



FINAL REPORT

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Programme			
Report date:	01.12.17	Project reference:	1003
Lead Researcher:	Nigel Rees		
Host institution:	WAST		
Project Title:	RAPID		
Project start date:	01.10.17	Project end date:	30.09.17
R&D Costs (Original)	£228,759		

Please complete the sections below. There are no word limits, but we suggest a maximum of one side of A4 for each section.

Introduction/Background:

Hip fractures are very common affecting a vulnerable and elderly population [1]. Hip fractures result in more admissions to orthopaedic trauma wards than patients with any other injury - accounting for 2.5% of hospital bed occupancy every day [2]; on average, patients are admitted for 21 days following a hip fracture[3], with huge financial impact on the National Health Service (NHS) [4]. Hip fracture is associated with a high mortality rate – over 5% at 30 days; over 10% at six months and over 20% at one year [5-7]. Delay to surgery – over 48 hours – has a detrimental effect on patient morbidity and mortality [8-10]. The National Institute for Health and Care Excellence therefore advises that surgery should take place on the day of admission or the following day [11].

Prehospital management of patients with hip fracture can cause severe pain as the injury site is difficult to immobilise and ambulance staff must move the patient by lifting and negotiating obstacles such as stairs and doorways; journey times may be long and ambulances may have to queue outside the Emergency Department (ED). Paramedics have a limited range of available pain relief options of paracetamol, opiates and Entonox, with the most frequently administered being intravenous (IV) morphine [12]. Several studies, however, have suggested that prehospital pain relief for patients with suspected hip fracture is inadequate, with up to 40% of patients not receiving any pain relief at all [13-18]. This may in part, be due to paramedics' reluctance to administer opioids [19,20].

The elderly population who are most likely to sustain a hip fracture often have co-morbidities and are particularly vulnerable to the side effects of opioids [21,22]. These side effects may necessitate further treatments: respiratory depression may require naloxone; constipation may require laxatives; opioid accumulation in renal failure may require dialysis; and confusion/delirium may delay surgery and increase morbidity. Avoiding opioids in this population may therefore lead to a reduction in morbidity and mortality; shortened length of stay in hospital; and improved health related quality of life [23-29].

Fascia Iliaca Compartment Block (FICB) is increasingly used in Emergency Department (ED) and orthopaedic wards in the care of patients with hip fracture. The technique was first described by Dalens et al in 1989 [30]. There is now an extensive body of literature suggesting that in-hospital FICB is easy to learn; can be administered by non-medical health professionals; and provides better pain relief with fewer side effects than opiates [31-49]. Prehospital FICB has been tested twice before – once in a prospective observational study of 100 patients in the Netherlands [50] and once in a randomised trial of 35 patients in Australia [51], with morphine provided in both control and intervention groups. Rapid Analgesia for Prehospital Hip Disruption (RAPID) is the first randomised trial in prehospital care in which the intervention group avoids opioids.

We hypothesise that the use of FICB to provide pain relief to patients with a hip fracture in prehospital care, combined with the avoidance of morphine, will improve patient experience and outcomes. In the first instance we carried out a study to test the feasibility of intervention delivery and trial methods, as is good practice when evaluating complex interventions [52].

Feasibility study aim

To assess the feasibility of undertaking a fully powered, multi-centre randomised controlled trial (RCT) to test the clinical and cost-effectiveness of paramedics providing FICB as early pain relief to patients who have fractured a hip at the scene of their injury.

Objectives

To assess:

1. Accuracy of recognition of hip fracture by paramedics and thus the safety and feasibility of FICB
2. Willingness of both patients and paramedics to participate in the study
3. Compliance with the FICB protocol by paramedics
4. Sample size required for a full randomised controlled trial (RCT) and recruitment period required to achieve this target
5. Acceptability of FICB as method of providing pain relief in prehospital care of patients with hip fracture
6. Which outcome measures to use in a full RCT and at what point: for example, pain scores before and after pain relief; whether the administration of FICB in prehospital care yields benefits for patients besides pain relief, notably side effects of opioids (nausea, constipation, respiratory depression and confusion); length of time before surgery; and length of stay in hospital. We shall also assess the ability of participants to complete forms, the incidence of missing data and the time taken to complete data collection
7. Whether study processes and outcomes achieve specified feasibility criteria for trial implementation

Methodology:

Trial Design

Single-centre randomised parallel group feasibility trial, allocation ratio 1:1 with qualitative data collection.

Participants

RCT Inclusion criteria: Adult patients attended by a participating study paramedic following a 999 call in the catchment area of the participating receiving hospital who were assessed as having an isolated hip fracture; conscious (Glasgow Coma Scale Score of ≥ 13); and haemodynamically stable.

Exclusion criteria: Patients who refused analgesia, were combative, or were attended by a participating paramedic who was working alone.

Patient consent

Consent to treatment: paramedics obtained on scene oral consent to treatment (i.e. analgesia) in line with usual practice e.g. for cannulation or venepuncture. *Consent to participation in the trial:* As it is not ethically appropriate to consent patients to research in a medical emergency [53], the Paramedic Research Support Officer (PRSO) sought consent from the patient to take part in the trial within approximately ten working days of the patient's injury.

Data collection

We collected routine data from the ambulance service patient clinical record for each participant, as well as hospital notes. We also collected patient data through questionnaires which were posted to patients with a stamped addressed envelope for them to return. We conducted interviews with patients who received FICB and three paramedic focus groups. With participants' consent, we audio-recorded interviews and focus groups and transcribed data for analysis.

Intervention

1. Paramedic training to deliver FICB
2. Use of a Hip Fracture Assessment Checklist Tool to identify eligible patients
3. FICB

Outcomes

In order to identify suitable outcome measures for a fully powered RCT, we collected the following:

Reported by patients: health related quality of life (using SF-12 [35]); mobility (using the modified Rivermead Mobility Index [36]); improvement in pain scores (from before pain relief to arrival at ED using 0-10 scale); Satisfaction with care received from paramedics (using a modified Quality of Care Monitor [38]); and qualitative data from patient interviews and paramedic focus groups

Routinely collected from hospital and ambulance records: mortality; length of hospital admission; safety; length of time the paramedic spent with the patient; use of anti-sickness medications and other pain relief; time the patient waited to go to surgery after arriving at hospital

Progression Criteria

The Trial Management Group (TMG) and independent Trial Steering Committee (TSC) pre-specified the following progression criteria to determine whether to proceed to a fully-powered RCT. All criteria were to be met within reasonable limits:

1. Recruit at least ten paramedics to conduct the trial
2. Paramedics recognise hip fracture with sensitivity of 75% and positive predictive value of 85%
3. At least 50% of intervention participants receive the intervention
4. At least 60% of recruited participants consent to follow up
5. Retrieve primary outcomes for at least 70% of consented participants
6. Mean participant satisfaction in intervention group is at least 80% of that in control group
7. Clinicians are in equipoise about safety and effectiveness of paramedic-administered FICB
8. Balance of serious AEs between groups

Sample size

In this randomised feasibility study we were not seeking to determine clinical effectiveness and did not therefore undertake a formal power calculation. We judged that ten paramedics recruiting 50 eligible patients into the trial over 12 months would be sufficient for us to assess whether the trial met our progression criteria.

Randomisation

We produced 100 sequentially numbered scratchcards with concealed trial arm allocation before recruiting patients; the randomisation schedule was produced by the trial statistician (GF). The randomisation had a 1:1 ratio and was stratified so that each paramedic received ten scratchcards comprising five intervention and five control allocations.

Blinding

Due to the nature of the intervention, the patients and paramedics could not be blinded to the allocation. As the REDCap database included the medications received by participants in order to record whether the intervention was received or not, analysis was not blinded.

Analysis

Statistical analysis was performed by GF and JKB using Stata version 15.0. All analysis was performed by treatment allocated. We undertook thematic analysis of data from interviews and focus groups. Two researchers (BAE, JB), the PRSO (LK,) and a public

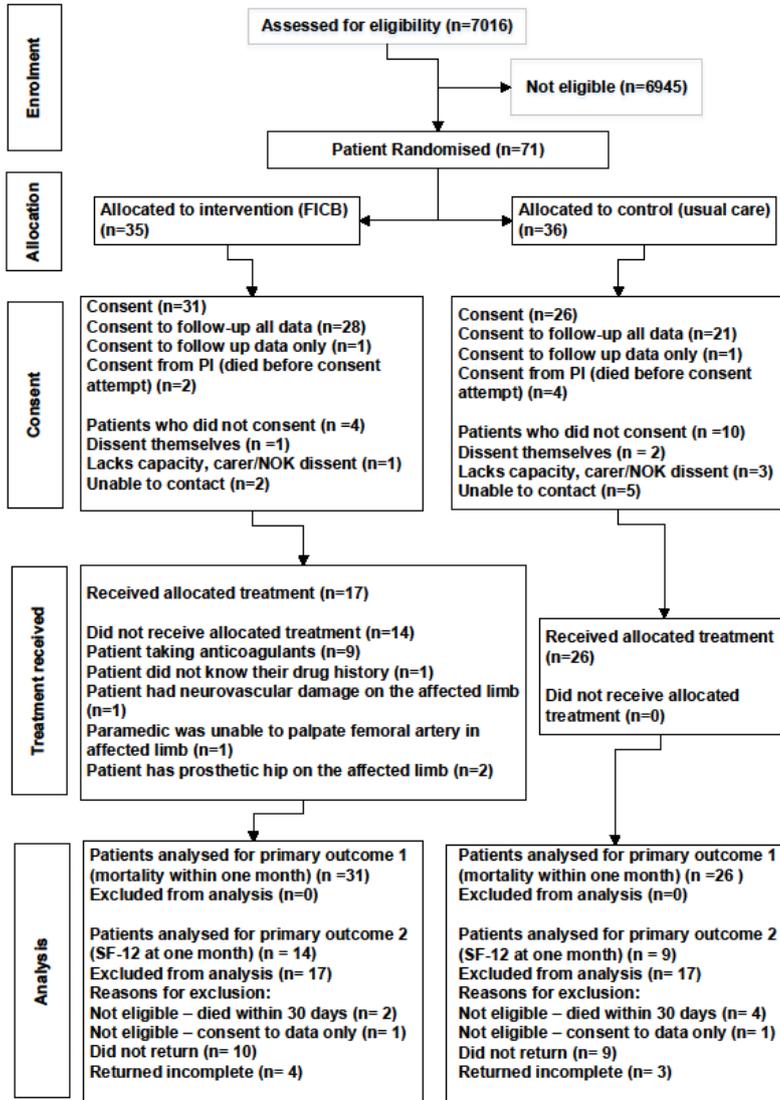
contributor (SJ) individually read and re-read transcripts to identify codes and categories from the data. These were discussed collectively, acknowledging the different perspectives of the analysis team [54,55] and grouped to generate themes and interpretation. BAE prepared write-ups of findings, for further reflection and input from the group in order to test and confirm findings [56-58].

In order to undertake a health economic review to assess the feasibility of a health economic evaluation for a fully-powered trial, we gathered relevant data (trainer and trainee hourly rates, training time, travelling time, equipment costs).

Results/outcomes:

CONSORT Flowchart (*Objectives 2, 3 and 7*)

The 'not eligible' patients were all patients attended by the study paramedics during the recruitment period. Patient recruitment was open for twelve month as planned (from 28th June 2016 – 30th June 2017) for the twelve active paramedics who were initially trained. The six additional paramedics who were trained later in the study were allowed to continue recruiting until 31st July 2017 as their training took longer than anticipated due to shift patterns; some did not achieve their competency until June 2017.



Baseline Characteristics (*Objective 3*)

	Experimental	Usual Care
N	31	26
Mean age in years, range	81.5, 63.6 – 101.4	82.2, 68.3 – 91.8
Female, n (%)	25 (80.6%)	20 (76.9%)
Time of paramedic arrival		
00:00-05:59 n (%)	5 (16.1%)	3 (11.5%)
06:00-11:59 n (%)	6 (19.4%)	8 (30.8%)
12:00-17:59 n (%)	12 (38.7%)	7 (26.9%)
18:00-23:59 n (%)	8 (25.8%)	8 (30.8%)

Outcomes

Fifteen patients were identified to be eligible for the study, but not randomised by the study paramedic who attended them. In the majority of cases (n=6), this was because the patient's affected leg had no obvious shortening or rotation. The study paramedics

randomly allocated eight patients who did not have a hip fracture shown radiographically in the ED ('false positives'), three of these patients had other fractures near the hip (pelvis (n=1), pubic ramus (n=1), acetabulum (n=1)). The other five suffered soft tissue injuries (Objective 1).

Questionnaires were returned by 61% of patients eligible to receive one at one month and 71% of patients eligible to receive one at six month.

	Hip fracture or femoral fracture on X-Ray	No hip or femoral fracture on X-Ray	Total
Randomised	46	11	57
Not randomised	15		
Total	64		
Sensitivity (49/64)	76.6%		
PPV (46/57)	80.7%		

Exploratory Analysis (Objectives 4 - 7)

Exploratory analysis was conducted of a secondary outcome measures to ensure there were no statistically significant differences between groups; none were found, except for the number of patients who received morphine in each group. Mean patient satisfaction in the intervention group was 97.1% of mean patient satisfaction in the control group. There was a difference of approximately nine days in the length of hospital stay between groups. Mortality status of patients was last checked 16/10/17, so analysis of mortality at six months includes patients recruited up to 16/04/17.

	Experimental	Usual Care	Difference (95% CI)
Mortality			
n	31	26	
Died at one month % (n)	6.45% (2)	15.38% (4)	-8.93 (-25.28 to 7.41)
n	18	13	
Died at six months % (n)	5.56% (1)	30.77% (4)	-25.21 (-52.44 to 2.02)
Satisfaction with care			
n	20	13	
Mean (SD)	3.37 (0.42)	3.47 (0.51)	-1.00 (-0.43 to 0.23)
SF-12 - One month			
n	14	9	
Physical Health mean (SD)	30.14 (7.14)	36.29 (10.19)	-6.15 (-13.64 to 1.35)
Mental Health mean (SD)	40.59 (12.87)	34.43 (15.13)	6.16 (-6.08 to 18.40)
SF-12 - Six months			
n	4	2	
Physical Health mean (SD)	34.15 (10.04)	42.64 (14.91)	-8.49 (-36.02 to 19.05)
Mental Health mean (SD)	44.31 (18.40)	57.80 (4.55)	-13.48 (-52.19 to 25.22)
Modified Rivermead Mobility Index – One month			
n	18	12	
Mean (SD)	5.22 (3.23)	6.67 (3.28)	-1.44 (-3.93 to 1.04)
Modified Rivermead Mobility Index – Six months			
n	7	4	
Mean (SD)	8.29 (3.25)	9.75 (2.50)	-1.46 (-5.75 to 2.82)
Mean difference in pain score			
n	23	14	
Mean (SD)	3.74 (2.71)	4.14 (2.74)	-0.40 (-2.28 to 1.47)
Medications administered by the study paramedic			
n	31	26	
Entonox % (n)	3.23% (1)	3.85% (1)	-0.62 (-10.28 to 9.04)
Paracetamol % (n)	51.61% (16)	80.77% (21)	-29.16 (-52.37 to 5.94)
Morphine % (n)	41.94% (13)	80.77% (21)	-38.83 (-61.88 to -15.79)
Ondansetron % (n)	35.48% (11)	23.08% (6)	12.41 (-10.96 to 35.77)
Time study paramedic spent with patient (from attendance at scene to arrival at ED)			
n	31	26	
Mean in minutes (SD)	79.77 (28.25)	74.81 (22.58)	4.97 (-8.80 to 18.73)
Time from arrival at ED to anaesthetic room			

n	25	17	
Mean in minutes (SD)	2069.84 (1693.58)	2044.71 (1319.27)	25.13 (-962.65 to 1012.92)
Length of hospital stay			
n	29	21	
Mean in days (SD)	17.69 (15.18)	26.81 (24.81)	-9.12 (-20.51 to 2.27)

Ancillary analyses (Objective 4)

As exploratory analysis showed length of stay to have a clinically but not statistically significant difference between groups, we have calculated the sample size required to find a three day difference in length of stay between groups, with 90% power at 5% level of confidence. Based on a mean length of stay of 21.5 in the control group (the mean of the entire cohort), and 18.5 days in the intervention group, approximately 1900 patients would be needed in analysis.

Harms (Objectives 3, 5 and 7)

The number of SAEs was balanced between trial arms. One patient who received FICB experienced early local anaesthetic toxicity symptoms and was treated with Intralipid as per the protocol by the study paramedic. Symptoms resolved immediately on treatment and no long term sequelae were recorded.

	FICB	Usual Care
Number of patients with SAEs	3	4

Protocol deviations

	Deviation
1	Morphine administered prior to giving FICB
2	Scratchcard selected at random instead of in sequential order (attempt to get intervention)
3	Prilocaine 1% used which was out of date – paramedic had not checked on front of trial pack or before giving to patient (no harm came to the patient)
4, 6, 7	Paramedic used scratchcard from back of pack instead of from front (accident)
5	Paramedic randomised a patient with suspected hip fracture who was also having a stroke. Patient was randomised to intervention, but due to time critical nature, paramedic did then not give FICB
8	Patient not approached for consent as they were on the End of Life Care Pathway
9	Patient was randomised when they shouldn't have been as they sustained a distracting injury
10	Association of Anaesthetists of Great Britain and Ireland (AAGBI) protocol for administration of intralipid followed instead of the RAPID protocol, as both documents were in intralipid pack and AAGBI document seen first
11	Date of randomisation not written on the scratchcard and scratchcard not signed
12	A study paramedic administered FICB to a patient in ED after patient recruitment had ended at the request of ED staff.

Qualitative Results

Eleven paramedics took part in three focus groups. We interviewed six patients and one daughter of a patient who was present when her mother received FICB.

Paramedic views

Paramedics believed that FICB was a suitable intervention for them to deliver; it aligned with their routine practice and was within people's capabilities to administer.

*The RAPID trial has just fitted naturally into our everyday patter. It hasn't taken us away from any other avenue. It's just given us another route of pain relief for patients that **definitely** need it. (FG1-2)*

Most respondents had administered one or two blocks but were frustrated at this low number which they said was mainly due to patients being excluded because of contra-indications. Challenges included: delivering the intervention when family or public members were present; needing to move the patient in order to administer the injection; being the only trial paramedic on a vehicle, working with a colleague without the knowledge and skills about FICB; and fearing their skills had decayed when not regularly used on real jobs.

Paramedics said they signed up with the RAPID trial in order to: improve patient care and outcomes; gain extra skills; demonstrate they were proactive, motivated individuals; and contribute towards widening the scope of paramedic practice.

I think it's a fantastic idea to have (FICB) prehospitally because people die from breaking their hip...they're inactive in hospital, they're pumped full of morphine and then they catch a chest infection and they die. It's something that we can do prehospitally to relieve their pain but also for them to have a more successful outcome. (FG03-9)

Respondents praised the training they received, welcoming the mix of classroom and practical sessions including the chance to practice with specialists and to have access to the training mannequin. They valued the refresher sessions provided after one patient experienced a toxicity reaction. They suggested ways to improve the training including: more prehospital scenario-based training; frequent practice sessions with hospital patients; and opening the packs and being familiar with the contents. In the event

of further research, they suggested briefing all paramedics and technicians at participating stations so they were all aware of the intervention.

Respondents seemed uncertain whether the block effectively reduced patients' pain, citing examples where it appeared to have made a difference and other instances where it had not. However, they said the drug was potentially better for patients because it reduced the risk of complications from morphine. They reported that it didn't change their approach to caring for patients but may have increased the time by up to ten minutes before patients received pain relief.

Respondents supported the use of scratch cards to randomise patients because it was simple, quick and the card fitted in a pocket.

Patient views

Respondents suggested they expected the paramedics to treat them safely and effectively but had very partial memories of the sequence or process of being cared for.

I can't really remember exactly what was happening because I was in so much pain. I think somebody gave me something to ease the pain...whatever they did for me, it eased that terrific pain. (Patient111)

Just one respondent recalled being offered the block and consented because the paramedic suggested it would enable them to carry him to the ambulance in a chair rather than by stretcher through a window. Those who were aware of receiving the block, because of what they were subsequently told, said they were happy with the intervention. No one was aware of having any side effects from the drug.

Public and patient involvement

Public members contributed to the study in several ways including:

- Questioning practicalities of obtaining pain scores from injured patients
- Amending content and layout of patient information sheets to simplify text, reduce content, add images and white space
- Highlighting life-changing consequences of hip fracture, importance of treatment and care, during qualitative analysis
- Speaking at dissemination events about the priority and personal impact of hip fracture on vulnerable patients
- Contributing to edits of study publications as named co-authors
- Contributing to lay sections of study outputs

Impact:

Limitations:

We are aware that a higher proportion of patients in the intervention group consented to follow up than those in the control groups; we are not aware of the reasons for this. It may be that those patients who knew they had received a new intervention felt 'special' and were therefore more willing to take part.

Given the nature of the intervention, it was not possible to blind paramedics or patients to the treatment they receive and sham FICB would be unethical.

The scratchcards were used out of order on four occasions; once deliberately and three times accidentally. Although this has not resulted in an imbalance in groups, in a fully-powered trial, we would need to slightly amend the pack of scratchcards that are given to paramedics so that the back card cannot be mistaken for the front. Also regarding scratchcards, the randomisation in this feasibility study was blocked by paramedics, so the paramedics would have been able to predict what the allocation was towards the end of their pack of ten cards. In a fully-powered trial, the randomisation would not be blocked by paramedic.

The statistical analysis presented has been conducted on a very small sample of patients – we compared outcomes between trial arms only in order to ensure that there were no large differences between groups and that we remain in equipoise concerning clinical effectiveness of prehospital paramedic administered FICB for hip fracture. We did not aim to establish clinical effectiveness, thus any differences in outcomes between groups should be considered with caution in this underpowered study. In addition, the statistician was not blinded to the patient's allocation when conducting analysis. Should a fully-powered trial be funded, the way of recording medications received by the participants should be altered to avoid this problem.

The return rate of questionnaires was not as high as hoped. This would make it inappropriate to use SF-12 or Quality Adjusted Life Years (QALYs) as the primary outcome in a fully-powered trial. This is likely due to the elderly cohort of patients in the study. In addition, the sample size required to detect a difference in mortality would be extremely high. Length of stay showed a clinically but not statistically significant difference between groups; we therefore propose to use length of stay as the primary outcome going forward, possibly modified to take into account whether the patient is discharged to the same level of independence from which they were admitted (e.g. if they were admitted from their own home but discharged to a nursing home, this would need to be taken into account in analysis).

We were not able to recruit our target number of patients for interview. Since qualitative research explores experiences and perceptions and respondents' views were consistent across the sample, we are confident that the intervention was acceptable to patients [57].

Fewer patients in the intervention arm received FICB than we expected (17 out of 31, 54.8%); we believe this is due to the high number of patients in this elderly cohort who require anticoagulation (n=9), which was an exclusion criterion for FICB.

Generalisability:

The paramedics in this feasibility study received extensive support from both the Consultant Anaesthetist who provided training to them and the PRSO. This level of support would or could not necessarily be replicated in each site used in a fully-powered trial. As this feasibility study requested volunteers to take part in the trial, they are not necessarily a representative sample of all the paramedics in the area; we acknowledge this to be a limitation. This will need to be considered if a fully-powered trial is undertaken.

Checking hospital records in order to identify eligible patients who were not randomly allocated by paramedics was extremely time consuming but necessary in this feasibility study to ensure the sensitivity of paramedics' recognition of hip fracture was good enough to proceed to a fully-powered trial. As the sensitivity was over 75%, we would not conduct this task in a fully-powered trial. As the fully-powered trial will be recruiting far more patients than this feasibility study has, we propose to use anonymised data from the Secure Anonymised Information Linkage Databank (SAIL) going forward, to make data collection more efficient. This would also allow us to modify the method of inclusion in follow up, so that all patients who did not dissent can be followed up anonymously, rather than actively seeking consent from elderly patients, particularly those who lack capacity. This would allow a more comprehensive assessment of patient outcomes and effectiveness.

Going forward:

All progression criteria were met within reasonable limits. As such, we are developing a funding application for submission to the NIHR HTA funding programme. Our bid will be for a multi-centre trial, and so we have sought expressions of interest to take part from other ambulance services. We have received nine formal questionnaires to help to decide upon the most appropriate collaborators. We held a dissemination event to present and discuss our findings to aid the development of the funding application for 'RAPID2'; all of the ambulance services who had submitted expressions of interest were invited to this event. There were approximately 40 attendees from various hospitals and ambulance services in the UK. A trial development group will be held in Bristol in January 2018 to further develop the application for RAPID2. We have submitted the concept of paramedic administered FICB to the NIHR HTA prioritisation panel, for consideration of a themed call. We will submit to a themed call in preference of the researcher led call, should one be announced.

We will be submitting the findings of RAPID to several conferences (HTAi, HSRUK, 999EMS RF, EMS2018 and the NHS Annual R&D forum), and our manuscript, a draft of which is attached as an appendix, will be submitted to Pilot and Feasibility Studies.

Annex: Monitoring Checklist (to be completed by researcher for Health and Care Research Wales internal monitoring purposes only)

Do you have you knowledge transfer / dissemination plan to promote awareness of your findings?	Yes
If yes, is the plan aimed at both academic and non-academic audiences?	Yes
Does your research include examples of successful public and patient engagement?	Yes
If yes, can we contact you for further information?	Yes
Did you register your project with the Health and Care Research Wales Clinical Research Portfolio, or equivalent?	Yes
Would you be willing to provide a case study / story of success to be included in Health and Care Research Wales publicity?	Yes
Have you submitted project outputs on to ResearchFish?	No

Lead researcher signature:	
Name:	Nigel Rees
Date:	01.12.17

References

1. Friedman SM, Mendelson DA Epidemiology of fragility fractures. *Clinics in Geriatric Medicine* 2014; **30**: 175-81.
2. Healthcare Quality Improvement Partnership. National Hip Fracture Database 2015.
3. Healthcare Quality Improvement Partnership National Hip Fracture Database (NHFD) Annual Report 2017 2017.
4. Dy CJ, McCollister KE, Lubarsky DA, Lane JM An economic evaluation of a systems-based strategy to expedite surgical treatment of hip fractures. *The Journal of bone and joint surgery. American volume* 2011; **93**: 1326-34.
5. Zeltzer J, Mitchell RJ, Toson B, Harris IA, Ahmad L, Close J Orthogeriatric services associated with lower 30-day mortality for older patients who undergo surgery for hip fracture. *The Medical journal of Australia* 2014; **201**: 409-11.
6. Hannan EL, Magaziner J, Wang JJ, Eastwood EA, Silberzweig SB, Gilbert M, et al. Mortality and locomotion 6 months after hospitalization for hip fracture: risk factors and risk-adjusted hospital outcomes. *Jama* 2001; **285**: 2736-42.
7. Mundi S, Pindiprolu B, Simunovic N, Bhandari M Similar mortality rates in hip fracture patients over the past 31 years. *Acta orthopaedica* 2014; **85**: 54-9.
8. Moran CG, Wenn RT, Sikand M, Taylor AM Early mortality after hip fracture: is delay before surgery important? *The Journal of bone and joint surgery. American volume* 2005; **87**: 483-9.
9. Holt G, Smith R, Duncan K, McKeown DW Does delay to theatre for medical reasons affect the peri-operative mortality in patients with a fracture of the hip? 2010; **92-B**: 835-41.
10. Simunovic N, Devereaux PJ, Sprague S, Guyatt GH, Schemitsch E, Debeer J, et al. Effect of early surgery after hip fracture on mortality and complications: systematic review and meta-analysis. *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne* 2010; **182**: 1609-16.
11. National Institute for Health and Care Excellence. Hip fracture: the management of hip fracture in adults (NICE clinical guideline 124), 2014.
12. Holdgate A, Shepherd SA, Huckson S Patterns of analgesia for fractured neck of femur in Australian emergency departments. *Emergency medicine Australasia : EMA* 2010; **22**: 3-8.
13. McEachin CC, McDermott JT, Swor R Few emergency medical services patients with lower-extremity fractures receive prehospital analgesia. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors* 2002; **6**: 406-10.

14. Simpson PM, Bendall JC, Tiedemann A, Lord SR, Close JC Provision of out-of-hospital analgesia to older fallers with suspected fractures: above par, but opportunities for improvement exist. *Academic Emergency Medicine : Official Journal of the Society for Academic Emergency Medicine* 2013; **20**: 761-8.
15. Vassiliadis J, Hitos K, Hill CT Factors influencing prehospital and emergency department analgesia administration to patients with femoral neck fractures. *Emergency medicine (Fremantle, W.A.)* 2002; **14**: 261-6.
16. Aronsson K, Bjorkdahl I, Wireklint Sundstrom B Prehospital emergency care for patients with suspected hip fractures after falling - older patients' experiences. *Journal of Clinical Nursing* 2014; **23**: 3115-23.
17. Pfrunder AA, Falk A-C, Lindström V Ambulance personnel's management of pain for patients with hip fractures; based on ambulance personnel's gender and years of experience 2017.
18. White LJ, Cooper JD, Chambers RM, Gradisek RE Prehospital use of analgesia for suspected extremity fractures. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors* 2000; **4**: 205-8.
19. Walsh B, Cone DC, Meyer EM, Larkin GL Paramedic attitudes regarding prehospital analgesia. *Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors* 2013; **17**: 78-87.
20. Jones GE, Machen I Pre-hospital pain management: the paramedics' perspective. *Accident and emergency nursing* 2003; **11**: 166-72.
21. Jakopovic D, Falk AC, Lindstrom V Ambulance personnel's experience of pain management for patients with a suspected hip fracture: A qualitative study. *International Emergency Nursing* 2015; **23**: 244-9.
22. Friesgaard KD, Christensen EF, Kirkegaard H, Bendtsen MD, Jensen FB, Nikolajsen L Prehospital intravenous fentanyl to patients with hip fracture: an observational cohort study of risk factors for analgesic non-treatment. *Scandinavian journal of trauma, resuscitation and emergency medicine* 2017; **25**: 5.
23. Rainer TH, Jacobs P, Ng YC, Cheung NK, Tam M, Lam PK, et al. Cost effectiveness analysis of intravenous ketorolac and morphine for treating pain after limb injury: double blind randomised controlled trial. *British Medical Journal (Clinical Research ed.)* 2000; **321**: 1247-51.
24. Craig M, Jeavons R, Probert J, Bengner J Randomised comparison of intravenous paracetamol and intravenous morphine for acute traumatic limb pain in the emergency department. *Emergency Medicine Journal : EMJ* 2012; **29**: 37-9.
25. Daniels AH, Daiello LA, Lareau CR, Robidoux KA, Luo W, Ott B, et al. Preoperative cognitive impairment and psychological distress in hospitalized elderly hip fracture patients. *American Journal of Orthopedics (Belle Mead, N.J.)* 2014; **43**: E146-52.
26. Robinson S, Vollmer C Undermedication for pain and precipitation of delirium. *Medsurg Nursing : Official Journal of the Academy of Medical-Surgical Nurses* 2010; **19**: 79-83; quiz 4.
27. Morrison RS, Magaziner J, Gilbert M, Koval KJ, McLaughlin MA, Orosz G, et al. Relationship between pain and opioid analgesics on the development of delirium following hip fracture. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences* 2003; **58**: 76-81.
28. Adunsky A, Levy R, Mizrahi E, Arad M Exposure to opioid analgesia in cognitively impaired and delirious elderly hip fracture patients. *Archives of Gerontology and Geriatrics* 2002; **35**: 245-51.
29. Marcantonio ER, Flacker JM, Michaels M, Resnick NM Delirium is independently associated with poor functional recovery after hip fracture. *Journal of the American Geriatrics Society* 2000; **48**: 618-24.
30. Dalens B, Vanneville G, Tanguy A Comparison of the fascia iliaca compartment block with the 3-in-1 block in children. *Anesthesia and analgesia* 1989; **69**: 705-13.
31. Foss NB, Kristensen BB, Bundgaard M, Bak M, Heiring C, Virkelyst C, et al. Fascia iliaca compartment blockade for acute pain control in hip fracture patients: a randomized, placebo-controlled trial. *Anesthesiology* 2007; **106**: 773-8.
32. Elkhodair S, Mortazavi J, Chester A, Pereira M Single fascia iliaca compartment block for pain relief in patients with fractured neck of femur in the emergency department: a pilot study. *European journal of emergency medicine : official journal of the European Society for Emergency Medicine* 2011; **18**: 340-3.
33. Lees D, Harrison WD, Ankers T, A'Court J, Marriott A, Shipsey D, et al. Fascia iliaca compartment block for hip fractures: experience of integrating a new protocol across two hospital sites. *European journal of emergency medicine : official journal of the European Society for Emergency Medicine* 2014.
34. Godoy Monzon D, Iserson KV, Vazquez JA Single fascia iliaca compartment block for post-hip fracture pain relief. *The Journal of emergency medicine* 2007; **32**: 257-62.
35. Godoy Monzon D, Vazquez J, Jauregui JR, Iserson KV Pain treatment in post-traumatic hip fracture in the elderly: regional block vs. systemic non-steroidal analgesics. *International journal of emergency medicine* 2010; **3**: 321-5.
36. Hogh A, Dremstrup L, Jensen SS, Lindholt J Fascia iliaca compartment block performed by junior registrars as a supplement to pre-operative analgesia for patients with hip fracture. *Strategies in trauma and limb reconstruction (Online)* 2008; **3**: 65-70.
37. Mouzopoulos G, Vasiliadis G, Lasanianos N, Nikolaras G, Morakis E, Kaminaris M Fascia iliaca block prophylaxis for hip fracture patients at risk for delirium: a randomized placebo-controlled study. *Journal of orthopaedics and traumatology : official journal of the Italian Society of Orthopaedics and Traumatology* 2009; **10**: 127-33.
38. Obideyi A, Srikantharajah I, Grigg L, Randall A Nurse administered fascia iliaca compartment block for pre-operative pain relief in adult fractured neck of femur 2008; **10**: 145-9.
39. Randall A, Grigg L, Obideyi A, Srikantharajah I Fascia Iliaca compartment block: A nurse-led initiative for preoperative pain management in patients with a fractured neck of femur 2008; **12**: 69-74.

40. Rashid A, Beswick E, Galitzine S, Fitton L Regional analgesia in the emergency department for hip fractures: survey of current UK practice and its impact on services in a teaching hospital. *Emergency medicine journal : EMJ* 2014; **31**: 909-13.
41. Fujihara Y, Fukunishi S, Nishio S, Miura J, Koyanagi S, Yoshiya S Fascia iliaca compartment block: its efficacy in pain control for patients with proximal femoral fracture. *Journal of orthopaedic science : official journal of the Japanese Orthopaedic Association* 2013; **18**: 793-7.
42. Haines L, Dickman E, Ayvazyan S, Pearl M, Wu S, Rosenblum D, et al. Ultrasound-guided fascia iliaca compartment block for hip fractures in the emergency department. *The Journal of emergency medicine* 2012; **43**: 692-7.
43. Watson P, Rugonfalvi-Kiss S Improving analgesia in fractured neck of femur with a standardised fascia iliaca block protocol. *BMJ quality improvement reports* 2016; **5**.
44. Hanna L, Gulati A, Graham A The role of fascia iliaca blocks in hip fractures: a prospective case-control study and feasibility assessment of a junior-doctor-delivered service. *ISRN orthopedics* 2014; **2014**: 191306.
45. Groot L, Dijkstra LM, Simons MP, Zwartsenburg MM, Rebel JR Single Fascia Iliaca Compartment Block is Safe and Effective for Emergency Pain Relief in Hip-fracture Patients. *The western journal of emergency medicine* 2015; **16**: 1188-93.
46. Mangram AJ, Oguntodu OF, Hollingworth AK, Prokuski L, Steinstra A, Collins M, et al. Geriatric trauma G-60 falls with hip fractures: A pilot study of acute pain management using femoral nerve fascia iliac blocks. *The journal of trauma and acute care surgery* 2015; **79**: 1067-72; discussion 72.
47. Reavley P, Montgomery AA, Smith JE, Binks S, Edwards J, Elder G, et al. Randomised trial of the fascia iliaca block versus the '3-in-1' block for femoral neck fractures in the emergency department. *Emergency medicine journal : EMJ* 2015; **32**: 685-9.
48. Williams H, Paringe V, Shenoy S, Michaels P, Ramesh B Standard preoperative analgesia with or without fascia iliaca compartment block for femoral neck fractures. *Journal of orthopaedic surgery (Hong Kong)* 2016; **24**: 31-5.
49. Candal-Couto JJ, McVie JL, Haslam N, Innes AR, Rushmer J Pre-operative analgesia for patients with femoral neck fractures using a modified fascia iliaca block technique. *Injury* 2005; **36**: 505-10.
50. Dochez E, van Geffen GJ, Bruhn J, Hoogerwerf N, van de Pas H, Scheffer G Prehospital administered fascia iliaca compartment block by emergency medical service nurses, a feasibility study. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine* 2014; **22**: 38.
51. McRae PJ, Bendall JC, Madigan V, Middleton PM Paramedic-performed Fascia Iliaca Compartment Block for Femoral Fractures: A Controlled Trial. *The Journal of Emergency Medicine* 2015; **48**: 581-9.
52. Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ (Clinical research ed.)* 2008; **337**: a1655.
53. Council GM Good practice in research and Consent to research 2013.
54. Garfield S, Jheeta S, Husson F, Jacklin A, Bischler A, Norton C, et al. Lay involvement in the analysis of qualitative data in health services research: a descriptive study 2016; **2**: 29.
55. Sweeney A, Greenwood KE, Williams S, Wykes T, Rose DS Hearing the voices of service user researchers in collaborative qualitative data analysis: the case for multiple coding. *Health expectations : an international journal of public participation in health care and health policy* 2013; **16**: e89-99.
56. Ziebland S, McPherson A Making sense of qualitative data analysis: an introduction with illustrations from DIPEx (personal experiences of health and illness). *Medical education* 2006; **40**: 405-14.
57. Marshall C, Rossman, G. *Designing qualitative research*, 5th edn. Los Angeles, SAGE, 2011.
58. Miles M, Huberman, AM. *Qualitative data analysis: an expanded sourcebook* 2nd edn. London, SAGE, 1994.