Pharmacists in Trauma: a randomised controlled trial of emergency medicine pharmacists in trauma response teams

Cristina Roman ,[1,2,3,4] Michael Dooley,[1,3] Mark Fitzgerald ,[5,6,7] De Villiers Smit,[2,4] Peter Cameron,[2,4] Biswadev Mitra [2,4]

Handling editor Ed Benjamin Graham Barnard

[1]Pharmacy Department, Alfred Health, Melbourne, Victoria, Australia
[2]Emergency and Trauma Centre, Alfred Health, Melbourne, Victoria, Australia
[3]Faculty of Pharmacy and Pharmaceutical Sciences, Monash University, Melbourne, Victoria, Australia
[4]School of Public Health and Preventive Medicine, Monash University, Melbourne, Victoria, Australia
[5]Trauma Service, Alfred Health, Melbourne, Victoria, Australia
[6]National Trauma Research Institute, Alfred Health, Melbourne, Victoria, Australia
[7]School of Translational Medicine, Faculty of Medicine, Monash University, Melbourne, Victoria, Australia

Correspondence to
Dr Cristina Roman, Pharmacy Department, Alfred Health, Melbourne, VIC 3001, Australia; c.roman@alfred.org.au

Received 23 October 2022
Accepted 20 April 2024
Published Online First 15 May 2024

Check for updates

© Author(s) (or their employer(s)) 2024. No commercial re-use. See rights and permissions. Published by BMJ.

To cite: Roman C, Dooley M, Fitzgerald M, *et al*. *Emerg Med J* 2024;**41**:397–403.

ABSTRACT

Background Analgesia is an important component for patient well-being, but commonly delayed during trauma resuscitation. The Pharmacists in Trauma trial assessed the effects of integrating pharmacists into trauma response teams to improve analgesia delivery and medication management.

Methods This unblinded randomised trial compared emergency medicine (EM) pharmacist involvement in trauma callouts versus standard care at an Australian level 1 trauma centre. Randomisation was performed via an online single sequence randomisation service. Eligible patients included those managed with a trauma callout during working hours of an EM pharmacist. Pharmacists were able to prescribe medications using a Partnered Pharmacist Medication Charting model. The primary outcome was the proportion of patients who had first dose analgesia within 30 min compared using the χ^2 test.

Results From 15 July 2021 until 31 January 2022, there were 119 patients randomised with 37 patients excluded as no analgesia was required. There were 82 patients included for analysis, 39 in the control arm and 43 in the intervention arm. The primary outcome was achieved in 25 (64.1%) patients in the control arm and 36 (83.7%) patients in the pharmacist arm (relative risk 1.31; 95% CI 1.0 to 1.71; p=0.042). Time to analgesia in the control arm was 28 (22–35) mins and 20 (15–26 mins) with pharmacist involvement; p=0.025. In the pharmacist arm, the initial dose of analgesia was prescribed by the pharmacist for 38 (88.4%) patients. There were 27 other medications prescribed by the pharmacist for the management of these patients. There were no differences in emergency and trauma centre or hospital length of stay.

Conclusion Addition of the EM pharmacist in trauma response teams improved time to analgesia. Involvement of an EM pharmacist in trauma reception and resuscitation may assist by optimising medication management, with members of the team more available to focus on other life-saving interventions.

Trial registration number ACTRN12621000338864.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ With an increasing ability to provide life-saving interventions after major trauma, rapid decision-making and prioritisation of many competing interests are essential.
⇒ Mitigation of uncontrolled pain should be a priority, however the administration of analgesia is frequently delayed in this cohort.

WHAT THIS STUDY ADDS

⇒ The addition of an emergency medicine (EM) pharmacist to trauma teams increased analgesia administration within 30 min of patient arrival.
⇒ Allocating pharmacists to medication management after major trauma improves speed and delivery of medication.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study supports the addition of an EM pharmacist to trauma teams to reduce time to first analgesia.
⇒ Pharmacists may also provide improved understanding and administration of other medications during trauma resuscitation.

INTRODUCTION

Multidisciplinary trauma response teams coordinate the reception and resuscitation of seriously injured patients. With an increasing ability to provide life-saving interventions after major trauma, rapid decision-making and prioritisation of many competing interests are essential.[1] In this dynamic setting, appropriate and timely analgesia is an important component for patient well-being, but frequently delayed.[2 3] Factors associated with a lack of provision of analgesia are insufficient staffing or ED overcrowding, perceptions that management of pain is a minor priority in trauma, and inadequate knowledge of pharmacokinetics and pharmacodynamics of medications used.[4–6]

There are significant consequences of uncontrolled pain in trauma patients. Prompt relief of pain, particularly for major trauma patients has been associated with reduced stress response, lower hospital length of stay (LOS), reduced potential for development of chronic pain and reduced amount of sedation required for intubated patients, days on the ventilator and LOS in intensive care units (ICU).[5 7–9]

Pharmacists have not traditionally been involved in trauma response teams in the ED. However, emergency medicine (EM) clinical pharmacy is a rapidly growing area of practice. There is increasing evidence that EM pharmacists are associated with

Emerg Med J: first published as 10.1136/emermed-2022-212934 on 15 May 2024. Downloaded from http://emj.bmj.com/ on June 22, 2024 at Ben Gurion Uni MALMAD Consortia. Protected by copyright.

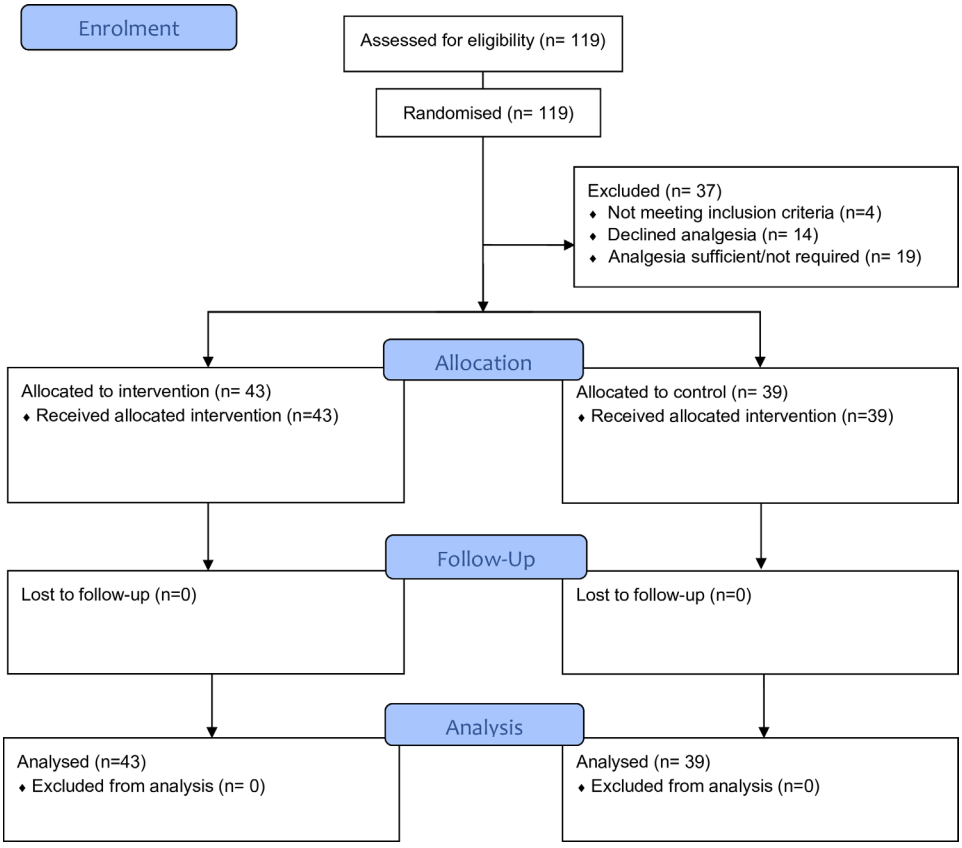

Figure 1 Consolidated Standards of Reporting Trials (CONSORT) flow diagram.

improved patient outcomes.[10–12] These include a reduction in medication errors, increased identification and reporting of adverse drug reactions, identification of medication-related problems and early consideration of existing home medications on admission to hospital. A recent systematic review reported EM pharmacist involvement in acutely unwell patients as an emerging area of practice.[13]

The Pharmacists in Trauma (PHIT) Trial assessed the effects of integrating pharmacists into trauma response teams to improve analgesia delivery and medication management. We hypothesised that when an EM pharmacist is integrated into the trauma response, the timely provision of appropriate analgesia could be improved. In addition, the EM pharmacist could facilitate an accurate medication history, prescribe and draw up other time-critical medications, while the trauma team focused on other life-saving interventions.

METHODS

Study design and setting

An unblinded randomised trial comparing early EM pharmacist involvement in trauma callouts versus standard care was performed. This study was conducted at an adult major referral hospital in metropolitan Melbourne, Victoria, Australia with an annual attendance of approximately 70 000 patients. During the period of the study, the Emergency and Trauma Centre (E&TC) was staffed by emergency physicians between the hours of 07:00 and 02:00, Tuesday–Thursday, and 24 hours a day, Friday–Monday, and advanced trainees in EM at all hours. The hospital provides state services for major trauma, burns, haemophilia, cystic fibrosis, heart and lung transplants, HIV, adult haematological malignancies. It is the busiest adult level 1 trauma centre in Australia, with over 1200 major trauma presentations annually and 5000 trauma admissions. Major trauma definition includes all patients with injury as their principle diagnosis who meet the following criteria: death after injury, Injury Severity Score (ISS) greater than 12 or significant injury to two or more ISS body regions, admission to an ICU for more than 24 hours requiring mechanical ventilation, requiring urgent surgery for intracranial, intrathoracic or intra-abdominal surgery or fixation of pelvic or spinal fractures, electrical injuries, drowning or asphyxia, admitted to ICU for more than 24 hours and requiring mechanical ventilation or death, all patients with a LOS of 3 days or more unless they meet Victorian State Trauma Registry exclusion criteria, all patients transferred from another hospital for the purposes of receiving further emergency care or admitted to a high dependency area unless they meet Victorian State Trauma Registry exclusion criteria.[14]

Selection of participants

Prearrival notifications (trauma callouts) are activated if a trauma patient meets predetermined criteria based on mechanism of injury and observations. Reception of trauma callout patients is delivered by a multidisciplinary trauma response team.[15] All patients managed with a trauma callout during EM pharmacist working hours (Monday–Friday, 07:00–21:00 hours) were eligible for enrolment.

Patients were randomised when the pharmacist was available to attend for early involvement in trauma callouts or standard care. Patients were excluded from enrolment if arriving after secondary transfer from another hospital, if trauma occurred more than 6 hours prior to arrival, or if they were receiving analgesia via a continuous infusion. After randomisation, patients were excluded from analysis if they were deemed to not require any analgesia by the medical team leader on arrival.

Emerg Med J: first published as 10.1136/emermed-2022-212934 on 15 May 2024. Downloaded from http://emj.bmj.com/ on June 22, 2024 at Ben Gurion Uni MALMAD Consortia. Protected by copyright.

Table 1 Baseline characteristics of age, gender, anticoagulant use, injury details, analgesia, initial observations and other conditions for intervention and control groups

	Control arm (no pharmacist) n=39	Intervention arm (pharmacist) n=43
Age, years, mean (SD)	51.0 (19.2)	42.6 (21.7)
Sex, n (%)		
Male	28 (71.8)	30 (69.8)
Female	11 (28.2)	13 (30.2)
Antiplatelets*†, n (%)	6 (15)	2 (4.6)
Anticoagulants*†, n (%)	1 (2.6)	7 (16.3)
Rivaroxaban or apixaban	1	5
Dabigatran	0	2
Warfarin	0	0
Anticoagulants* requiring urgent reversal†, n (%)	0	1 (2.3)
Time since injury:*		
<1 hour	6	7
1–2 hours	21	26
>2–3 hours	7	7
>3 hours	1	1
Injury type, n (%)		
Blunt	36 (92.3)	40 (93.0)
Penetrating	3 (7.7)	3 (7.0)
ATS triage category, n (%)		
1	4 (10.3)	5 (11.6)
2	31 (79.5)	35 (81.4)
3	4 (10.5)	3 (7.0)
Mode of arrival, n (%)		
Ambulance, road, car	29 (74.3)	36 (83.7)
Helicopter	8 (20.5)	7 (16.3)
Other	2 (5.1)	0
Prehospital analgesia, n (%)	36 (92.3)	36 (83.7)
Pain score, NRS on arrival, median (IQR)	5 (3–8)	4 (0–7)
First analgesia type, n (%):		
Morphine	8 (20.5)	10 (23.3)
Fentanyl	17 (43.6)	28 (65.1)
Ketamine	7 (17.9)	0
Other	7 (17.9)	5 (11.6)
Initial GCS Score, median (IQR)	15 (14–15)	15 (15–15)
Initial SBP (mm Hg), mean (SD)	138.5 (35.7)	134.5 (32.8)
Initial HR, mean (SD)	82.7 (17.9)	86.3 (18.1)
Shock Index ≥1.0, n (%)	2 (5.1)	2 (4.7)
Presenting serum lactate (mmol/L), mean (SD)	2.15 (1.1)	2.16 (1.3)
Presenting serum INR, mean (SD)	1.0 (0.1)	1.1 (0.2)
RSI in the ED, n (%)	2 (5.1)	4 (9.3)
ISS, median (IQR)	9 (4–20)	9 (1–16)
TBI, n (%)	3 (7.7)	2 (7.0)

*Missing data in 6 patients.
†Home medications
ATS, Australasian triage scale; ATS, a clinical tool used to establish maximum wait times for medical assessment and treatment where 1 is for patients needing immediate review and 5 is for patients that can wait up to 120 min.; GCS, Glasgow Coma Scale; HR, heart rate; INR, international normalised ratio; ISS, injury severity score; NRS, numerical rating scale; RSI, rapid sequence induction; SBP, systolic blood pressure; SD, standard deviation; TBI, traumatic brain injury.

Randomisation was performed by one of the study investigators via an online single sequence randomisation service with allocations concealed via opaque, sealed, numbered envelopes prior to commencement of the study. During EM pharmacist working hours, the designated pharmacist available to attend a trauma callout selected the next envelope in sequence that corresponded to either the intervention or control arm.

Interventions

When a patient was randomised to the intervention arm, the EM pharmacist attended the trauma callout on patient arrival as part of the team. Specific responsibilities of the EM pharmacist were to: facilitate rapid analgesic decision-making after consultation with the medical team leader on previous allergies, known past medical history and current medications; prescribe and draw up analgesia for administration by a nurse; obtain an accurate and efficient medication history on patient arrival to identify patients that were taking anticoagulants and the need for urgent reversal. The EM pharmacist could also expedite prescribing, and administration of other medications such as antimicrobial prophylaxis, tetanus/diphtheria vaccination, nerve blocks, calcium administration, essential home medications and second dose analgesia including for patients who had undergone rapid sequence induction (RSI). Prescribing of medications occurred either directly by the EM pharmacist via the Partnered Pharmacist Medication Charting (PPMC) model or by medical staff.[12] Medical prescribing in a trauma callout occurred by verbal orders from the medical team leader that were documented by the trauma nurse scribe and prescribed in the electronic medical record retrospectively by medical staff. Prescribing via the PPMC model of care occurred by the pharmacist prescribing the medication before or at the time of administration directly into electronic medical records.[12] Pharmacist prescribing is not standard practice in most countries and requires additional training. Prescribing via the PPMC model of care requires a pharmacist to have 2 years of general clinical experience and successfully complete the PPMC credentialing. As part of the model a credentialed pharmacist takes a medication history then has a face-to-face discussion with the medical officer about current medical and medication-related problems, following which a medication management plan is agreed on. The medication management plan is documented in the patients' medical record and co-signed by the medical officer. Appropriate medications are then prescribed by the pharmacist on the patient's medication record.[12]

The EM pharmacists attending trauma calls have at least 2 years of clinical experience in hospital pharmacy practice and are required to complete formal training prior to involvement. Successful trauma credentialing includes completion of an inhouse online trauma module for pharmacists and successful involvement in a trauma callout under supervision by a senior pharmacist, the PPMC credentialing, Therapeutic Drug Monitoring of Aminoglycosides and Vancomycin credentialing, stroke thrombolysis credentialing and sepsis credentialing.[12 16–18]

In the standard care arm, the EM pharmacist did not attend the trauma callout on patient arrival as part of the team. The pharmacist communicated the treatment allocation to the medical team leader and nurse scribe and gave them a data collection form to complete. The pharmacist was available for consultation if requested by the trauma response team and would also review other patients based on clinical judgement and availability, after a time delay, which was current standard practice.

Outcomes

The primary outcome was the proportion of patients who received analgesia within 30 min of arrival into the E&TC. This target aligns with recommendations from peak professional organisations in EM worldwide.[19–22] Both the EM pharmacists and the trauma callout team were unblinded as to the primary

Emerg Med J: first published as 10.1136/emermed-2022-212934 on 15 May 2024. Downloaded from http://emj.bmj.com/ on June 22, 2024 at Ben Gurion Uni MALMAD Consortia. Protected by copyright.

Table 2 Primary and secondary outcomes for intervention and control groups

	Control arm (no pharmacist) n=39	Intervention arm (pharmacist) n=43	P value
Analgesia administration within 30 min of arrival, n (%)*	25 (64.1%)	36 (83.7%)	0.042
Median time to analgesia, minutes (IQR)	28 [(22–35)	20 (15–26])	0.025
Median time to prescription of analgesia, minutes (IQR)	41.5 (22–110)	14 (7–19)	<0.001
Median time to second dose analgesia, minutes (IQR)	75 (37–167)	56 (28–91)	0.12
LOS in E&TC, median hours (IQR)	5.4 (3.5–8.1)	5.3 (3.4–8.5)	0.90
LOS in hospital, median hours (IQR)	97.0 (28.5–194.9)	115.3 (27.5–190.2)	0.99

*Primary outcome.
E&TC, emergency and trauma centre; LOS, length of stay.

outcome. Time of arrival was defined as the time of patient registration. Time of first dose analgesia data were recorded prospectively by a trained staff member (trauma nurse scribe) who was a part of the trauma callout but not involved in the study via a data collection form.

The secondary outcomes were to describe the pharmacist intervention in medication management including the types of medications prescribed by the EM pharmacist and the number of patients that were identified as taking anticoagulation requiring urgent reversal, time to analgesia, time to prescription of analgesia defined as the time from registration until the first dose of analgesia was prescribed in the patients' medical record, time to second dose analgesia defined as the time from patient registration to the time the second dose of any analgesia was signed off on the electronic medical record, pain score 60 min postarrival, LOS in the E&TC and hospital, and death on hospital discharge. Initial pain score is documented electronically as a mandatory field at triage using the Numerical Rating Scale (NRS) from 0 to 10, where 0 is no pain and 10 is the worst pain imaginable. Subsequent pain score documentation is completed intermittently throughout the patient stay in the E&TC. Data for secondary outcomes and baseline characteristics were collected retrospectively via electronic medical records.

Analysis

A retrospective audit of 28 major trauma patients revealed that 67% of patients had first doses of analgesia within 30 min of arrival. In this trial, we assessed for a change in proportion of patients receiving analgesia within 30 min from 67% to 95% using an alpha of 0.05 and 80% power. A sample size of 37 patients was required for each group. To account for potential loss to follow-up and early deaths we aimed to recruit 40 patients with analgesia delivery in each arm.

Continuous data were summarised using means and standard deviation (SD) if near-normally distributed, reported with the use of rounded parentheses for SD. Medians with IQR were used if data were skewed, reported with the use of square brackets for IQR. Categorical variables were summarised using proportions. The primary outcome variable was reported using relative risk (RR) with 95% CIs, and proportions compared using the χ^2 test. Time to analgesia administration was displayed using a Kaplan-Meier survival graph and compared using the log-rank test. A value of $p<0.05$ was defined to be statistically significant. All analyses were performed using Stata V.15.0 (Statacorp, Texas, USA).

The trial was registered with the Australian New Zealand Clinical Trials Registry (ANZCTR) ACTRN12621000338864. There was no external funding for this trial.

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.

RESULTS

From 15 July 2021 until 31 January 2022, there were 119 patients randomised. Of these, 37 patients were excluded as no analgesia was required, leaving 82 patients for analysis: 39 in the control arm and 43 in the intervention arm (figure 1). No patients were lost to follow-up, and all patients were managed as allocated. Baseline characteristics of study participants are listed in table 1. One patient in the control arm and seven patients in the intervention arm were taking anticoagulants as home medications. The two groups appeared equally matched with regard to the listed variables. There were six different EM pharmacists that were involved in the intervention arm.

Primary outcome

Inclusion of the EM pharmacist in the trauma response team led to a significant reduction in time to first dose of analgesia. The primary outcome of first dose of analgesia administered within 30 min was achieved in 25 (64.1%) patients in the control arm and 36 (83.7%) patients in the intervention arm (RR 1.31; 95% CI 1.00 to 1.71; p=0.042).

Median time to analgesia in the control arm was 28 (22–35) min and 20 (15–26) min in the intervention arm; p=0.025 (table 2). Time to first dose of analgesia is illustrated in figure 2. Median time to prescription of analgesia on the electronic medical record was 41.5 (22–110) min in the control arm and 14 (7–19) min in the intervention arm (p<0.001). In the intervention arm, the initial dose of analgesia was prescribed by the pharmacist for 38 (88.4%) patients.

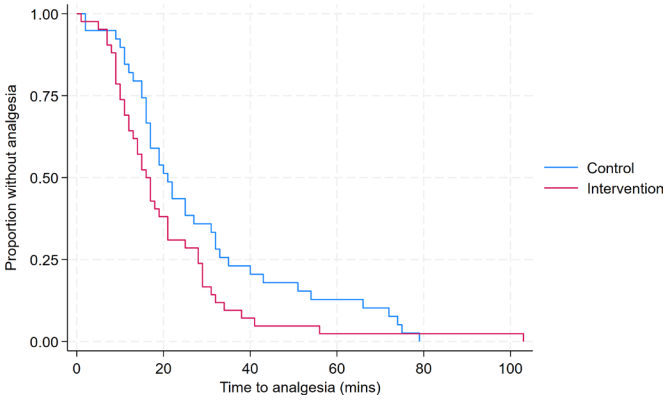

Figure 2 Kaplan-Meier time to first dose analgesia.

Emerg Med J: first published as 10.1136/emermed-2022-212934 on 15 May 2024. Downloaded from http://emj.bmj.com/ on June 22, 2024 at Ben Gurion Uni MALMAD Consortia. Protected by copyright.

The second dose of analgesia was administered after a median of 75 (37–167) min in the control arm and 56 (28–91) min in the pharmacist arm (p=0.12). In the intervention arm, the EM pharmacist prescribed a range of other medications apart from first dose analgesia including idarucizumab (for specific reversal of a patient taking dabigatran anticoagulation and administered at 82 min after presentation), sedation and analgesia post-RSI, local anaesthetics, antimicrobials, and tetanus prophylaxis (table 3).

At 60 min after arrival, there was no difference in median pain scores among the two groups (p=0.50). Median pain score in the control arm was 4.5 (2.5–6), while pain score in the intervention was 5.0 (2.5–6.5), however, there was missing data for 42/82 (51%) of patients. Median E&TC LOS in the control arm was 5.4 (3.5–8.1) hours and 5.3 (3.4–8.5) hours in the intervention arm; p=0.90. There were three patients admitted to the ICU in the control arm and five in the intervention arm. Median hospital LOS in the control arm was 97.0 (28.5–194.9) hours and 115.3 (27.5–190.2) hours in the intervention arm (p=0.99).

DISCUSSION

In the PHIT rial, integration of the EM pharmacist into trauma callouts improved time to first dose analgesia in an adult level 1 trauma centre. The results demonstrate that the EM pharmacist can improve the delivery of timely analgesia. This is an important intervention in a setting where inadequate management of pain has been previously reported.[6 23] In the reception and resuscitation of trauma patients in the E&TC most time-critical tasks are completed within the first 30 min. Therefore, an 8 min reduction in time to analgesia is likely to be valuable to patients and allow other clinicians in the trauma response to focus on competing demands, improving efficiency of the team. In addition, improvements in time to prescription of analgesia may improve safety through a reduction on the reliance of verbal medication orders.

Pain assessment and analgesia administration within 30 min of arrival for patients with moderate to severe pain aligns with the Quality Standards for Australian EDs, National clinical indicators for EDs, the European Society of Emergency Medicine Guidelines, the American College of Emergency Physician (ACEP) Guidelines and patient expectations.[19–22 24 25] Early analgesia has the potential for many downstream effects in trauma including improved efficiency and quality of care and potential for avoidance of many pain-related complications.[5 7 8] By allocating this task to the EM pharmacist, other aspects of the medication administration process are also expedited including early upfront decision-making with the medical team leader on appropriate analgesic options, early prescribing on the electronic medical record of first doses by the EM pharmacist and drawing up of medications for immediate administration by the trauma nurse.

The results of this trial build on evidence from observational studies in North America demonstrating that the presence of a pharmacist during trauma resuscitations was associated with a decrease in times to sedative and analgesia provision after intubation.[4 26] A unique feature in this study was the ability of the EM pharmacist to prescribe medications via the PPMC model of care which has been shown to reduce medication errors in the ED.[12] PPMC ensures that home medications are considered early after patient arrival to hospital. Additionally, medications administered in the initial reception of trauma patients are prescribed directly into electronic medical records in a timely fashion, in most cases prior to administration. Prescribing medications prior to administration may help to improve safety and accuracy of verbal medication orders commonly used in the initial reception and resuscitation of a trauma patient in the ED. A variety of medications were prescribed by the EM pharmacist after discussion with the medical team leader, demonstrating their expert drug knowledge in a diverse range of trauma patient presentations (table 3).

This study focused on the impact on time to analgesia, however, there were a number of other EM pharmacist responsibilities in the trauma call including the early identification of patients taking home medications that affect coagulation. Approximately 20% of patients in this study were taking anticoagulants or antiplatelets on arrival (table 1), which are associated with higher mortality after trauma.[27]

The EM pharmacist was able to assist in early identification and treatment, thereby mitigating some of the risks from such medications and, where appropriate, facilitating targeted therapy to improve coagulation. An example of this was the identification of one patient on dabigatran as a home medication by the EM pharmacist on arrival with reversal occurring early post identification of high-risk bleeding. Assigning the EM pharmacist to this crucial role should be prioritised given the well-established literature in favour of accurate medication history-taking and extensive knowledge on appropriate anticoagulant reversal.[28] Older patients are a rapidly growing proportion of major trauma presentations and are more likely to be taking multiple high-risk medications.[29] Involving the EM pharmacist in trauma calls as part of standard of care may equip trauma systems to meet the growing demand to manage polypharmacy and complex analgesic regimens for this cohort of patients in particular. Other high-risk groups of patients are those with opioid use disorders and chronic pain, where the EM pharmacist may assist with early identification via access to prescription drug monitoring programs and optimisation of multimodal analgesia.

This randomised trial reports on the impact of the EM pharmacist in trauma callouts and is the first study known to be conducted outside of North America. The Australian standards of practice for EM pharmacy services includes involvement

Table 3 Medications prescribed by EM pharmacist (intervention arm)

Medication	Number of patients (%)
Morphine IV bolus	7 (16)
Fentanyl IV bolus	27 (63)
Ketamine IV bolus	3 (7)
Morphine IV infusion	1 (2)
Midazolam IV bolus	1 (2)
Midazolam IV infusion	1 (2)
Rocuronium IV	1 (2)
Oxycodone PO	5 (12)
Oxycodone/Naloxone SR PO	1 (2)
Paracetamol PO	5 (12)
Celecoxib PO	3 (7)
Ibuprofen PO	1 (2)
Ropivacaine femoral nerve block	1 (2)
Cefazolin IV	9 (21)
Piperacillin/Tazobactam IV	1 (2)
Cefepime IV	1 (2)
Home medications	2 (5)
Tetanus vaccination	6 (14)
Antiemetics IV	4 (9)
Idarucizumab IV	1 (2)

EM, emergency medicine; IV, intravenous; PO, oral.

Emerg Med J: first published as 10.1136/emermed-2022-212934 on 15 May 2024. Downloaded from http://emj.bmj.com/ on June 22, 2024 at Ben Gurion Uni MALMAD Consortia. Protected by copyright.

in trauma resuscitation as an emerging service that is strongly encouraged.[30] However, Australian EM pharmacy practice is uncommon in this high acuity setting.[1 13] In contrast, the latest survey from North America shows increasing involvement of EM pharmacists in acutely unwell patients, with evidence for improved medication administration and a reduction in medication errors.[4 26 31] The American Guidelines for EM pharmacy services state that EM pharmacists should be present at all critical and acute resuscitative efforts in the ED, ideally 24 hours a day, 7 days a week.[32] This aligns with the ACEP Policy Statement for Clinical Pharmacist services in the ED.[33] Our study provides evidence to support this guidance to expand access to EM pharmacists during trauma resuscitation internationally, particularly after hours, where disparities in critically injured trauma patient outcomes exist.[34]

The major limitation of this trial was that it was performed in a single centre. Specific subgroup analyses could not be performed due to the small sample size. Prospective evaluation of high-risk subsets of trauma presentations is necessary to target appropriate interventions for specific groups including older patients, shocked trauma, intubated trauma and traumatic brain injuries.

Using a non-pharmacist healthcare provider may be an effective strategy to promote early analgesia, however the practicality of an EM pharmacist model relates to integration with other roles. The efficiencies of EM pharmacists include added accountability for a range of therapeutic decisions relating to medications. From those initially required, as well as early consideration of home medications and how these may impact on therapeutic decisions.

This trial was conducted in an adult level 1 trauma centre with a well-established pharmacy service, and it is possible that the results would not be generalisable to other trauma centres without a highly trained EM pharmacy service. There was also potential for selection bias as patients were only recruited during pharmacist working hours Monday–Friday. The different profile of injured patients who arrive after-hours may therefore impact on effectiveness.[34] Further evaluation of the impact of a pharmacist in a 24-hour service is needed. Human factors associated with EM pharmacist presence on arrival of a trauma callout patient also require further exploration including staff attitudes, the impact of the EM pharmacist on reducing cognitive load and potential hindrances to explore effective working models of integrating pharmacists within EM resuscitation teams. Additionally, being an unblinded trial, there was potential for change in behaviour among clinicians in the control arm of the study. However, we expect that this change in behaviour would have enabled earlier analgesia delivery, reducing the effect size and thereby strengthening the conclusions of this trial. Although unlikely, it is also possible that the assumption of delegation of analgesia to the pharmacist led to delays to analgesia in the control arm, leading to a larger difference between groups.

In conclusion, early involvement of the EM pharmacist in trauma callouts improved time to analgesia and enabled prescription of analgesia by pharmacists for patients in a timely manner. There were secondary benefits from medication history-taking and prescribing of other medications. Involvement of an EM pharmacist in trauma reception and resuscitation may therefore assist by optimising medication management, with members of the team more available to focus on other life-saving interventions.

X Cristina Roman @CristinaGhijben and Biswadev Mitra @Biswadev_M

Contributors CR: Study guarantor, conceptualisation, data curation, investigation, methodology, project administration, validation, visualisation, writing of the original draft, writing of the review and editing; MD: conceptualisation, investigation, methodology, supervision, validation, visualisation, writing of the original draft, writing of the review and editing; MF and DVS: investigation, supervision, validation, visualisation, writing of the original draft, writing of the review and editing; PC: conceptualisation, investigation, methodology, validation, visualisation, writing of the original draft, writing of the review and editing; BM: conceptualisation, formal analysis, investigation, methodology, supervision, validation, visualisation, writing of the original draft, writing of the review and editing.

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 This study involves human participants. Ethics committee approval including a waiver of the requirement to seek informed consent was obtained by The Hospital Research & Ethics Committee (AH:7/20).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information.**Data availability statement** All data relevant to the study are included in the article.

ORCID iDs
Cristina Roman http://orcid.org/0000-0002-6889-2338
Mark Fitzgerald http://orcid.org/0000-0003-0183-7761
Biswadev Mitra http://orcid.org/0000-0002-0508-2450

REFERENCES

1 Roman CP, Dooley MJ, Mitra B. Emergency medicine pharmacy practice in Australia: a national survey. *Pharmacy Practice and Res* 2019;49:439–46.
2 Berben SAA, Meijs THJM, van Dongen RTM, *et al*. Pain prevalence and pain relief in trauma patients in the accident & emergency department. *Injury* 2008;39:578–85.
3 Carrie C, Stecken L, Cayrol E, *et al*. Bundle of care for blunt chest trauma patients improves analgesia but increases rates of intensive care unit admission: a retrospective case-control study. *Anaesth Crit Care Pain Med* 2018;37:211–5.
4 Amini A, Faucett EA, Watt JM, *et al*. Effect of a pharmacist on timing of postintubation sedative and analgesic use in trauma resuscitations. *Am J Health Syst Pharm* 2013;70:1513–7.
5 Weingart GS, Carlson JN, Callaway CW, *et al*. Estimates of sedation in patients undergoing endotracheal intubation in US EDs. *Am J Emerg Med* 2013;31:222–6.
6 Dißmann PD, Maignan M, Cloves PD, *et al*. A review of the burden of trauma pain in emergency settings in Europe. *Pain Ther* 2018;7:179–92.
7 Carroll KC, Atkins PJ, Herold GR, *et al*. Pain assessment and management in critically ill postoperative and trauma patients: a multisite study. *Am J Crit Care* 1999;8:105–17.
8 Ahmadi A, Bazargan-Hejazi S, Heidari Zadie Z, *et al*. Pain management in trauma: a review study. *J Inj Violence Res* 2016;8:89–98.
9 Stanger S, Dahill M, Hillary C, *et al*. Improving analgesia prescription for trauma Inpatients. *BMJ Open Qual* 2018;7:e000397.
10 Jacknin G, Nakamura T, Smally AJ, *et al*. Using pharmacists to optimize patient outcomes and costs in the ED. *Am J Emerg Med* 2014;32:673–7.
11 Patanwala AE, Sanders AB, Thomas MC, *et al*. A prospective, multicenter study of pharmacist activities resulting in medication error interception in the emergency department. *Ann Emerg Med* 2012;59:369–73.
12 Tong EY, Roman C, Mitra B, *et al*. Partnered pharmacist charting on admission in the general medical and emergency short-stay unit–a cluster-randomised controlled trial in patients with complex medication regimens. *J Clin Pharm Ther* 2016;41:414–8.
13 Roman C, Edwards G, Dooley M, *et al*. Roles of the emergency medicine pharmacist: a systematic review. *Am J Health Syst Pharm* 2018;75:796–806.
14 VSGDHS. Victorian state trauma system: definition of major trauma. 2015. Available: https://www.health.vic.gov.au/patient-care/definition-of-major-trauma
15 Cameron PA, Gabbe BJ, Smith K, *et al*. Triaging the right patient to the right place in the shortest time. *Br J Anaesth* 2014;113:226–33.
16 Roman CP, Dooley M, Nevill A, *et al*. Introduction of an emergency medicine pharmacist-led sepsis alert response system in the emergency department: a cohort study. *Emerg Med Australas* 2023;35:564–71.
17 Cairns KA, O'Brien DJW, Corallo CE, *et al*. Pharmacist-led therapeutic drug monitoring: implementation of a successful credentialing model. *Pharmacy Practice and Res* 2017;47:477–82.
18 Roman C, Cloud G, Dooley M, *et al*. Involvement of emergency medicine pharmacists in stroke thrombolysis: a cohort study. *J Clin Pharm Ther* 2021;46:1095–102.
19 ACEM. *Joint policy statement emergency department pain management*. 2009.
20 (ACHS) ACoHS. *Australasian clinical indicator report: 2012-2019*. 21st edn. Sydney, Australia: ACHS, 2020.

Emerg Med J: first published as 10.1136/emermed-2022-212934 on 15 May 2024. Downloaded from http://emj.bmj.com/ on June 22, 2024 at Ben Gurion Uni MALMAD Consortia. Protected by copyright.

21 EUSEM. *Guidelines for the management of acute pain in emergency situations*. EUSEM, 2020. Available: www.eusem.org
22 ACEP. *Ensuring emergency department patient access to appropriate pain treatment*. ACEP, 2018.
23 AIHW. Australian Institute of health and welfare, emergency department care 2020-2021. 2022. Available: https://www.aihw.gov.au/reports-data/myhospitals/sectors/emergency-department-care
24 Thomas SH. Management of pain in the emergency department. *ISRN Emergency Medicine* 2013;2013:1–19.
25 Fosnocht DE, Swanson ER, Bossart P. Patient expectations for pain medication delivery. *Am J Emerg Med* 2001;19:399–402.
26 Robey-Gavin E, Abuakar L. Impact of clinical pharmacists on initiation of postintubation analgesia in the emergency department. *J Emerg Med* 2016;50:308–14.
27 Miller M, Morris R, Fisicaro N, *et al*. Epidemiology and outcomes of missing admission medication history in severe trauma: a retrospective study. *Emerg Med Australas* 2017;29:563–9.
28 Marshall J, Hayes BD, Koehl J, *et al*. Effects of a pharmacy-driven medication history program on patient outcomes. *Am J Health Syst Pharm* 2022;79:1652–62.
29 Beck B, Cameron P, Lowthian J, *et al*. Major trauma in older persons. *BJS Open* 2018;2:310–8.
30 Welch S, Currey E, Doran E, *et al*. Standard of practice in emergency medicine for pharmacy services. *Pharmacy Practice and Res* 2019;49:570–84.
31 Porter BA, Zaeem M, Hewes PD, *et al*. Pharmacist involvement in trauma resuscitation across the United States: a 10-year follow-up survey. *Am J Health Syst Pharm* 2019;76:1226–30.
32 Ortmann MJ, Johnson EG, Jarrell DH, *et al*. ASHP guidelines on emergency medicine pharmacist services. *Am J Health Syst Pharm* 2021;78:261–75.
33 ACEP. *Clinical pharmacist services in the emergency department*. ACEP, 2021.
34 Mitra B, Cameron PA, Fitzgerald MCB, *et al*. "After-hours" staffing of trauma centres and outcomes among patients presenting with acute traumatic coagulopathy. *Med J Aust* 2014;201:588–91.

Emerg Med J: first published as 10.1136/emermed-2022-212934 on 15 May 2024. Downloaded from http://emj.bmj.com/ on June 22, 2024 at Ben Gurion Uni MALMAD Consortia. Protected by copyright.