Artificial Intelligence in Prehospital Clinical Decision Support Systems: What are the Opportunities and Challenges?

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Introduction: Artificial intelligence (AI) is a field of computer science which concerns the theory and development of computer systems able to perform tasks normally requiring human intelligence. Use of AI within medicine is an area of growing interest, particularly machine learning. Fig. 1 illustrates the relationship between artificial intelligence and machine learning. This project aims to identify key themes in research related to AI in prehospital medicine, and examine the potential opportunities and challenges involved in use of AI within prehospital clinical decision support systems (CDSS).

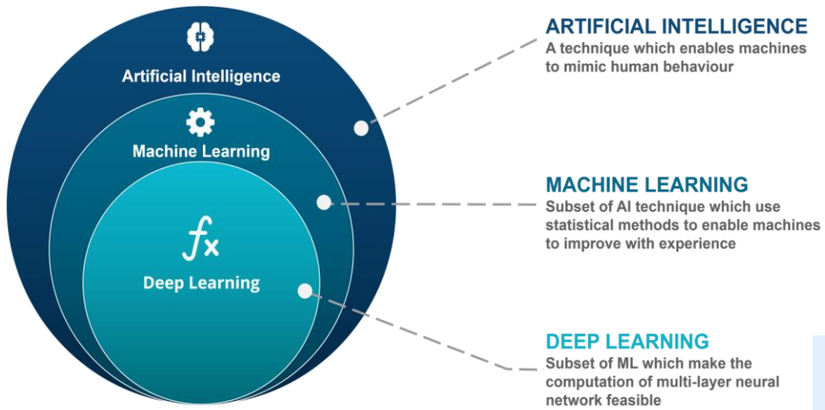

Figure 1: Artificial Intelligence, Machine Learning and Deep Learning[1]

Methods: Of 168 studies identified through a literature search, 18 which had developed AI or evaluated its use in an emergency care setting in a way which was deemed relevant to prehospital care were included in qualitative analysis. Themes of these studies included:

- The potential for AI to triage patients more accurately than existing conventional triage tools
- The prediction of patient outcomes from prehospital data, including analysis of written patient notes
- Assisted dispatch, including recognising out-of-hospital cardiac arrest (OHCA) from emergency calls
- Interpretation of physiological data and investigation results

Results: Potential opportunities and challenges involved in integrating AI into prehospital CDSS were identified from these studies:

Opportunities

Risk stratification: 8 studies demonstrated an improvement in triage accuracy and predication of outcomes for AI models over conventional triage tools and scoring systems.[2-9] No research has been carried out into integration of AI within electronic patient records (ePCR), but this holds potential to improve predictions at the point of care from larger amounts of more complex data without placing additional burdens on clinicians' cognition.

Interpretation of physiological data: The integration of AI into sensors monitoring vital signs to produce 'smart' sensors would allow clinicians to gain better insight into physiological trends or presence of pathology. 4 studies demonstrated AI outperforming clinicians at investigation interpretation.[10-13]

Dispatch: AI was demonstrated to be both more sensitive and faster than dispatchers at detecting OHCA from audio calls, with only marginally decreased specificity.[14]

Challenges

Interpretability: For clinicians to trust AI, they must know the process by which it comes to a decision. Machine learning is a type of AI which can be difficult to audit *(Fig. 2)*; all the studies identified utilised machine learning in some way. However, Bayesian Network models can be built with input from domain experts to graphically present the reasoning and evidence behind their decisions to try to overcome this.[15,16]

Useability: AI is unlikely to be accepted if it places extra demand on clinicians' cognition without clear value, so seamless integration should be prioritised.

Biases: Despite appearing objective, AI is acutely sensitive to biases within datasets. Care must be taken to mitigate these effects if use of AI is to become widespread.[17]

Digital health: AI requires widespread adoption of digital health platforms by prehospital services to become viable. As of 2018, only 7/13 UK ambulance services were using ePCR.[18]

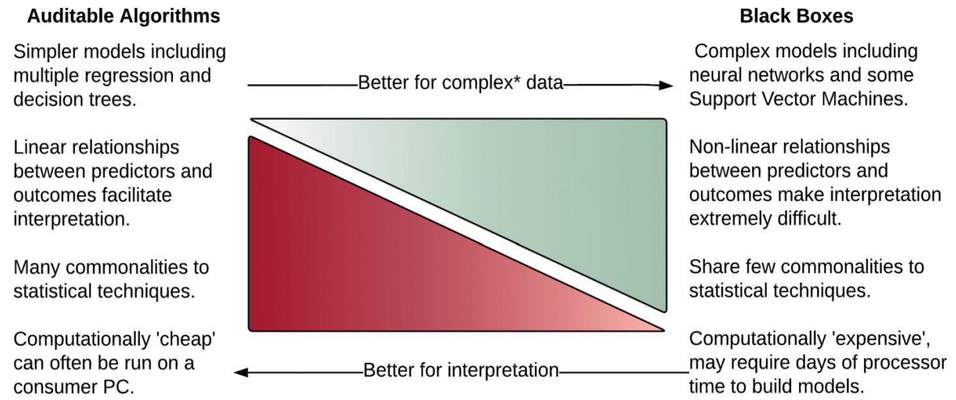

Figure 2: The balance between auditable algorithms and black boxes[19]

Conclusion: AI has potential to augment decision making in the prehospital setting through its accuracy of predictions from inputted data. Its integration faces challenges from transparency of decision-making processes, biases within datasets and current limitations of digital health. More research is needed to evaluate how clinicians interact with various forms of AI, and governance must consider the challenges inherent in the use of non-human intelligence within healthcare.

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Epidemiology and mapping of road traffic collisions with child casualties in Wales

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Background

- Road traffic collisions (RTCs) are one of the leading causes of childhood deaths and trauma
- Children, being smaller and less visible to traffic are at greater risk of severe consequences of RTCs
- Data from the police force, STATS19, informs national policy on RTCs in Wales

Aims

- Determine the accuracy of STATS19 by comparing data from a major trauma centre (MTC) to STATS19
- Characterise RTCs involving child pedestrians, cyclists and car occupants
- Map locations of RTCs to identify clusters and to find out if more injuries occur in deprived areas using the Welsh Index of Multiple Deprivation

Methods

We analysed children aged 0-16 years from 2017-2019 in **STATS19;** the Welsh air ambulance, Emergency Medical Retrieval and Transfer Service (**EMRTS**) and a MTC at University Hospital of Wales Emergency Department (**UHW ED**) for:

- Age and gender
- Pedestrian, cyclist or vehicle occupant
- Hour, day of week, season of RTC
- Road type, speed limit, crossing facilities

Results

Figure 1: RTC locations, Wales

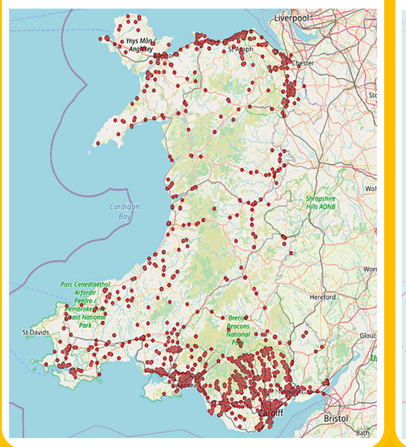


Figure 2: RTC clusters, Wales

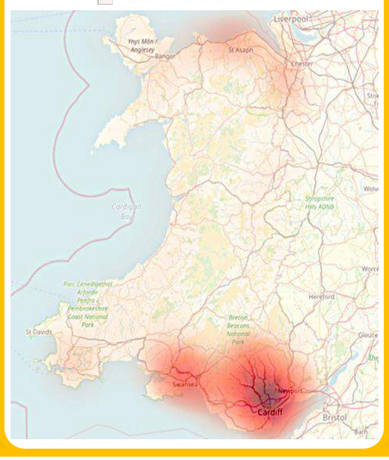
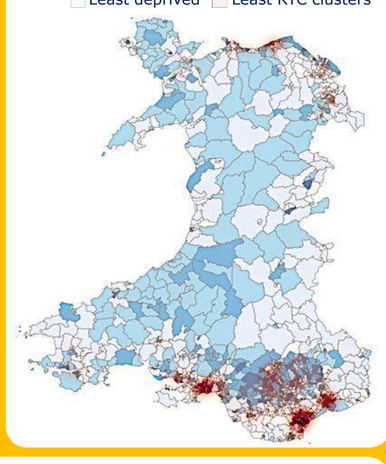


Figure 3: RTC clusters and shading by deprivation fifths, Wales



Key point 1: STATS19 under-reports RTCs with 1,859 child casualties (all Wales) compared to 1,170 (one MTC)

Key point 2: Males aged 11-16 years had highest rates of injury at 92.2 per 100,000 population

Key point 3: Injuries peaked at school journey times and were highest at 2pm-5pm: 45.1% (STATS19), 63.5% (EMRTS), 35.2% (UHW ED)

Key point 4: Most RTCs were located on: single carriageways (84.7%), 30 mph zones (66.9%), between junctions (54.1%) and with no pedestrian crossings within 50 metres (85.0%)

Key point 5: Rate ratio of injury was 2.03 times greater in the most deprived areas compared to the least deprived areas

Figure 4: RTC clusters with school locations, Cardiff

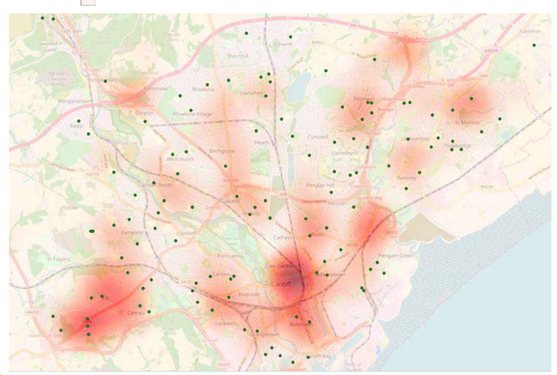
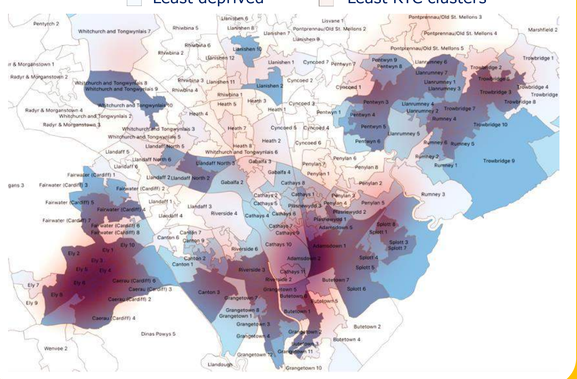


Figure 5: RTC clusters and shading by deprivation fifths, Cardiff



Discussion

- Findings reveal the scale of data that the Welsh Government is missing. Without this knowledge we are failing to see the whole picture and cannot accurately characterise risks to road users
- Emergency Departments and pre-hospital services play an important role in recording child casualties due to RTCs

Conclusion

- Collaboration between emergency and pre-hospital providers and improvements in data quality is needed to inform national public health policy in order to reduce the incidence of child casualties following RTCs
- Road safety schemes should be prioritised in the most deprived areas where the burden of injury due to RTCs is highest, which will help to lessen the social inequality gap

Report + References

SCAN ME

Fat Embolism Syndrome in Trauma – a Narrative Review

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Abstract

Fat embolism syndrome is a rare but significant complication that can occur following skeletal trauma. The syndrome has systemic effects, predominantly that of respiratory, neurological and cutaneous features. The pathophysiological mechanism of the syndrome is a subject of debate. Diagnosis of the condition relies on a clinical suspicion, alongside characteristic investigation findings and largely non-specific abnormalities on imaging. Supportive care is the mainstay of treatment. Following a long bone fracture, early immobilisation and definitive fixation reduce the risk of the syndrome developing. Of the several trialled prophylactic medications, corticosteroids have shown the most promise, however they carry significant side effects. Risk factors should be assessed on a case-by-case basis to optimise the prophylactic measures and appropriate treatments for each patient.

Definitions[1]

- **Fat embolism** (FE) is defined by the presence of globules of fat within the cardiovascular system.
- **Fat embolism syndrome** (FES) is the clinical presentation of the FE phenomenon. It is characterised by the triad of respiratory insufficiency, neurological disturbances and a petechial rash.

Aetiology[2]

- FES can occur in a variety of clinical scenarios, including:
  - **Skeletal trauma** (long bone fractures or isolated soft tissue injury)
  - Elective orthopaedic procedures
  - Aesthetic surgery
  - Specific medical conditions.

Pathophysiology[3]

- The underlying mechanism of FES remains a subject of debate.
- The two main proposed theories are; the **mechanical** theory and the **biochemical** theory.
- In reality, the pathophysiology of FES is likely a combination of the mechanical and biochemical theories.

Incidence[1]

- The true incidence of **FES** in trauma is unknown, with estimates from **0.9% to 19%** of trauma patients.
- The subclinical FE is a more frequent occurrence after trauma, with blood samples and autopsies showing circulating fat in 67% and 68% of trauma patients respectively. FE often goes undiagnosed due to having limited clinical features.

Prognosis[4]

- FES has a **10% mortality rate** in patients who receive supportive care.
- FES carries a significant burden of disease, causing significant complications in the recovery from trauma.

Clinical features[5-9]

The classic triad of FES comprises **respiratory insufficiency**, **neurological disturbances** and a **petechial rash**. In patients with FES, the clinical course and manifestations are diverse. Typically, there is a latent period, followed by the onset of respiratory symptoms, 24 to 72 hours after the initial insult, however this can be variable.

- **Respiratory symptoms** are reported in 80% to 96% of patients with FES. Hypoxia, tachypnoea, dyspnoea and respiratory failure are the most common respiratory manifestations.
- **Neurological disturbances** are reported in 60% to 86% of patients with FES. Neurological manifestations range from acute confusion to focal neurological deficits and seizures. These symptoms are commonly transient.
- **Petechial rashes** are reported in 8.3% to 60% of patients with FES. See figure 1 (below) for the characteristic appearance. Typically distributed over the anterior aspect of a supine patient due to the fat globules floating in the vessels.

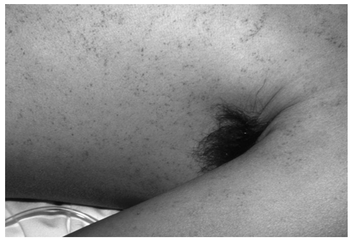

Figure 1: An example of the petechial rash seen in FES[10]

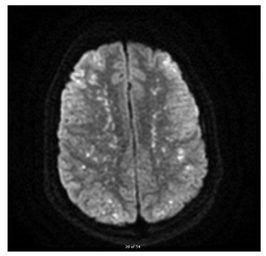

Figure 2: An example of the starfield pattern seen on MRI in cerebral FES[11]

Diagnosis[1,12]

- FES is a **clinical diagnosis** supported by biochemical indicators and imaging findings.
- **Diagnostic tools**: The **Gurd**, **Lindeque** and **Schonfeld** diagnostic **criteria** could be used as a guide to the clinical signs and symptoms of FES patients, however they are all based on observational data.
- **Biochemistry**: there is **no** specific **diagnostic marker**. Common biochemical changes include: hypoxaemia, unexplained anaemia, thrombocytopaenia, hypoalbuminaemia, raised inflammatory markers, raised lipase, and raised free fatty acids.
- **Imaging**: changes seen in FES are dynamic and often non-specific.
  - Chest radiography may show diffuse patchy consolidation.
  - High-resolution computed tomography may show ground-glass opacification.
  - Magnetic resonance imaging (MRI) is the best modality for cerebral FES. The pathognomonic 'starfield' pattern may be seen (see figure 2).
- **Bronchoalveolar lavage**: fat droplets can be detected in alveolar macrophages in FES, however this is thought to be a non-specific sign.

Prevention and Management[1,5]

- Currently the management of FES is **supportive medical care** – no specific targeted therapies have been accepted as effective at treating FES.
- Supportive care in FES involves optimising oxygenation and ventilation to prevent hypoxia, maintaining haemodynamic stability and administering fluids and blood products as required.
- The incidence of FES following trauma can be **reduced** by:
  - **Early fracture immobilisation**
  - **Early surgical fixation** with **adaptive surgical techniques**
- Many **prophylactic** options have been trialled. **Corticosteroids** show the most promise in the prophylaxis of FES, however their significant side effect profile cannot be ignored. Decisions should be made on a case-by-case basis.

Fat Embolism Syndrome in Prehospital Care

- Prehospital care teams are often the first to treat patients who have experienced skeletal trauma, allowing them to intervene in the acute stages following trauma and reduce the risk of FES occurring.
- **Prehospital priorities** in the **reduction** of FES following trauma include:
  - **Prompt correction of hypoxia and hypovolaemia**
  - **Early fracture immobilisation**
- Further research is needed to develop a risk stratification tool, which would allow the targeted administration of corticosteroids to trauma patients at high risk of developing FES.

Conclusions

- FES is significant complication following skeletal trauma, alongside other causes.
- The true incidence of FES is unknown but is estimated to be between 0.9% and 19%. Subclinical FE occurs more frequently.
- The clinical features of FES; respiratory insufficiency, neurological disturbances and a petechial rash, often present 24 to 72 hours after injury.
- FES is a clinical diagnosis supported by results from biochemical tests and imaging findings. Imaging findings are dynamic and variable.
- Management of the syndrome is supportive care, focused on oxygenation and ventilation, maintaining haemodynamic stability and monitoring for complications.
- ECMO and hyperbaric oxygen therapy may be of use in severe FES, however further research into these interventions is required.
- Acutely, the early immobilisation and rapid correction of hypoxia and hypovolaemia reduce the risk of FES in long bone fractures.
- Early definitive surgery should be undertaken. Corticosteroids reduce the development of the syndrome, but cause immunosuppression so should be used with caution.

Contact details

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Impact of apnoeic oxygenation on desaturation events during pre-hospital rapid sequence induction: a retrospective cohort study

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Canolsfan Academaidd Meddygaeth Frys (CAMF)
Emergency Medicine Academic Centre (EMAC)

EPIC iBSc

EMRTS Cymru
Emergency Medical Retrieval & Transfer Service

AMBIWLANS AWYR CYMRU
WALES AIR AMBULANCE

Introduction

- Pre-hospital emergency anaesthesia (PHEA) is a key intervention for critically unwell patients, however, the role of apnoeic oxygenation (AO) in preventing desaturation events is currently uncertain.
- Evidence is limited and conclusions about AOs efficacy, especially within the pre-hospital environment, are yet to be drawn. (1,2)
- Emergency Medical Retrieval and Transfer Service (EMRTS) rapid sequence inductions (RSIs) all follow a standard operating procedure (SOP). AO has been removed since the COVID-19 pandemic due to classification as an aerosol-generating procedure, creating the opportunity to study the effects of AO on desaturation events. (3)

Aim

To undertake a retrospective cohort study, analysing the effect of apnoeic oxygenation on the rate of desaturation events in patients undergoing pre-hospital rapid sequence induction.

Method

- This study analysed the differences between 2 groups. Patients prior to COVID-19 received AO, whilst the group during the pandemic underwent a standard RSI without AO.
- A desaturation event was defined as SpO_2 <93% in accordance with the Australasian guidelines and oxygen dissociation curve physiology. (4)

	Inclusion criteria	Exclusion criteria
Population	Patients ≥16 years old undergoing an EMRTS RSI between May 2015 – December 2020	• Patients in cardiac arrest upon EMRTS' arrival • Aged ≤ 15 • Secondary transfers
Outcomes	Oxygen saturations (prior to RSI, 0, 5, 20, minutes post RSI and minimum and maximum)	• Incomplete documentation • 2 or more missing saturation readings, or where minimum and maximum were absent

Table 1: The inclusion and exclusion criteria used in the study and the outcomes assessed.

- Fisher's exact test concluded that a sample size in excess of 26000 would be required to determine whether AO significantly reduced desaturation events.
- Induction agents and pre-oxygenation strategies were at the clinician's discretion within the SOP, a qualitative analysis survey was shared to EMRTS clinicians to identify common practices and anecdotal opinions of AO.

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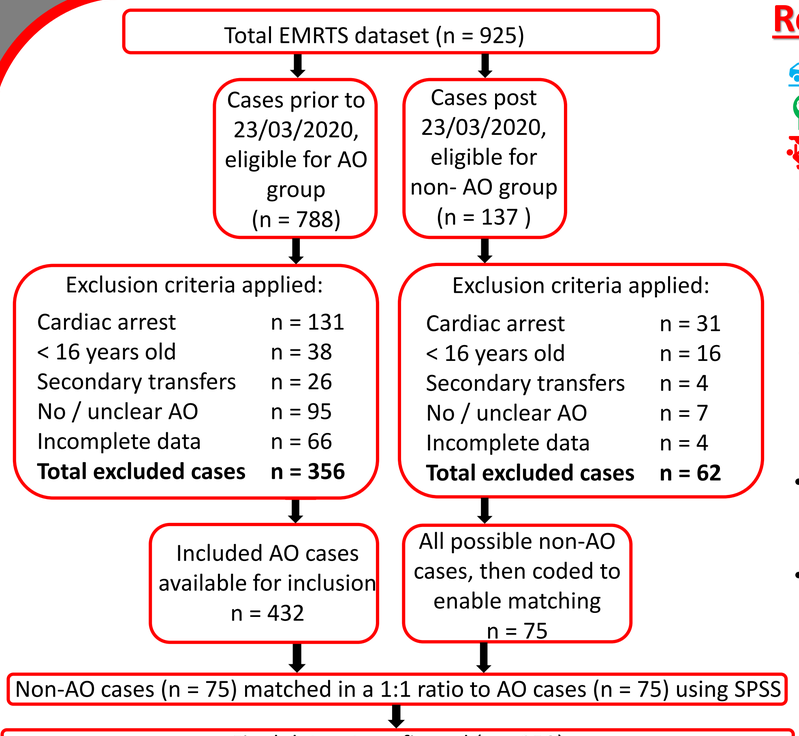
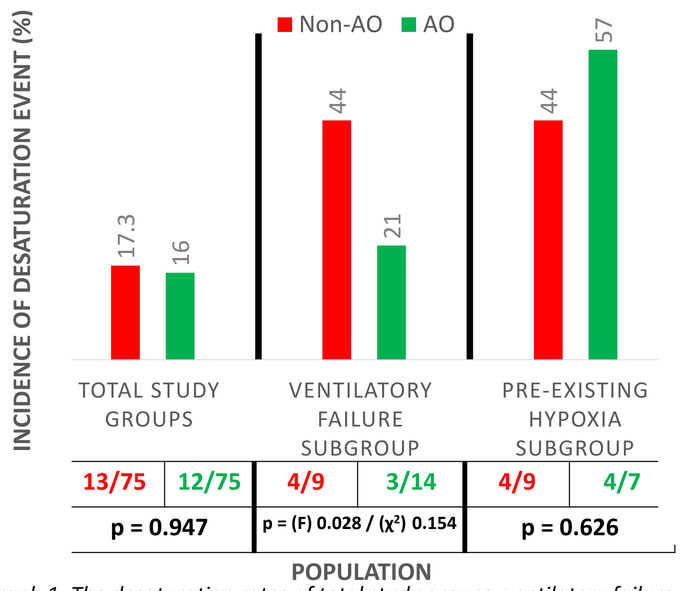


Flowchart 1: The method by which participants were selected and excluded



Graph 1: The desaturation rates of total study groups, ventilatory failure and pre-existent hypoxia subgroups with non-AO and AO. The table beneath shows the numbers of patients within each group that desaturated.

Results

There were no significant differences between the two study groups. Most patient's injuries occurred due to: road traffic collisions, falls from >2 metres and intracranial pathology (each 24%, n=18) causing reduced GCS and airway compromise.

- The AO group had a lower incidence of desaturation events, 16% compared with 17.3%.
- Ventilatory failure patients had a reduced rate of desaturation events, AO = 44%, non-AO = 21% (χ^2 p = 0.028, Fisher's exact p = 0.154).
- Patients with pre-existing hypoxia had an increased rate of desaturation events, 44% in non-AO and 57% in the AO group.

Qualitative Results

- There was a 32% response rate to the survey (n=19/60)
- 36.8% preferred AO, 15.8% preferred not using AO and the remainder had no preference.

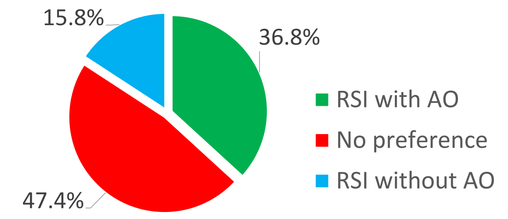


Figure 2: Clinician's opinions regarding AOs as part of RSI.

Discussion

- AO reduced the rate of desaturation events by 1.3%, this association was non-significant and an extremely large study would be required to demonstrate this.
- In contrast to previous studies that concluded respiratory failure patients did not benefit from AO. (2,5) Our results suggest that the addition of AO for patients with ventilatory failure of traumatic aetiology could reduce the incidence of hypoxia, but this sub-group was small.
- The pre-existing hypoxia group experienced more desaturation events with AO, however this sub-group was extremely small and individual cases had a large impact.

Conclusion

- AO is unlikely to benefit the majority of patients, but AO could reduced the incidence of hypoxia in specific subgroups such as patients with ventilatory failure.
- Our recommendation is to include AO during pre-hospital RSIs until further higher-powered research is required. as it is a simple, easy intervention which does not harm the patient.

BRINGING THE DOCTOR TO THE 999 CALLER

Does Discharge at the Scene Prevent Emergency Department Attendance?

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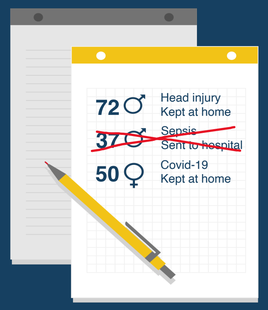
Introduction

The Physician Response Unit (PRU) bridges the gap between the ambulance service and the emergency department (ED) in the Aneurin Bevan University Health Board (ABUHB). Bringing the ED doctor to the 999 caller, the scheme treats and discharges over 50% of patients in their own homes and may prevent hundreds of patients from attending the ED each year.(1) However, without following-up patients discharged in the community, how can we be sure that the PRU is delivering definitive care at the time of treatment? There are currently no published studies of physician-led community emergency medicine services that follow-up patients discharged at the scene to establish whether they require further treatment in the ED. This pilot study aims to be the first.

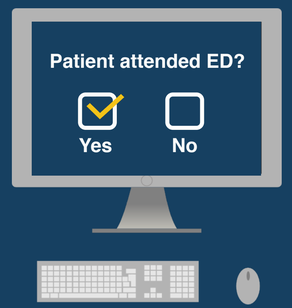
Aims

To identify **what proportion of patients attend the ED** despite being treated and discharged in the community by the PRU and **what factors are associated with ED attendance.**

Data Collection



All patients discharged at the scene by the PRU between 1st October and 31st December 2020 were identified from PRU documents.



Eligible patients (see study inclusion criteria) were searched for on two ED databases to identify whether they attended an ABUHB ED within seven days of PRU discharge.
Additional data recorded included: age, sex, postcode-mapped Welsh Index of Multiple Deprivation quintile, presenting complaint type, time interval before ED attendance and inpatient admission status.

Patients Discharged by PRU
N=111

Study Inclusion Criteria:
- Aged ≥18 years old
- Sufficient details for identification

Patients Eligible for Study
N=103

Regardless of ED attendance, all patients were contacted for a scripted telephone feedback survey (see telephone survey exclusion criteria). A maximum of four contact attempts were made for each patient. The time interval between discharge and the telephone survey ranged between 2 weeks and 2.5 months.

Telephone Survey Exclusion Criteria:
- No identifiable telephone number
- Clinician concerns for contact
- Patient deceased
- Care home resident with dementia
- Hospital inpatient with no mobile number
- Declined telephone survey

Patients Eligible for Telephone Survey
N=50

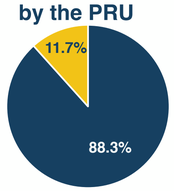
Data Analysis

Associations between ED attendance and patient demographics and satisfaction level were analysed by:
- Pearson chi-squared tests (χ^2)
- odds ratios (OR)
- relative risk (RR)

Using IBM SPSS Statistics version 26.

Results: ED Attendance Rate & Clinical Outcomes

12 out of 103 patients attended the ED after treatment in the community by the PRU



Patients waited a mean of 2 days before attending the ED

9 out of the 12 patients were admitted for a hospital stay

Results: Characteristics of ED Attenders

Male sex was associated with an increased likelihood of ED attendance:
OR= 4.067
(95% CI 1.134-14.587)
$\chi^2(1)=5.171$, p=0.023

The majority (58.3%) of ED attenders were in the most deprived quintile of the Welsh population, but the association with ED attendance was not significant ($\chi^2(1)=3.056$, p=0.080).

Two thirds of the patients who attended the ED presented due to the continuation of symptoms.

This included both Covid-19 patients in the study.

Results: Patient Satisfaction

94% of eligible patients were successfully contacted.
There was no significant association identified between the level of satisfaction and whether or not patients attended the ED for any of the questions asked with the telephone survey.

Do you remember the job roles of the people who treated you?

The risk of staying at home was reduced amongst patients who correctly remembered who treated them (RR 0.744; 95% CI 0.572-0.967) with 30% of these patients attending the ED.

How satisfied were you with the explanation you were given about what the PRU was?

This question received the lowest level of satisfaction with 28% of patients being 'very dissatisfied' or 'dissatisfied' This prompted the introduction of a PRU information leaflet after the study.

How satisfied were you with the decision not to send you to hospital?

Thirty percent of ED attenders were 'very dissatisfied' or 'dissatisfied' with the decision not to be sent to hospital compared to 5.4% of non-attenders.

Overall, how satisfied were you with your experience with the PRU?

Discussion

Discharging patients in the community without access to blood tests or radiology carries a greater level of risk than ED-based care. The means that the 5% cut-off for re-attendance rate used in many hospital EDs cannot be directly applied to the pre-hospital environment. Although a target cannot be set based on this project alone, this project starts the discussion of an ideal and achievable target ED attendance rate for patients discharged in the community. Although factors associated with ED attendance have been identified in this study, without further multivariate analysis, their effects are likely to be influenced by confounders such as access to GP services,(2) comorbidities and fears of Covid-19 prevalence in hospitals.(3,4)

Conclusion

This pilot study demonstrates the requirement for monitoring of ED attendances for all patients discharged in the community by emergency physicians. Doing so allows trends, rates and potentially the efficacy of the scheme to be measured to ensure that physicians are assigned to patients where enhanced clinical decision-making will make the largest difference.

Acknowledgements

With thanks to Dr Kosta Morley, Dr Bastiaan Hoogendoorn, the Aneurin Bevan University Health Board and the Physician Response Unit team for their continued support in the production of this project.

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Acute Behavioural Disturbance and Sudden Death Following Police Contact

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Background

- Sudden death following police contact is a death without a clear non-cardiac cause occurring in the process of arrest, detention, or other police contact, often in previously healthy individuals.
- In England and Wales, the terms 'excited delirium' and 'acute behavioural disturbance' (ABD) have been used by coroners' courts to classify some cases of death following police contact[1].
- ABD describes a spectrum of hyperadrenergic autonomic dysfunction. Its features are extreme psychomotor agitation, paranoia and fear, strength, increased pain tolerance, hyperthermia, cardiopulmonary arrest, and death[2].
- ABD is highlighted as a medical emergency and up to two-thirds of deaths may occur in the prehospital phase[3].
- Inquest findings in deaths attributed to ABD have suggested that the terminology is confusing and that further deaths could be prevented through better recognition of the phenomenon[4].

Aims

- To outline what terminology is used in the literature and in what context.
- To evaluate what presenting features are the most important for prehospital recognition of ABD.
- To assess the theories and evidence for the pathophysiology of deaths in ABD.

Methods

- A literature review was conducted on PubMed, Web of Science, Scopus, and EMBASE databases. Out of 554 results, 78 were included in the qualitative synthesis.

Results

- Large volume of terms are used, potentially impairing communication between police and emergency services.
- 'Delirium' describes the neuropsychiatric manifestation of an underlying serious and identifiable medical cause. However, in deaths following ABD, a clear organic cause is commonly not identified.
- Hyperthermia is one of the critical signs of severe presentation. However, measuring temperature in the prehospital environment is challenging.
- Drugs most reported in conjunction with ABD are sympathomimetic dopamine agonists. Dopamine is linked to control of temperature and the sympathetic nervous system.
- Dopaminergic signalling combined with struggle cause catecholamine levels higher than expected in maximal exertion.
- Lactic acidosis and hyperkalaemia in ABD deaths are profound.
- Restraint is present in nearly all fatal cases, and may prevent compensatory respiratory alkalosis.

Conclusion

- 'Excited delirium' is an inappropriate term that should be phased out of use in UK guidelines.
- Hyperthermia is one of the critical signs prehospital clinicians should look for to recognise severe presentation.
- There is no evidence in the literature that ABD is fatal in the absence of restraint.
- Aberrant dopamine signalling and catecholamine surges are the key pathophysiological changes in acute behavioural disturbance.
- Death appears to occur due to a combination of cardiac dysfunction, extreme exertion, metabolic derangement, and fatal hyperthermia, all contributed to by struggle and restraint.

Terms used	Description of usage
Acute behavioural disturbance (ABD)	Term primarily used in the UK, including in RCEM and FFLM management guidelines. This is sometimes used interchangeably with ED, or to reflect a spectrum of disorders of which ED is the extreme endpoint.
Acute behavioural disorder	Another term used in the UK and Australia, phased out with the growing recognition that 'disorder' may not best reflect ABD.
Excited delirium (ED)	Term most predominant in the literature, coined by Wetli and Fishbain in 1985[5]. Widely used in forensic, policing, sociology, and emergency medicine literature. Use of 'delirium' is incorrect from a psychiatric perspective, as often underlying
Excited delirium syndrome (ExDS)	Term used by some medical examiners to refer to cases of death following presentation of ED. However, some researchers use the terms ED and ExDS interchangeably. The odds of ExDs diagnosis are 10-fold compared to agitated delirium or agitated delirium syndrome in fatal cases.
Agitated delirium	Prevalent term in North American research along ED. Identical pre-mortem characteristics are described in the literature, but the use of this term is more likely with less aggressive forms of restraint and non-fatal cases.
Agitated delirium syndrome	Prevalent term in North American research along with ED and ExDS. Identical pre-mortem characteristics are described in the literature, but the use of this term is more likely with less aggressive forms of restraint and non-fatal cases.
Autonomic hyperarousal state	Term preferred by some researchers to recognise the overlap with other medical and psychiatric conditions, difficulty ascribing causes, and confusion about the term ED.
Acute exhaustive mania	Term to link the presentation to psychiatric issues and recognise similarities to catatonic excitement.
Delirious mania	Term to link the presentation to psychiatric issues and recognise similarities to catatonic excitement.
Acute excited states	Term used by some North American researchers to reflect a spectrum of presentation rather than a single condition.
Cocaine-induced delirium	Term used by some researchers and occasionally in narrative verdicts to refer specifically to presentation that is adjacent to or believed to be caused by cocaine use.
Cocaine-induced psychosis	Description of features resembling ABD in cocaine users in case reports in the 1970s. Still occasionally used by researchers.
Amphetamine-induced delirium	Term used by some researchers and occasionally in narrative verdicts to refer specifically to presentation that is adjacent to or believed to be caused by amphetamine use[3].

Prehospital Recognition of ABD

- Severe aggression by itself may suggest intoxication rather than ABD.
- Incoherent, not engageable, unable to follow simple commands.
- Fluctuating level of consciousness and quiet periods are danger signs.
- Hyperthermia is associated with highest number of other 'syndromic' features.

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How to improve survival rate in Out-of-hospital Cardiac Arrest (OHCA) in the UAE- A cross sectional study

Background: Out-of-Hospital Cardiac Arrest (OHCA) is one of the most common life-threatening emergency encounter by paramedic during their duty. OHCA is considered as one of the main leading causes of death in many countries, and many reports indicate that United Arab Emirates (UAE) got a lower survival rate compared to other countries (Alqahtani S, 2019). According to Pan-Asian Resuscitation Outcome Study (PAROS), OHCA is a global health problem that represents an incidence rate of 50 to 60 out of 100,000 persons/years (Doctor, N, 2017).

Aim

To determine the survival rate of OHCA in the UAE by identifying factors and interventions that can affect the survival rate, as well as focus on how to improve the survival rate.

Methodology

In this cross-sectional observational study, a survey questionnaire with 16 questions in total was conducted to study the survival rate in OHCA in order to improve it in the future. N-341 participants with 95% confidence level and 5% confidence interval. Paramedics and Emergency Medical Technicians (EMTs) were the target of the survey, and the results of the survey took 2 weeks to be completely gathered and ready to be presented in this poster. Results are also supported with some evidence-based articles.

- Sample size: A total of N-341 Emergency Medical Services (EMS) professionals in the UAE answers were gathered to form and analyze the results of this study.
- Inclusion criteria: EMS professional more than 5 years of experience (answered by 323 EMS professionals).
- Exclusion criteria: Incomplete survey responses from 5 EMS professionals and 13 responses with less than 5 years of experience.

Figures

Contributing factors to reduced survival rate in OHCA in the UAE:

Figure 1: Patient related

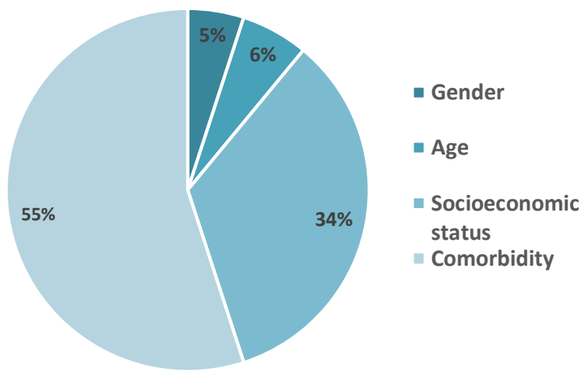


Figure 2: Paramedic / service related

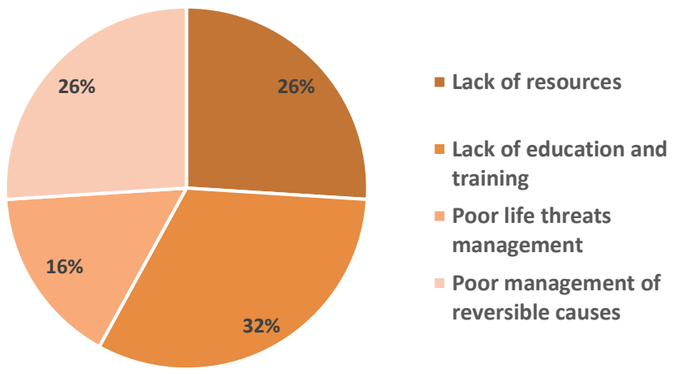


Figure 3: Community related

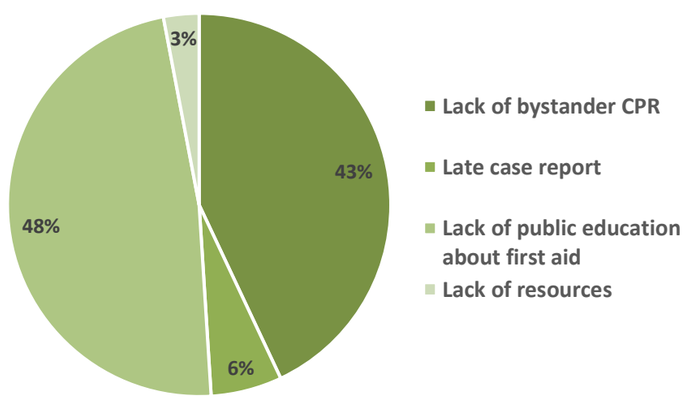
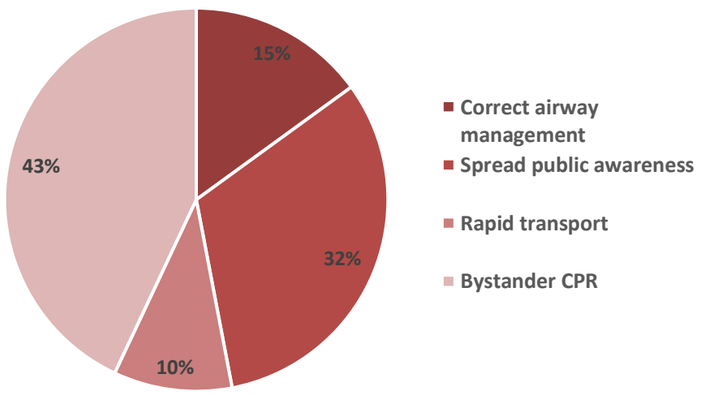


Figure 4: How to improve survival rate of OHCA



Results

During this study N-341 paramedics and EMTs were surveyed to share their expert opinion about the survival rate in out-of-hospital cardiac arrest. 65% of the participants face less than 5 cardiac arrests within a month. Most participants get ROSC less than 10% of the time. Factors that contribute to the onset of this issue are mainly comorbidities (55%) followed age (34%) as figure 1. This was supported by a published journal about OHCA (Myat, Song & Rea, 2018).

When it comes to service-related contributing factors, leading cause is lack of training and education (32% as shown in figure 2). When asked about the community related factors that may reduce the survival rate, 48% of the participants chose the lack of public knowledge and awareness (Navab, E, 2019). Meanwhile, 43% chose lack of bystander CPR as a contributing factor.

As per figure 4, bystanders CPR play a major role in patient OHCA outcome. When asking the participants how can the bystanders contribution in patient resuscitation affect the survival rate, most of them considered it as a positive attribute, whereas few of the participants thought otherwise. Public awareness and training as well as training the dispatchers to properly instruct the caller or the bystander to commence chest compressions prior ambulance arrival was recommended by EMS professionals. 43% of participants recommended bystander CPR to improve the patients' outcomes, and this is supported by evidence published by the American heart association (AHA,2016).

Conclusion

In conclusion, the lack of public awareness regarding first aid and early CPR remains the main barrier to improve survival rate in the UAE for OHCA. Majority of the EMS professional emphasize on chain of survival as key for improve survival rate, most of them suggested to spread public awareness about first aid and early CPR as well as training the dispatchers to deliver proper instructions to the caller or the bystander who has witnessed a patient collapse to initiate the CPR.

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A retrospective analysis of Community First Responder dispatch times in Oxford

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Background

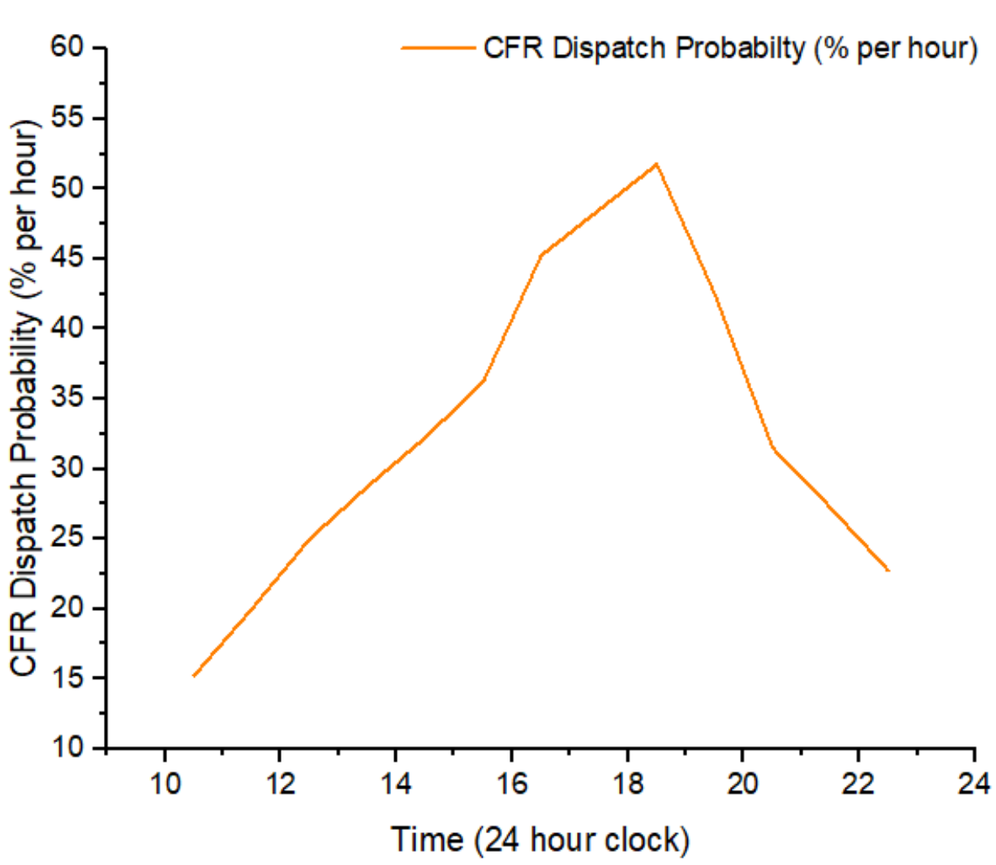
Community First Responders (CFRs) respond to emergency calls and provide life-saving interventions before the arrival of an ambulance. In Oxfordshire, CFRs can staff ten different marked Dynamic Response Vehicles (DRVs) and will often proactively stand by' in urban areas at times of perceived high demand. CFRs across the county spend in excess of 1000 hours in DRVs during a typical month.

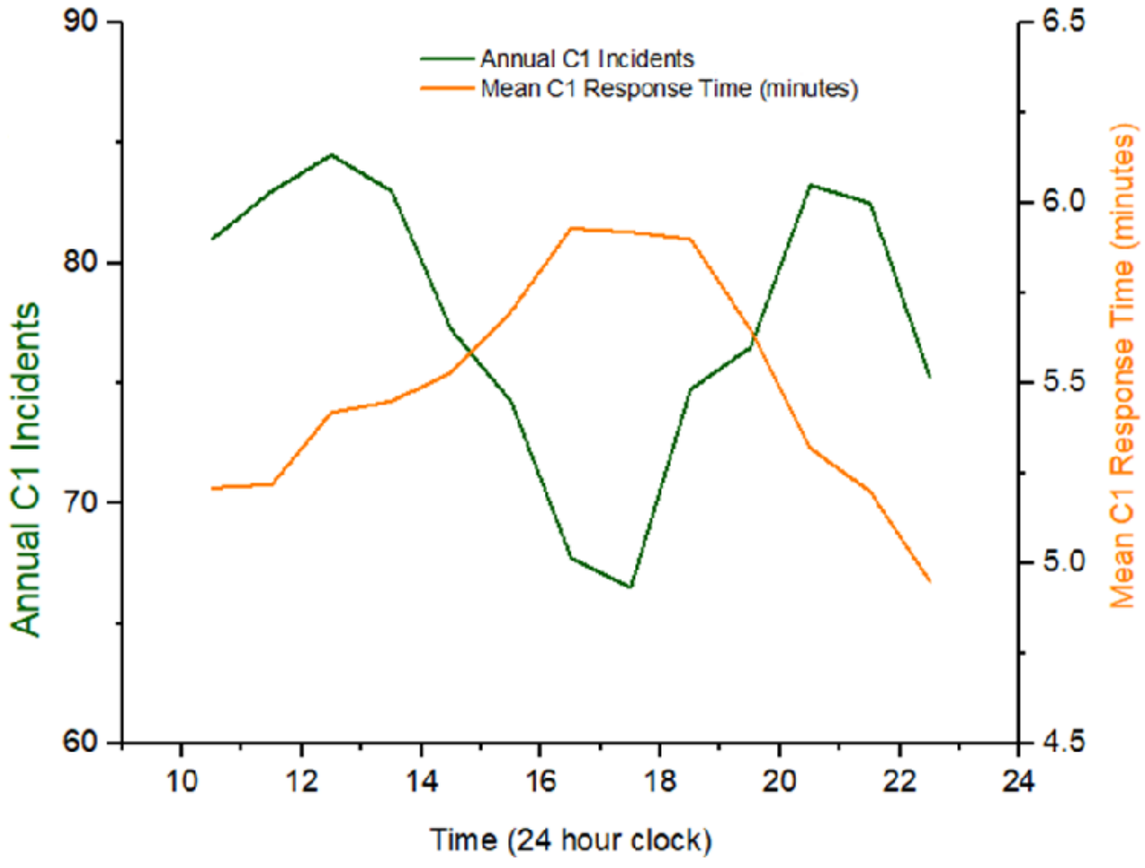
There is no published data on trends in operational demand for CFRs, despite much anecdotal debate on the topic. The study aim was therefore to asses when DRVs are likely to be dispatched to incidents, and evaluate if CFRs were available to respond at these peak times.

Methods

Oxford University CFRs[1] routinely collect data on operational hours and dispatch times. The study included all data for a single DRV between 1 October to 31 December 2020, which responded exclusively within the city of Oxford (post codes OX1 - OX4).

CFR dispatch probability was calculated by comparing total operational time (for each hour between 9am - 1am) with the respective number of incidents within that time period which the DRV was dispatched to. Ambulance service data[2] on Category 1 incidents in Oxford was included for comparison. All values was plotted as a 4 point moving average against time. The study met the criteria for service evaluation so no ethical approval was required.





Results

163 operational hours and 58 incidents were included, and there was no correlation between operational hours and dispatch probability ($r_p = .045$, $p < .001$). Only 18.7% of CFR activity occurred during the busiest period of 5pm - 7pm (which accounted for 35% of demand), and 42% of CFR shifts started at 7pm or later, by which point CFR demand was falling by 17% per hour. Mean C1 response time strongly correlated with CFR demand ($r_p = .90$, $p < .001$). CFRs were 40% more likely to be dispatched at weekends than during the week.

Discussion

This study demonstrates that demand for CFRs in Oxford has a clear daily pattern. At present, CFRs are mainly using DRVs during the evening and should be encouraged to volunteer during the late afternoon when demand is higher.

CFR demand closely reflects local operational pressure on the ambulance service. Some care should be taken when interpreting these findings as they are reflective of a single city during national lockdown.

1 - Seligman WH et al (2016) Initial experience in setting up a medical student first responder scheme in South Central England. Emerg Med J 33:155–158

Do pre-alerts to the Emergency Department for sepsis improve time to initiation of the 1-hour sepsis bundle and subsequent outcomes: a systematic review.

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Introduction

Sepsis is a life-threatening condition that requires prompt assessment and treatment. Paramedics can assess patients prior to arrival at the Emergency Department, and alert the receiving hospital, allowing them to prepare resources and staff for their arrival. In the United Kingdom (UK) the National Institute for Health and Care Excellence (NICE) recommends that patients with a high-risk criteria for sepsis have a pre-alert (1).

Sepsis is a particularly important topic currently with the ongoing COVID-19 pandemic. This virus has led to patients being more susceptible to superadded lung infections and most deaths in critically ill COVID-19 patients have been caused by sepsis (2).

Methods

P: Patients with a suspicion of sepsis arriving in the emergency department.
I: Pre-alerting the ED prior to arrival compared to no pre-alert or an ED sepsis alert.
O: outcome measures of: time to antibiotics, time to IV fluids, length of hospital stay, mortality, ICU admission

Electronic searches across four databases yielded 359 articles. These were screened for relevance against the inclusion and exclusion criteria. 2 articles were included in the analysis.
Relevant data were extracted and the articles critically appraised, grading the risk of bias.

Results

The two studies reported reduced time to antibiotics in the group that received a pre-alert (Mean difference of 16 minutes, p<0.001 in Hunter et al. (3) and of 28 mins, p= 0.004 in Mixon et al (4)). There was no significant difference in mortality or intensive care admissions between the two groups.

Outcomes	Study	Pre-alert (95%CI/IQR)	ED alert (95%CI/IQR)	Difference	p-value
Time to antibiotics (mins)	*Mixon et al.*	48.5 (34-87)	64.5 (47-99)	-16	**P<0.001**
	Hunter et al.	33 (26-40)	61 (44-78)	-28	**P=0.004**
ICU admission	*Mixon et al.*	18.2%	15.3%	2.9%	P=0.62
	Hunter et al.	33.0%	52.0%	-19.0%	**P=0.003**
Mortality	*Mixon et al.*	16.3%	9.6%	6.6%	P=0.07
	Hunter et al.	14.0%	11.0%	3.0%	P=0.565

Table 1: Collated patient outcome data.
Note: P-values taken from article. Mixon et al. is reporting median and IQR and Hunter et al. is reporting mean and CIs.

Both studies used an observational design and had a serious risk of confounding that could explain the reported effects on time to antibiotic. The patients in the pre-alert group tended to be older with more physiological abnormalities, both shown to have worse prognosis (5,6) and suggestive of more severe sepsis.

Baseline characteristic	Study	Pre-alert	ED alert	Difference
Av. Age (yrs)	*Mixon et al.*	74.5	67	7.5
	Hunter et al.	69	64	5
Initial RR (bpm)	*Mixon et al.*	30	20	10
	Hunter et al.	27	24	3
Initial HR (bpm)	*Mixon et al.*	105	106.5	-1.5
	Hunter et al.	112	102	10
Initial SBP (mmHg)	*Mixon et al.*	106	130	-24
	Hunter et al.	122	128	-6
Initial DBP (mmHg)	*Mixon et al.*	63.5	77	-13.5
	Hunter et al.	67	82	-15
Initial temp (deg C)	*Mixon et al.*	38.4	37.1	1.3
	Hunter et al.	38.1	38	0.1
Initial lactate (mmol/L)	*Mixon et al.*	1.95	2.67	-0.72
	Hunter et al.	3.4	3.1	0.3

Table 2: Collated patient baseline data.
Note: Mixon et al. is reporting median and Hunter et al. is reporting mean.

Discussion

- The differences in age and physiology suggest the outcomes could be explained by confounding and this may relate to the way ED alerts and pre-alerts select patients.
- Assuming the difference in time to antibiotics to be true, it may not be clinically important. A recent systematic review found no difference in mortality between patients who received antibiotics within 1 hour or 3 hours of recognition of sepsis (7).
- Pre-alerts are not without adverse effects. Prioritising these patient groups inevitably leads to other patient groups being deprioritised. There is also an increase in resources required when these pre-alerts are initiated in the form of medical personnel, higher dependency beds, laboratory tests.

Conclusion

National guidance recommending pre-alerts for sepsis is based on limited evidence. This review suggests a modest effect on time to antibiotics that may be subject to confounding, with no evidence of an effect on subsequent outcomes.

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Regional Anaesthesia use in the Prehospital Environment: a Systematic Review

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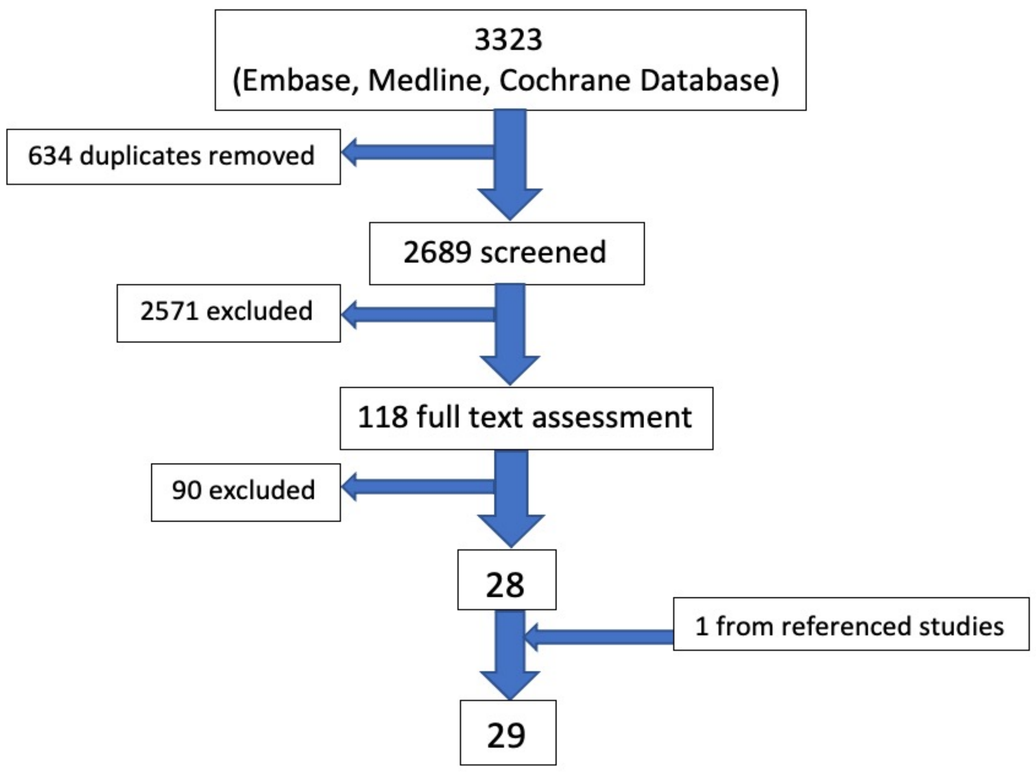
Introduction

Trauma is a common presentation for the prehospital clinician. **Pain is often severe and poorly managed** in the prehospital environment[1]. Regional anaesthesia is an effective and safe analgesic used in the hospital setting, with **RCEM making recommendations** that all patients presenting with a neck of femur fracture should have a fascia iliaca block as part of their analgesic plan[2]. Regional anaesthesia offers advantages such as **reduced opioid usage** and the reduced systemic side effects from its use[3].

Aim: To ascertain what evidence is available for the use and effectiveness of regional anaesthesia in the prehospital environment

Methods

A systematic literature search of Medline, Embase and Cochrane Database was carried out in May 2020 to identify eligible studies. Search terms relating to regional anesthesia and the prehospital environment were used.




(4)

Regional anaesthesia was shown to be an effective analgesic for very painful injuries such as this bilateral digital frostbite injury where a **pain score of 0/10** was achieved 10 minutes after delivering bilateral wrist blocks[4].

In the 29 papers included **no adverse outcomes** were documented.

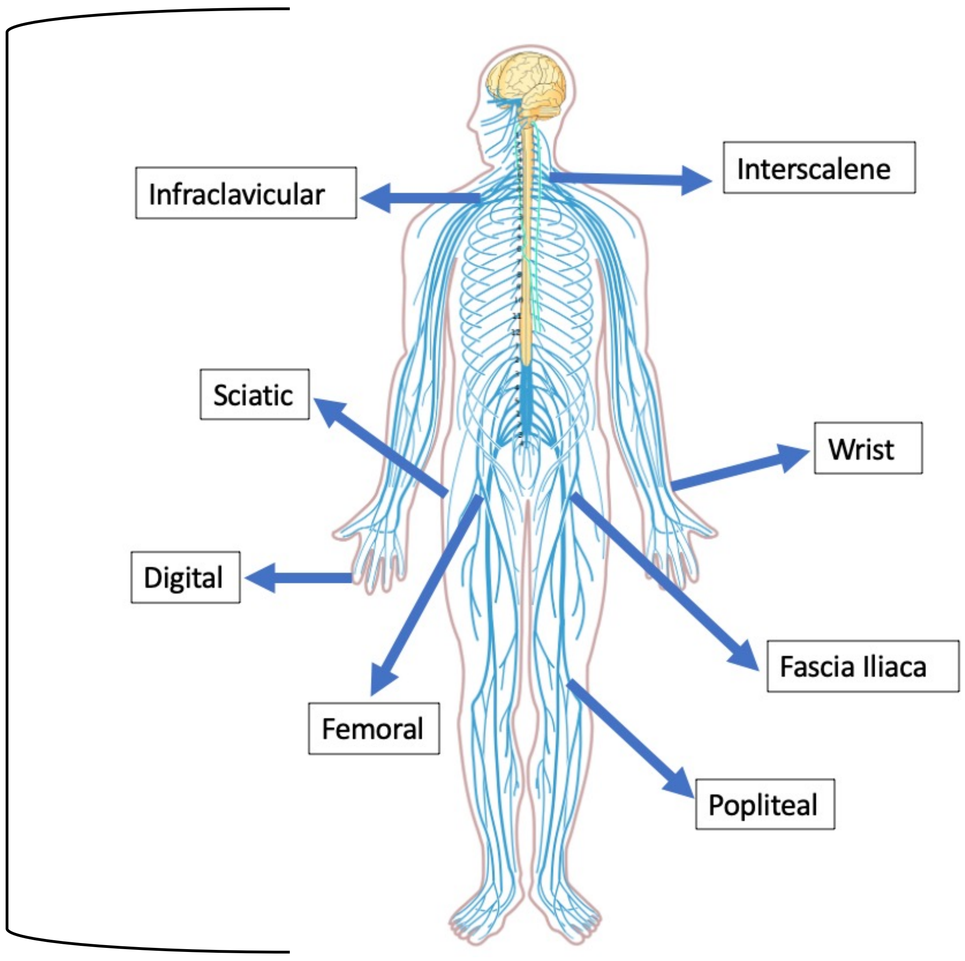
Results

Regional anaesthesia has been delivered prehospital by a range of clinicians:

- Paramedics
- Emergency Physicians and anaesthetists
- EMS Nurses

A wide range of blocks have been successfully performed:

- Majority of studies are case reports or case series
- Four RCTs



Conclusion:
Current evidence suggests regional anaesthesia is a feasible and safe analgesic option in the prehospital environment and can be carried out by a range of clinicians. There is no high-level evidence available for any regional blocks in this setting other than the femoral nerve block and fascia iliaca block.

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Perceptions of the Ergonomic Impact of Using Body Armour by Prehospital Medical Teams

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Background

- Knife and gun crime constitute a significant number of reported offences in England and Wales, with the highest incidence in Greater London[1].
- The associated healthcare burden forms 32% of the workload of London HEMS.
- Body armour is utilised by these clinicians as personal protective equipment when attending to patients in these environments.
- Much research has been conducted into the ergonomic impact of body armour usage in both police and armed forces populations. However, the specific impacts on prehospital medical teams is not known.

Aim

- The aim of this study was to explore the perceptions of prehospital clinicians use of body armour.

Data Collection

- Doctors and paramedics from London HEMS were invited to participate.
- 9 clinicians attended focus groups (3 groups of 3 participants)
- Data collection was deemed complete when theoretical saturation was reached.

Data Analysis

- A constructivist approach utilising hermenuetic phenomenology was employed.
- This approach was chosen as its focus on the lived experience facilitates the exposition of hidden aspects of human experience. It was hoped this would allow for development of a rich understanding of the experience of the clinical team with body armour.
- Recordings from the focus groups were imported into NVivo . The recordings were transcribed verbatim and de-identified prior to analysis.
- The data were analysed according to the six stages of hermeneutic analysis[2]. This process is displayed in figure 1.

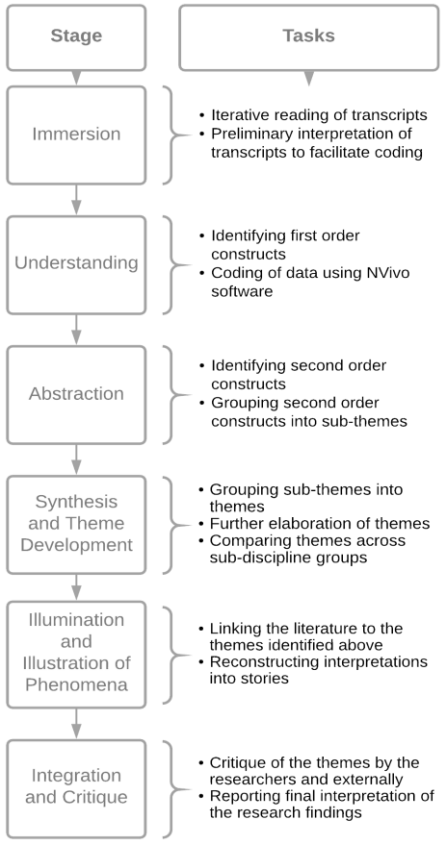

Figure 1: Data Analysis

Conclusion

This is the first study to investigate the ergonomics of body armour use within a prehospital medical service, and it has revealed ergonomic challenges that should be considered when reviewing SOPs and future procurement. The feasibility of providing formed armour in a range of sizes for female users and a PPE system which would allow greater flexibility of interoperability of armour and flight suit components should be investigated in particular.

Results

- **Comfort**
  - **Mobility**: Body armour restricted the movement of the wearer. Bending movements were worst affected. This prevented some clinicians being able to achieve an adequate view while performing laryngoscopy.
  - **Heat**: Heat was an issue when wearing the body armour, particularly in summer. In some people, this added to stress levels and impacted human factors by making team-members more irritable. Symptoms of dehydration after wearing armour were reported. This is important as previous research[3] has shown a significant reduction in cognitive functioning due to dehydration.
- **Appearance**
  - The armour currently used by London HEMS is a covert style which is worn under the flight suit. The importance of the public perception of clinicians wearing body armour was discussed. Some felt wearing orange with no visible armour was protective and appearing non-threatening was important. Others felt that public are more used to seeing teams in armour, so overt armour is suitable. Using the covert style reduces the ability to remove clothing layers to adapt to the environment therefore the suitability of covert vs overt armour should be explored further.
- **Female Fit**
  - Female participants generally felt that the body armour did not fit well to the female form and the armour supplied was designed primarily for male users. Fit around breasts was identified as a key problem area. Most women reported the fit around breasts was poor which affected the overall coverage and comfort of the vest
- **Time**
  - All groups highlighted that there is a delay in getting to scene if you need to don body armour. The participants felt that an overt style of armour would represent a time-saving as it could be quickly put on above the clothes already being worn without having to doff layers first.

I can't intubate in it ... I went down to do laryngoscopy and I literally couldn't see anything 'cause [the] stab vest was hindering me so I . . . take the stab vest off, throw it over the garden wall . . . then go and do the intubation.

I think it [the heat] makes me feel more stressed and then you get that sometimes you sort of have to catch yourself a bit being short and irritated by things and things like that. So I think it's not conducive to, you know. What we should be doing, which is bringing calm to chaos.

I think probably people are getting more used to seeing people with body armour and stuff on. And if you've got a bright orange suit on, you probably don't look quite so much like a terrorist or somebody bad or police.

They're not designed for people with boobs.

They weren't designed for anyone who had boobs or was short.

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Effect of COVID-19 on Care Provided by Police Medics

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1. INTRODUCTION

Police Officers in Specialist Roles deliver immediate **life-saving medical care** when first on scene to incidents.[1]

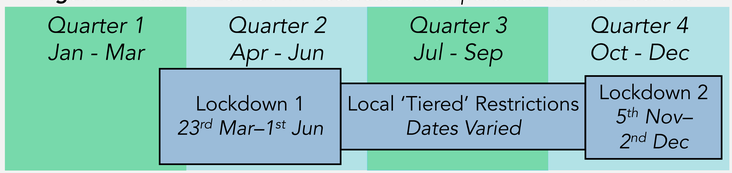
Medical care is documented post-incident on **Patient Report Forms (PRFs)** to quality assure care and audit.[1]

During 2020, **COVID-19 restrictions** impacted the behavior of the public and the **activity of emergency forces,** including Police Officers in Specialist Roles.[2,3]

2. AIM

To **quantify** and **explore** if COVID-19 restrictions **impacted** the number and type of **incidents** attended compared to 2019.[4]

Figure 1: *National Lockdown Restrictions compared to Annual Quarters*



3. METHODS

1. PRFs completed in 2019 and 2020 from **four police forces** (two urban, two semi-rural) were collated[4]
2. Incident type extracted; inter-personal **Assault**, road traffic collisions (**RTCs**), **Mental Health**, **Medical**
3. 2019 and 2020 data was analysed by **Quarter** (Figure 1) to assess the impact of **COVID-19 restrictions**

4. KEY FINDINGS

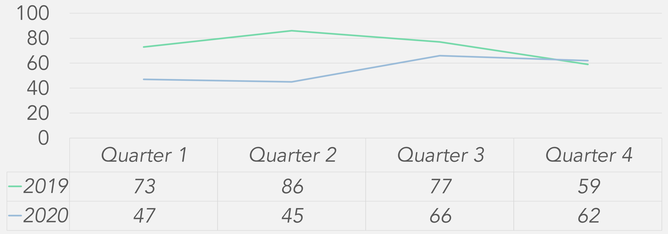


Figure 2: *Graph displaying total number of incidents attended by all police forces per quarter.*

Figure 3: *Number and Proportion of incidents attended in 2019 (left) versus 2020 (right). In red: Change in Total between Years: Change in Proportion between Years*

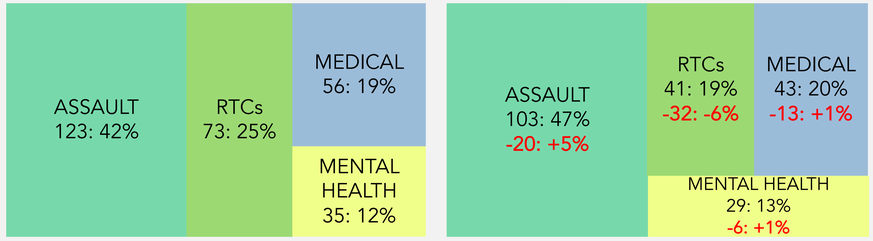
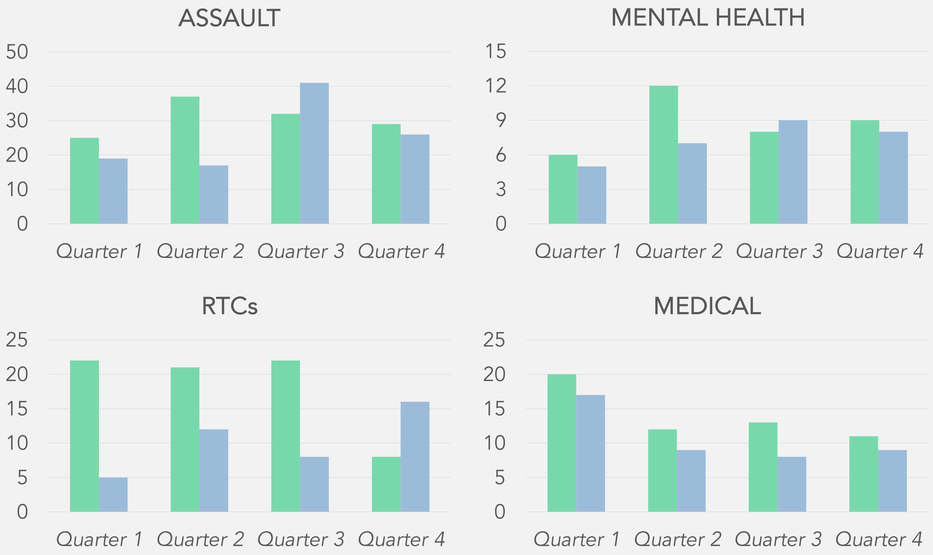


Figure 4: *Graph's displaying number of each incident type attended by all police forces per quarter.*



5. RESULTS

25% decrease in call-outs in 2020 (220) compared to 2019 (295), significantly in Quarters 1 and 2 (Figure 2).

Proportions of incident type attended were similar except **RTC (-6%)** and **Assault (+5%)** (Figure 3).

Most significant decreases in 2020: RTCs incidents in Quarters 1, 2 and 3, Assault and Mental Health in Quarter 2. Assault **increased** above 2019 in Quarter 3.

6. DISCUSSION

- It is unclear if there were differences in incidents attended between **urban** and **rural** police forces.
- Results may reflect **changes in emergency resource allocation** as opposed to changes in incidence.[2]
- Results were analysed to quarters which **do not exactly correlate** with COVID-19 restrictions.
- **Further research** with more police forces PRFs **required** to quantify impact of COVID-19 restrictions

7. CONCLUSION

There was a **significant decrease** in the number of incidents attended by Police Officers in Specialist Roles in 2020. **Research is required** to explore relationships between COVID-19 restrictions and incidents attended.

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