Supplementary file 2: The 142 research questions excluded following rating in Round 2

Research question	**Mean importance rating in Round 2**
How have survival rates evolved in the last two decades and what are the factors that will improve survival rates in the next 20 years?	3.67
Do pre-hospital antibiotics for non-grossly contaminated penetrating trauma/large open wounds reduce subsequent wound infection?	3.67
How often do pre-hospital critical care services obtain follow up on their patients to confirm or deny their primary survey findings to improve learning and training?	3.67
Does 5% hypertonic saline have a role in non-traumatic intracranial haemorrhage with signs of raised ICP?	3.66
What key words are used by a layperson to describe a viable cardiac arrest who may benefit from a critical care team and a good neurological outcome is likely versus those likely to be fatal?	3.64
In patients with undifferentiated non-traumatic intracranial bleeding receiving pre-hospital PHEA what range of systolic blood pressures in transit is correlated with an improvement in patient focused outcomes (e.g. mortality/morbidity)?	3.64
Would a national 'code red' bypass system be beneficial to improve outcomes by taking unstable haemorrhaging patients straight to theatre?	3.64
Would outcomes in critically unwell children (including in ROSC following medical cardiac arrest) be better if taken to a tertiary centre and would the experience be better for patients and their families?	3.63
Can a rule based dispatch tool be used to identify patients that would benefit from critical care team interventions as accurately as a clinician?	3.62
For children should there be a national standard age per page?	3.61
In pre-hospital critical care research what is the correct outcome measure (s) to use? There is a belief from some that by the time of survival to discharge (weeks or months from the incident) that any treatment effect of pre-hospital care is so diluted that it results in negative trials.	3.61
Is there outcome evidence for direct-to-burns centres in the UK?	3.61
Can standard ambulance responding resources adequately identify patients that will benefit from specialist pre-hospital resources (including community emergency medicine, frailty teams and critical care teams)?	3.60
Current major trauma tools permit TU bypass for up to 45-60 minute journeys - but what is the more meaningful metric: transfer time only, or on scene time to arrival in hospital?	3.59
Do patients receiving pre-hospital anaesthesia suffer from awareness under anaesthesia?	3.58

Does the application of a pelvic binder in trauma patients improve outcomes and can we produce better evidence-based guidelines for their use?	3.57
Can pre-hospital thoracostomy incisions be safely used for in-hospital chest drains? Does the pre-hospital administration of antibiotics around the time of procedure affect this?	3.57
Are pre-hospital critical care teams meeting the analgesic requirements of paediatric patients?	3.57
What is the right dose and frequency of adrenaline in cardiac arrest to improve neurologically intact survivors?	3.57
Does careful pre-hospital control of point of care PaCO2 via invasive arterial access sensors improve outcomes (e.g. coagulopathy, multiorgan dysfunction, cardiac output, neurological recovery, 30-day mortality) in brain injured patients?	3.57
What is the experience of relatives involved in stopping resuscitation at scene for adults in medical cardiac arrest and how can this be improved?	3.57
What are the barriers to using integrated IT systems between the pre-hospital and in-hospital phase of care?	3.56
Is ketamine infusion an effective post RSI sedative agent? Is there an alternative better agent?	3.55
Can a routine formal debrief process following complex jobs reduce the risk of staff sickness?	3.55
What anatomical/physiological injury patterns represent the greatest proportion of pre-hospital deaths and how can these be best treated in future?	3.55
In patients with or without airway/ventilation compromise in the pre-hospital setting, is pre-hospital RSI detrimental compared to hospital RSI in terms of patient survival?	3.55
For pre-hospital practitioners what is currency and competency, and how can these be measured?	3.53
What endpoints should we use when titrating to physiological parameters (e.g. blood pressure targets in trauma, head injury, mixed disease) and is variability in recorded observations predictive of worse outcomes? Are point-of care blood measurements useful (e.g. lactate, calcium, other biomarkers?)	3.53
Does videolaryngoscopy improve the first pass success rate for intubation compared to direct laryngoscopy in patients undergoing pre-hospital emergency anaesthesia, including in special groups e.g. obese patients?	3.51
Is pre-hospital paediatric trauma care managed as effectively as the adult population or do we do less for children?	3.51
How do non-medical responders (Police, Fire, etc.) feel about witnessing pre-hospital critical care interventions (RSI, thoracostomy, thoracotomy, blood transfusion, amputation, hysterotomy)? Do these cause psychological distress, if so how can the impact of this be mitigated?	3.50

Is bolus IV levetiracetam effective as a second line antiepileptic in patients with benzodiazepine refractory status epilepticus in the pre-hospital setting? (Primary outcomes of seizure control, secondary outcomes of seizure recurrence and complications including need for airway support).	3.49
Does pre-hospital regional anaesthesia improve patient outcomes and patient experience (e.g. time to analgesia/pain scores)?	3.49
Can survivable outcomes for catastrophic haemorrhage be improved by CCP led/ delivered plasma?	3.47
Which triage system leads to better patient outcomes: injury-based tool or mechanism and clinical suspicion of injury?	3.47
What are the unmet needs of adult trauma patients in the pre-hospital setting in order to improve future patient experience?	3.47
In the absence of the availability of blood products in patients at risk from death from bleeding does permissive hypotension or a crystalloid based resuscitation strategy lead to decreased mortality?	3.46
What is the optimum size and composition of a pre-hospital critical care team, and how does this impact on patient outcomes?	3.46
Can use of body-worn cameras and review of footage during pre-hospital taskings improve team debriefing, personal and institutional learning?	3.45
In patients (major trauma and post cardiac arrest) receiving pre-hospital anaesthesia which physiological values (HR, BP, EtCO2, SpO2) are associated with good functional outcome?	3.45
How do we improve recognition by critical care teams of traumatic haemorrhage pre-hospital?	3.44
What are the geographical gaps in pre-hospital critical care provision in England and Wales?	3.44
Is the use of Penthrox for acute traumatic pain safe in the under 16s?	3.43
Is there a role for defined pre-hospital care pathways to directly bring patients for ECMO?	3.42
What does ‘good’ look like, from the perspective of service users and relatives of those accessing pre-hospital critical care services?	3.42
Can a dedicated follow-up support clinician improve quality of life for major trauma patients compared to those who do not receive such care?	3.42
What are the risk factors associated with paediatric PHEA?	3.41

What is the optimum C-spine immobilisation strategy for patients suffering major trauma? Do rigid collars worsen outcomes and is a more pragmatic strategy a safe option?	3.40
What is the optimal dose and route of TXA administration in bleeding patients and are there any side effects to administration (e.g. hypotension which could be confused with bleeding)?	3.40
Can the integration of critical care teams with ambulance crews, including shared basing and cross training, improve time to time-critical intervention?	3.40
Does pre-hospital partial zone 1 REBOA improve coronary perfusion and clinical outcomes in patients with severe haemorrhagic shock, irrespective of the origin of bleeding (i.e arterial, venous, parenchymal, bony)?	3.39
Can intra-nasal ketamine confer a significant improvement in analgesic relief for patients with severe pain, compared to standard care?	3.37
Does time from 999 to arrival of critical care team with patient impact on patient-focused outcomes (e.g. mortality/morbidity)? If yes, is there an optimal time for critical care arrival and how can this be factored into mission planning (e.g. air vs road)?	3.37
Is the mental welfare of pre-hospital critical care providers more or less negatively affected than standard ambulance crews?	3.35
Deployment of critical care teams: when should a team mobilise by air versus road? (Considerations: patient outcomes, cost, night versus day flying).	3.35
What are the long-term sequelae of pre-hospital administered analgesia and sedation regimes in terms of: 1. long term pain outcomes; 2.long term psychological sequelae (including PTSD and associated conditions); 3. other patient-reported outcome measures?	3.34
What is the incidence of dysphoria associated with pre-hospital ketamine use and does routine co-administration of midazolam prevent it?	3.32
Does large bore central venous access for major haemorrhage patients improve outcomes in non-urban pre-hospital critical care services?	3.31
Can a national training programme for critical care paramedics within HEMS improve the standardisation and quality of care?	3.31
Can non-clinical dispatchers effectively improve time to PHEA in a well governed pre-hospital care team using existing triage tools and coding?	3.30
How are HEMS teams perceived by the ambulance services and what factors could be improved to ensure the patient pathway is improved?	3.30
Is REBOA superior to thoracotomy with aortic compression in blunt traumatic cardiac arrest?	3.29
Scene times, ambient temperatures and weather, exposure and warming devices - why are we still delivering cold patients to hospitals?	3.28

What do sub-specialty trained PHEM doctors do next? Do they stay in PHEM? What does a PHEM career look like? Does the training scheme work?	3.28
EtCO2 as a surrogate of PaCO2 for targeting physiological parameters: What is the correlation between PaCO2 and pre-hospital EtCO2? What calibrations of EtCO2 measurement are used across the country?	3.27
Do the patient triage destinations assigned by pre-hospital medical teams improve patient outcome in non-life threatening patients?	3.27
Do pre-hospital critical care services over-triage patients to major trauma centres?	3.27
Does administering pre-hospital antibiotics improve patient outcomes significantly?	3.26
Can frailty be assessed in older patients with trauma in the pre-hospital setting, and does it impact their outcome?	3.25
Does a critical care team deployment alter the decision of egress of patients to the nearest ED for patients of gunshot or stabbings by the ambulance crew or does it lead to a delay to definitive care when not in TCA?	3.25
Does routine core body temperature measurement in adult trauma patients undergoing endotracheal intubation, result in better avoidance of hypothermia in the pre-hospital setting?	3.23
Should we be using specific drug therapies in cardiac arrest management (e.g. naloxone in opiate induced arrest/calcium chloride in those with suspected hyperkalaemia - dialysis/renal patients)?	3.22
What are the pharmaceutical options for intranasal paediatric analgesia for non-physicians, bearing in mind the medicolegal framework surrounding controlled drugs?	3.22
What coping support mechanisms are in place locally, regionally and nationally to promote well-being in the team?	3.22
In the management of the adult pre-hospital medical cardiac arrest what is the optimal ventilation strategy (pressures/volumes/ PEEP)?	3.21
What is the best fluid warmer for pre-hospital teams?	3.21
Is it important to have a nationally-led major incident working group to develop nationally agreed responses to major/catastrophic incidents? Do we need a subgroup within AAUK to work alongside NARU?	3.20
What are the educational benefits of hospital placements (such as ITU, ED and Theatres) on the performance and development of Specialist Paramedics in Critical Care? What are the learning objectives for these placement activities and how can they be measured and evidenced?	3.20
Are on-line platforms suitable for post-incident debrief and shared learning events after critical incidents?	3.19
Do pre-hospital intravenous and intra-arterial lines increase the risk of line-associated sepsis?	3.19

Is midazolam superior to diazepam for all cause seizure termination?	3.18
What are the benefits of, employment, recruitment and retention of Critical Care Paramedics in a pre-hospital service?	3.15
Is intranasal fentanyl superior to intranasal diamorphine for the treatment of moderate to severe pain in paediatric patients?	3.15
Is the 'hateful eight' validated for the identification of haemorrhagic shock pre-hospital, and which parameters are most reliable?	3.14
Is intravenous fentanyl superior to intravenous morphine in the management of moderate to severe pain in the PH setting?	3.13
What factors predict subsequent diagnosis of a causative coronary artery lesion disease in shockable OOHCA? (i.e. risk factors, history, ECG changes in ROSC to guide triage decisions to PPCI or elsewhere)	3.12
In a matched cohort of [trauma or medical] patients where a pre-hospital critical care team [all teams with same capabilities] arrives at a patient does the length of scene time (arrival to mobile in vehicle) impact on patient focused outcomes (e.g. mortality) and is there a group of patients in whom scene time is not related to patient focused outcomes (e.g. mortality)?	3.11
How is it most appropriate for consent to participate in clinical trials to be communicated and gained from patients receiving emergency care?	3.11
For patients in cardiac arrest secondary to hypothermia and/or drowning does an integrated patient care pathway from pre-hospital to ICU reduce 30-day mortality and improve functional outcomes?	3.08
In PHEA, how does the haemodynamic response compare with Ketamine/Fentanyl/Rocuronium induction vs Midazolam/Fentanyl/Rocuronium in the severe polytrauma patient?	3.08
Can critical care interventions such as drug assisted intubation, thoracostomy and blood product administration be safely performed by autonomous non-physicians? What level of education and experience would be required to allow this to safely happen and how would these interventions be governed?	3.08
Is it possible to quantify and assess a pre-hospital care physician's non-technical skills?	3.08
Can paramedics treat more cardiac arrests at scene and terminate earlier without detriment to that patient whilst benefiting other patients by freeing resources?	3.07
How accurate is pad placement for defibrillation in cardiac arrest?	3.07
When used at analgesic & sedative doses, does ketamine as an infusion provide less side effects than as a bolus?	3.07
Does assistant + CCP led interventions improve quality & timing of interventions on scene (compared to solo CCP RRVs)?	3.05

What is the current scope of practice and future direction of advanced paramedic practice in pre-hospital critical care teams?	3.05
Which pre-hospital services patients would benefit from paramedic delivered pre-hospital critical care?	3.04
Does the pre-hospital administration of dobutamine, levosimendin or adrenaline improve clinical outcomes (haemodynamics, cardiac output, multiorgan dysfunction, 30-day mortality) in patients with cardiogenic failure secondary to traumatic brain injury?	3.03
What adjuncts are available to optimise metabolic resuscitation in the pre-hospital phase for exsanguinating or high ISS patients? (e.g. ragadenoson/high-dose insulin/steroids etc)	3.03
Does the use of metaraminol at induction of PHEA reduce the incidence of hypotension?	3.03
Can a structured training program in "Non-Technical Skills" be demonstrated to reduce on scene times?	3.01
Can artificial intelligence be used to establish individualised blood pressure treatment goals in the pre-hospital setting for patients with TBI?	3.00
Is handover to an ED trauma team safer than retention of the patient into the hospital phase and then transition to imaging and/or theatre led by the pre-hospital care team?	3.00
Do personality types make an impact on team dynamics and the effectiveness of the pre-hospital care team?	2.99
How effective is the Lucas device compared to manual chest compressions in pre-hospital cardiac arrest management?	2.97
What is the incidence of unrecognised oesophageal intubation by Paramedics, Critical Care Paramedics, and Doctor/Paramedic HEMS team?	2.97
Does USS guided RUSH examination improve targeted reversible cause assessment in CCP led cardiac arrest management?	2.97
What does CCP-led service provision look like across the country? What lessons can be learnt to develop similar service provision to benefit local and regional differences in geography and demographics?	2.97
How can pre-hospital care be best tailored to meet the needs of local patient groups?	2.97
How should the cold chain for blood products be best managed?	2.96
What is the environmental impact of pre-hospital critical care - can it be reduced?	2.96

Does the base specialty of a PHEM doctor affect their first pass intubation success and other outcomes in the PHEM environment?	2.92
What are the barriers to paramedic progression in pre-hospital care?	2.91
Penthrox use: what is the national availability, what are the barriers to its use and is it safe to use during patient transfer via land and air?	2.91
Does remote access to on-scene monitoring (including video streaming) for the receiving ED team help to improve clinical outcomes?	2.88
Do pre-hospital care teams have a responsibility to provide immediate psychological support to bystanders at incidents and how would/could they do this to minimise harm?	2.86
Pre-hospital critical care is not equitably administered to females or older patients (compared to younger males). Why does this bias exist (when identifiable) and how may it be overcome? Which other at risk groups do not receive equitable care?	2.85
Would a pre-hospital lactate reading in the context of a traumatically injured patient assist in the decision to activate major haemorrhage protocols?	2.84
Should critical care paramedics working in the UK, be recognised as a speciality profession by the HCPC and have specific annotation to their registration?	2.82
Should pre-hospital clinicians use ultrasound FAST scans to triage?	2.82
Does the routine administration of antiemetics impact rate of air sickness in concussed/head-injured patients?	2.78
Is pre-hospital plasmin-TEG feasible in the pre-hospital arena to identify patients requiring massive transfusion in trauma?	2.77
What role do Air Ambulances have in the development of advanced practice roles for paramedics?	2.77
Should Penthrox become the drug of choice for simple painful procedures, replacing ketamine, and is Entonox then obsolete?	2.77
What is the most commonly used leadership model in the pre-hospital setting?	2.75
Are out of hospital cardiac arrest patients becoming too cold by inadvertent exposure whilst providing advanced life support?	2.75
Is hyperangulated videolaryngoscopy better than direct videolaryngoscopy or standard videolaryngoscopy in the pre-hospital environment?	2.75

In trained level 8 teams, how often does 'can't intubate can't oxygenate' (CICO) occur? How often is Plan D used (i.e. surgical airway)?	2.73
Is USS needed for safe subclavian access in the pre-hospital environment?	2.69
Does the perception of risk alter the appetite for employers to enable to full clinical potential of critical care paramedics?	2.67
How do first pass intubation rates on the floor vs on the stretcher compare?	2.67
What differences exist in education, training pathways, skills and knowledge between established overseas critical care paramedic and doctor-paramedic pre-hospital critical care teams (for example MICA in Victoria, Australia) and their UK counterparts?	2.67
For pre-hospital clinicians does the use of personal issue aviation helmets with additional hearing protection reduce the hearing loss associated with pre-hospital flights compared to "pooled" helmets?	2.65
In adults which upper limb splintage gives the best analgesic effect and long term outcome?	2.64
Does FASTER outperform FAST for the identification of acute stroke in the pre-hospital setting?	2.60
Is there a role for active cooling in any critical care scenario except for heat stroke and malignant serotonin syndrome?	2.59
Are external abdominal tourniquets useful in exsanguinating abdominal/pelvic haemorrhage?	2.47
What is pre-hospital critical care, what is enhanced care, is there a difference and does it matter?	2.45
Is it safe to wake up and discharge patients at scene after pre-hospital sedation?	2.40
Which position is better for out of hospital obstetric patients: Left or right lateral tilt?	2.24
Does conveying relatives to hospital with critically ill patients increase the chances of the ambulance crew getting COVID? Qualitative study of experience of patient and relative when relative is conveyed versus not.	1.93