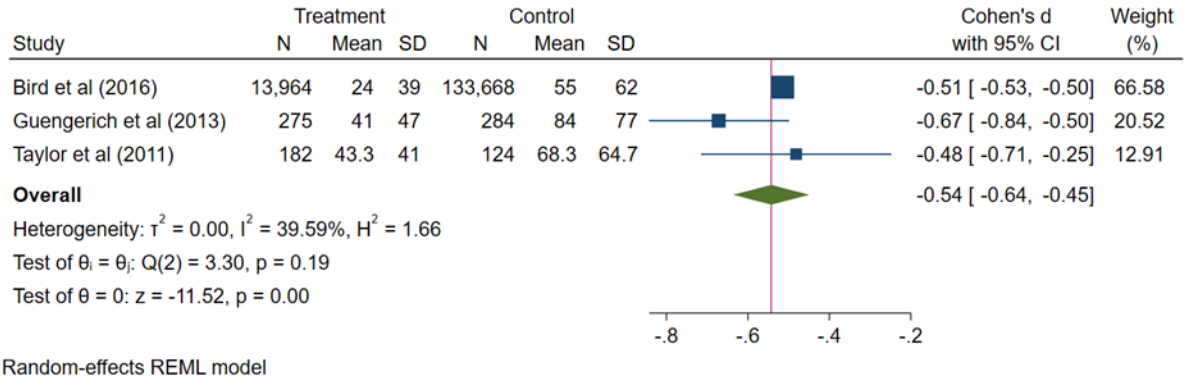

Figure 4: Meta-Analysis of the Effect of ESPs on Wait Time in Comparison with Usual ED Medical Care (detailed forest plot)

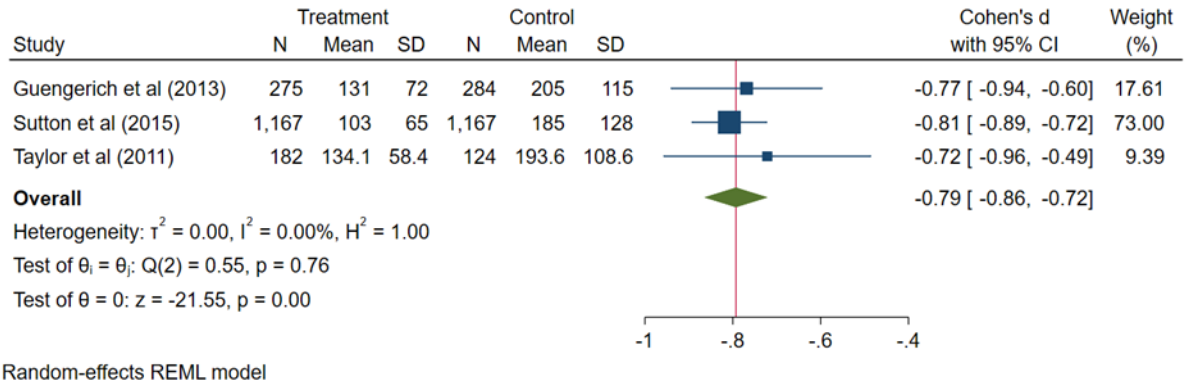

Figure 5. Meta-Analysis of the Effect of ESPs on LOS in Comparison with Usual ED Medical Care (detailed forest plot)