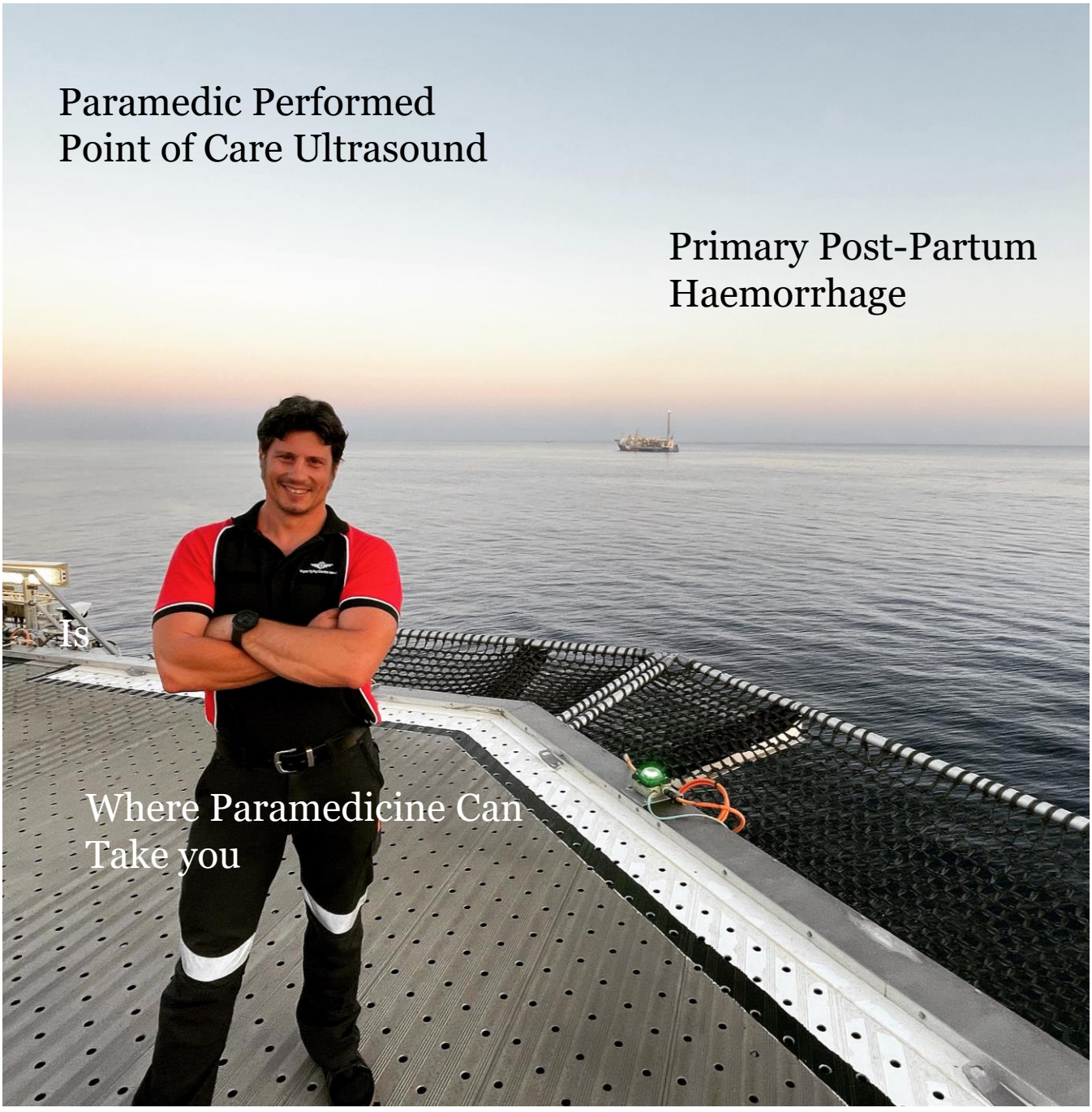
THE SHIFT EXTENSION



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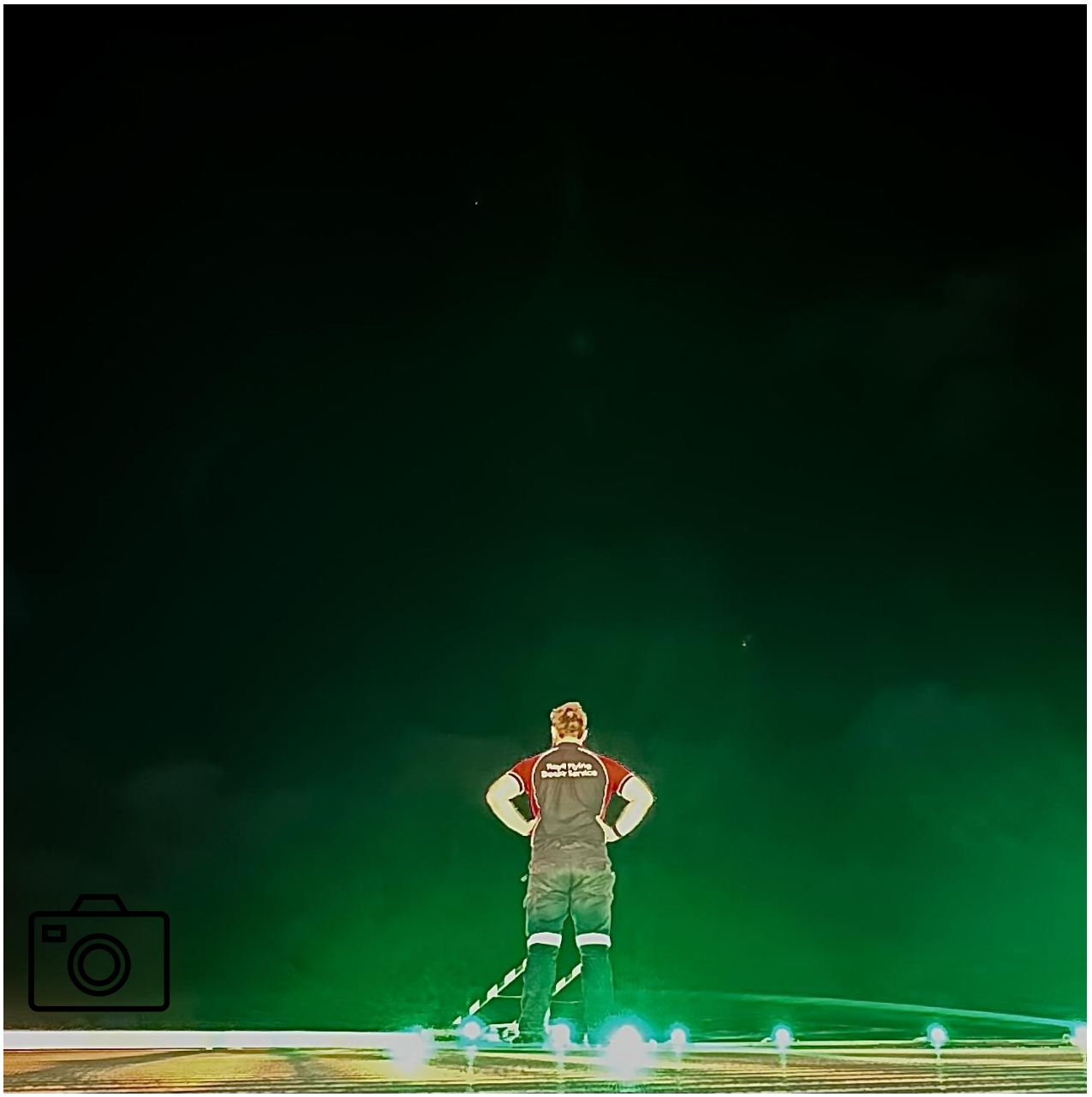

PARAMEDICINE in FOCUS
‘Off Shore’

Photo by: Andy Bell

PARAMEDICINE in FOCUS
‘Floating Clinic’

Photo by: Sunny Whitfield

PARAMEDICINE in FOCUS
‘Desert Troopy’

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PARAMEDICINE in FOCUS
‘Underwater Paramedicine’

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THE SHIFT EXTENSION

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The Shift Extension is a free-to-access, open-source publication that is committed to providing industry-relevant literature and information to enhance the development of the paramedicine profession through the sharing of information.

Cover image courtesy of Andrew Bell

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Editorial

Where Paramedicine Can Take You….

Recently, I returned home from an off-shore contract. I had been responsible for the welfare, safety and health of the film crew while we were diving with great white sharks in the Southern Ocean for the next part of a Discovery + project.

This role meant providing high level paramedical support in an incredible hostile environment where the water we were operating in was 7.3 degrees on a warm day, the wind often high and the seas rough (it is called the Roaring Forties for a reason). With beasts designed to shred and kill, and a long long distance from any kind of professional health care it was a test in professional practice.

In preparation for this role, we built the medical kits using a Top 3 model. For those unfamiliar, a Top 3 model permits you the ability to predict the 3 most likely presentations and the 3 most catastrophic presentations which then allows you to better prepare the kits.

We spent 10 days battling the elements but safely brought all crew back with the objectives satisfied.

I count myself as fortunate in my career because I have spent over half of it working in what people have defined as non-traditional paramedic roles. but I feel like now is the time for us to properly define paramedicine. No longer is it confined to ambulance roles only. Paramedicine has taken me to many corners of the globe including the Himalayas and the Andes, The Sahara, Gobi and the Kalahari, and now I can tick of 6 of the 7 oceans. Paramedics are practicing in areas previously unavailable and as our professional practice increases, so to will the opportunities. Now more than ever there are more alternative paramedicine career pathways for paramedics who are looking for something outside of street ambulance. But let's emphasise, these are not “non-traditional” anymore. These are simply part of the paramedic role.

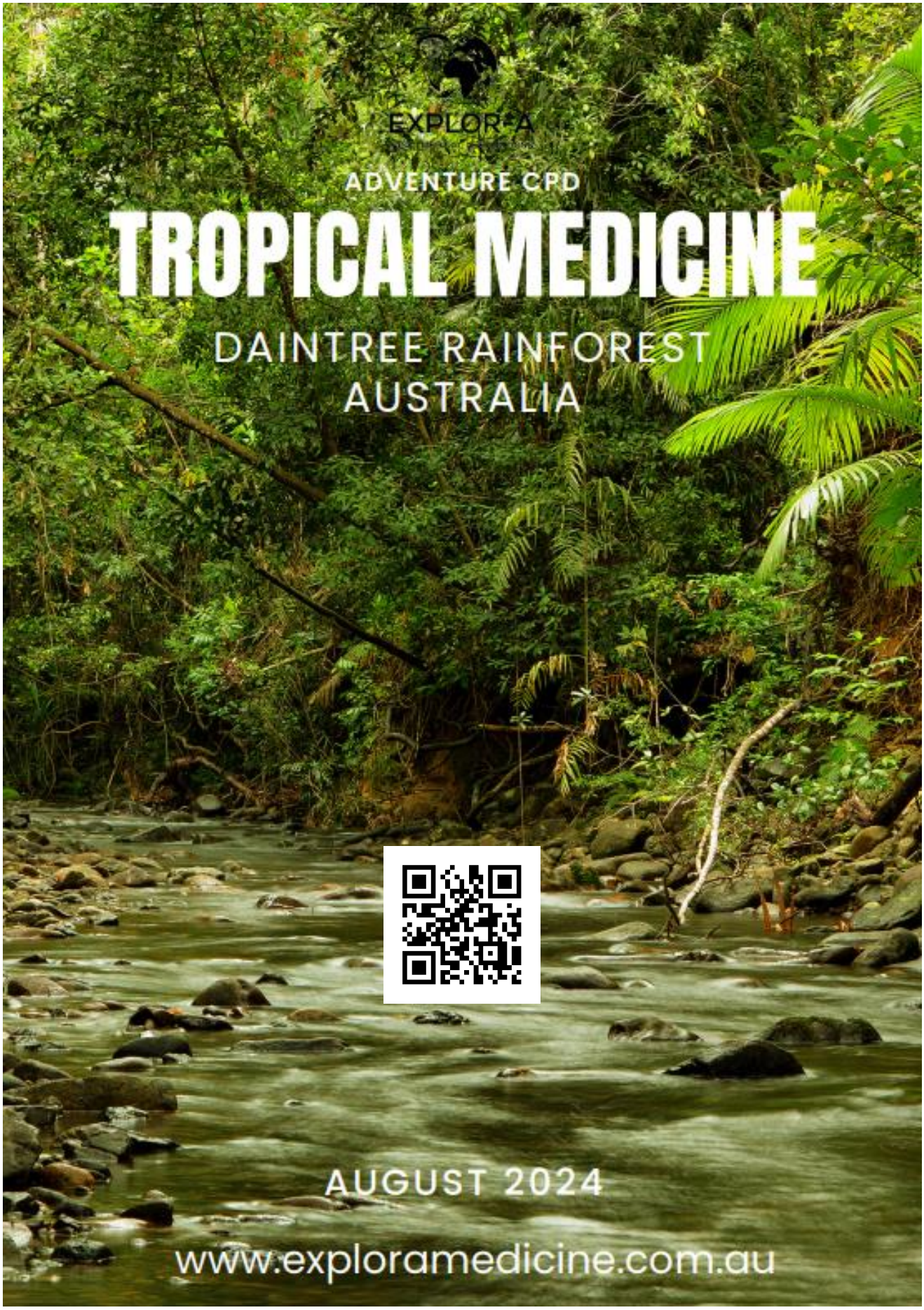
Wherever people go, medicine must follow and paramedics are sure positioned well to provide that care.

In this volume we have we get some insight into RFDS WA paramedic roles as they develop. We also have some advice on nutrition and some case studies.

Take care out there on shift.

Sunny

Editor-in-Chief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Ask a Paramedic with CCP Nick

Got a question?
Questions can be sent to Nick at hello@theshiftextension.org

How safe is prehospital intubation and why are our state services so varied in their scopes to allow paramedics to intubate?

This all depends on your definition of "safe". Safety comes down to several variables. Safety occurs when you know how to do the skill, have the experience to do it well, the maturity to know when to and when not to do it and the mindset to be able to learn from the experience. These are subjective markers however we also look at first pass success rates and instances of adverse events (hypoxia, laryngospasm, unrecognised oesophageal intubation) as ways to measure safety. Even so, safety is not binary. There is no clear line in the sand when suddenly a safe intubation becomes an unsafe one.

Different state services have different scopes because they all judge safety differently. They also do pre-hospital intubation differently. For example, all services do cold (drug free) intubation during cardiac arrest. Some also do rapid sequence inductions. Different risks and appetites for risk generally result in different scopes of practice. Do I think prehospital intubation is safe? Yes. Do I think every paramedic should practice the skill? I don't think so.

Needle vs. knife for chest decompression? I'm taught needle but I see intensive care using a knife on placement - why is there a difference?

There are several different chest decompression techniques and devices out there. Needles have come a long way from a simple cannula to more rigid devices like the Pneumodart. If we are referring to using a knife on the lateral side of the chest, this is simply a different method of chest decompression called a thoracostomy. We make an incision through the intercostal muscle to access the pleural cavity and manually decompress the space with a finger. If we are referring to using a knife on the anterior chest where we normally place a needle, then this is to stop the needle sheath from splitting. Sometimes when we place a needle with a plastic sheath straight into the chest, it can be difficult to pass through the skin. The extra force can lead to the sheath splitting. To prevent this, we can make a small incision first to bypass the skin avoiding damage to the device.

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Paediatrics With Paramedic Author Amy

Got a question about managing paeds?
Questions can be sent to Amy at hello@theshiftextension.org

Reducing Medical Anxiety in Kids

Paramedics across Australia are busier than they have ever been before. And with that, things like school visits and other important community engagements all get put on the back burner. Many of us don't feel like we have the time around busy shifts and not every service has the ability (or luxury) to have a dedicated community education/engagement department. Unfortunately, this has resulted in a significant decline in interactions with young children in calm and safe environments. Research conducted by the Royal Children's Hospital in Melbourne found that children who are familiar with medical procedures and medical professionals generally experience less anxiety, less distress and are more cooperative during procedures which in turn empowers the child and builds resilience (Royal Children's Hospital Melbourne, 2021).

Additionally, school and community visits have more impact than just showing children an ambulance and flashing lights. These crucial interactions can shape how children grow to understand and respond in emergencies - a vital life skill. Research suggests that kids are highly motivated to learn basic lifesaving skills such as recognising a cardiac arrest, calling for help and performing CPR. It is suggested that teaching children about CPR at regular intervals as they age will develop their skills and knowledge, so that a four-year-old who can identify when to call 000 becomes a 10-year-old who may begin to perform effective chest compressions (ILCOR, AHA, EHC, 2023).

With time and availability barriers in mind, the book, 'What Paramedics Do', was developed as a resource that any school or community can use independently to help reduce medical anxiety through familiarity and provide children with education about Paramedics and tips on how/when to call 000. But, the book is not essential in providing this information by any means. Our everyday passings, waves from our ambulance and general interactions with children have much more of an impact than I think we ever could have imagined.

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Rad Research with Paramedic Matt

Got a question about paramedicine research?
Questions can be sent to Matt at hello@theshiftextension.org

Hey folks,
Research doesn't have to be dull! Here's a short little blurb where we share a random selection of fun, quirky research articles we've stumbled across.

This 2020 study did a meta-analysis (which just means using statistics to pool the results of lots of smaller studies, hopefully getting an overall answer that's more reliable) of the accuracy of lung auscultation.

They pooled 34 studies (for reference, that's a lot) and found that, for all acute lung diseases overall, we have a sensitivity of 37% and specificity of 89% when having a listen.

How should you use this study? It's a great reminder not to rely on any one tool for diagnosis and treatment decisions.

This probably also means that more accurate tools like ultrasound (which, for example, has 100% sensitivity and 90-something% specificity for pneumonia) is the way of the future for all of us.

DOI: 10.1038/s41598-020-64405-6

Citation: Arts, L., Lim, E.H.T., van de Ven, P.M. et al. The diagnostic accuracy of lung auscultation in adult patients with acute pulmonary pathologies: a meta-analysis. Sci Rep 10, 7347 (2020).

What does that mean?

Sensitivity is how well you pick something up - so only 37% of patients with a lung disease were identified on auscultation. This means if you don't hear anything, you can't say the patient doesn't have a disease; you will miss 63% of unwell patients!

Specificity is how accurate the sound is for a condition - unsurprisingly, this is higher at 89%, meaning if you hear something on auscultation, most of the time there is a problem in the lungs. But, again, for 11% of patients, there won't be a lung pathology at all, and the abnormal sounds are normal for them.

Rad Research continued

For the COPD/Asthma combo, the sensitivity of wheezes was 26%; three quarters of patients ultimately diagnosed with the conditions won't wheeze.

The good news is everyone is OK at auscultating haemos/pneumos, with a sensitivity of 70% and a specificity of 99%.

How should you use this study? It's a great reminder not to rely on any one tool for diagnosis and treatment decisions.

Got a Questions about paramedicine research?
Questions can be sent to Matt at hello@theshiftextension.org

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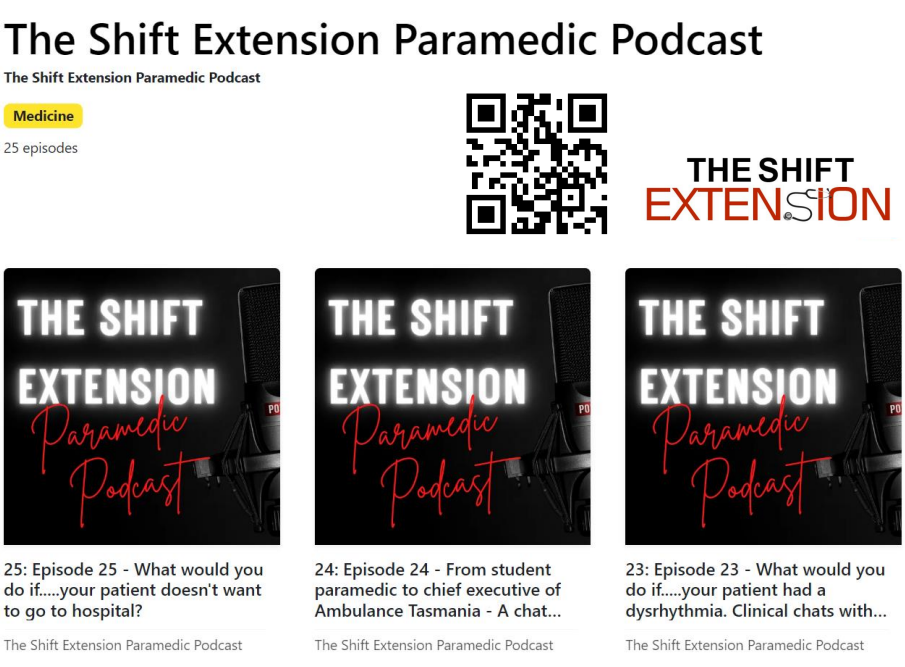

Wellness With Dr Sandy

Got a question about paramedic wellness?
Questions can be sent to Sandy at hello@theshiftextension.org

Prioritizing Paramedic Wellbeing

It's easy to talk about it. In fact, it's so easy that the idea of the construct of paramedic wellbeing (health and wellbeing or wellness and the list goes on) that we get caught up in the idea that talking about it and doing something about it become fuzzy. Add to this the availability of high quality (and low quality) personal data about our human performance that we can enter a gridlock state. And…how many of you just glanced at the Garmin or Apple Smartwatch on your wrist? And for good measure, add in the increasing pace of life: work, rest, family, study, exercise, overtime, shift overrun, ramping, CPD…the list goes on continually. As paramedic health advocate, Dr Ben Meadley states "the health and wellbeing of paramedics is central to a successful ambulance service and the provision of the highest level of clinical care"(1)

Recognizing the Challenges

Paramedics face a unique set of stressors stemming from the unpredictable nature of their work. The constant exposure to traumatic incidents, long hours, and irregular shifts can lead to burnout, compassion fatigue, and even post-traumatic stress disorder (PTSD) (2-4). Recognizing these challenges is the first step towards prioritizing self-care and seeking support when needed. But how do we get to the point of acknowledging these stressors. I know, personally, that I avoided the thought of unpacking and reflecting on all the stressors that accompanied me during my paramedic career. And I paid a price for it. What I do know (at this point in my life) is that there are key areas to start to examine and put into practice:

Building Resilience

Research suggests that resilience can be cultivated through a combination of individual and organizational strategies (5). At the individual level, paramedics can adopt mindfulness techniques, engage in regular physical activity, and maintain a strong support network. These practices not only mitigate the effects of stress but also enhance overall psychological resilience. But where do we find these resources? And how do we know they advocate best practice? Part of the solution lies in finding trusted sources. Recently, a first responder website, Respondr (www.respondr.com.au) began offering some of this information.

Embracing Peer Support

Peer support programs have emerged as a cornerstone of paramedic wellbeing. By fostering a culture of openness and trust, these programs provide a safe space for paramedics to debrief, share experiences, and seek advice from colleagues who understand the unique challenges of the profession. Studies have shown that peer support not only reduces feelings of isolation but also promotes psychological healing and resilience. There is much work still to do in this space and it will take more research to find the best way to utilise peer support in effective ways for paramedics.

Accessing Professional Resources

In addition to peer support, paramedics should have access to professional resources such as counselling services and mental health initiatives. These resources can offer specialized support tailored to the needs of paramedics, including trauma-focused therapies and stress management techniques. By proactively addressing mental health concerns, paramedics can prevent the escalation of symptoms and maintain optimal functioning both on and off the job.

Advocating for Change

Paramedic wellbeing is not solely the responsibility of individuals—it also requires systemic changes within the healthcare industry. This includes implementing evidence-based scheduling practices, providing adequate rest periods between shifts, and promoting a culture of openness and support within paramedic organizations. By advocating for these changes, paramedics can create healthier work environments that prioritize both patient care and provider wellbeing.

In conclusion, prioritizing paramedic wellbeing is essential for maintaining a resilient and effective workforce. By integrating best evidence-based practices, embracing peer support, accessing professional resources, and advocating for systemic change, paramedics can enhance their overall quality of life while continuing to serve their communities with excellence and compassion.

1. Meadley B, Caldwell J, Perraton L, Bonham M, Wolkow AP, Smith K, et al. The health and well-being of paramedics - a professional priority. Occup Med. 2020;70(3):149-51.

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3. Nirel N, Goldwag R, Feigenberg Z, Abadi D, Halpern P. Stress, Work Overload, Burnout, and Satisfaction among Paramedics in Israel. Prehosp Disaster Med. 2012;23(6):537-46.

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Sandy is a Registered Paramedic who began a career in paramedicine over 30 years ago in Canada. Since emigrating to Australia in 2013, he has gone on to complete a PhD in paramedic health while at the same time, teaching a new generation of paramedics.

To find out more about Sandy''s work check out the Edge Human Performance Group (www.edgehumanperformancegroup.au)

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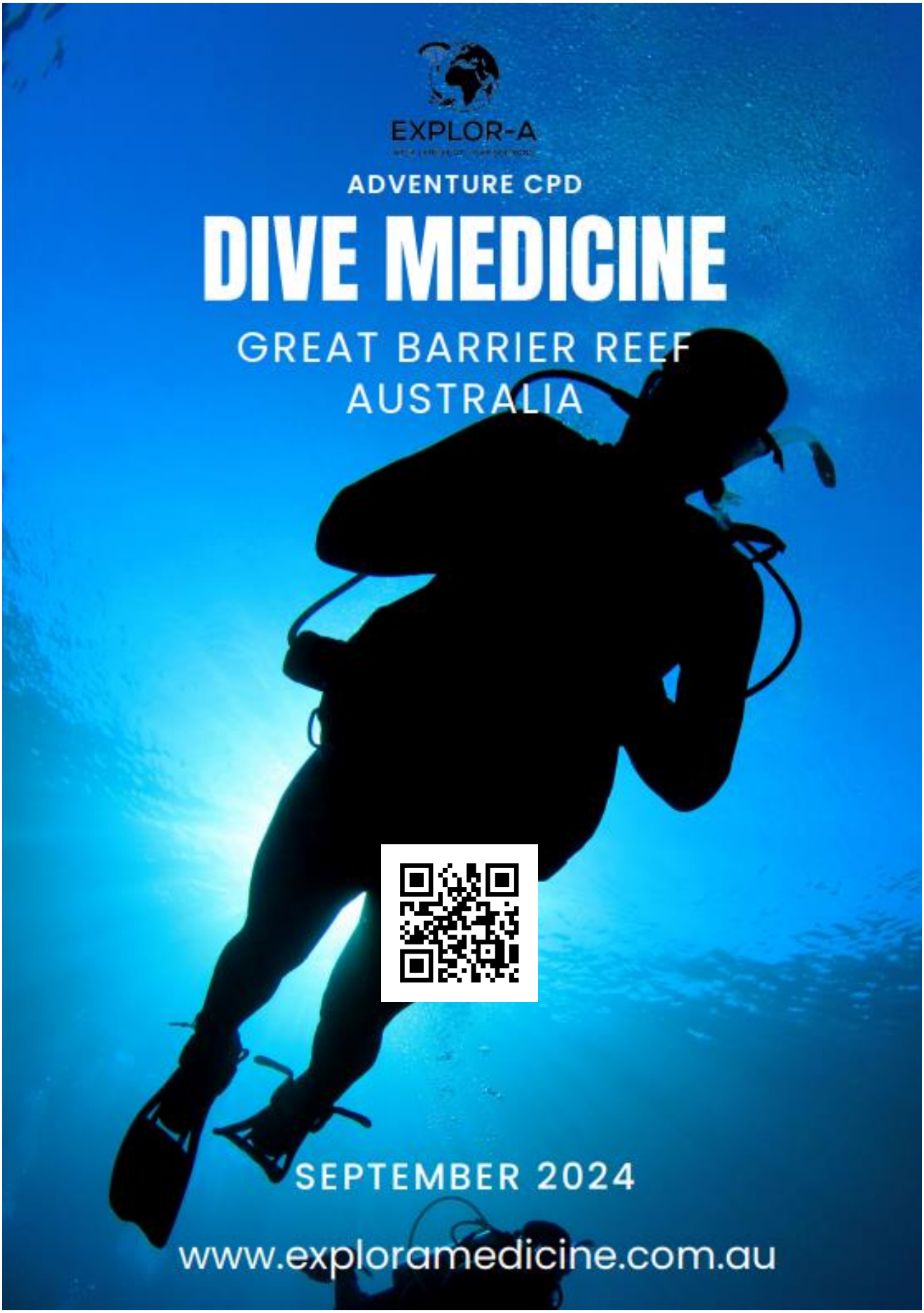
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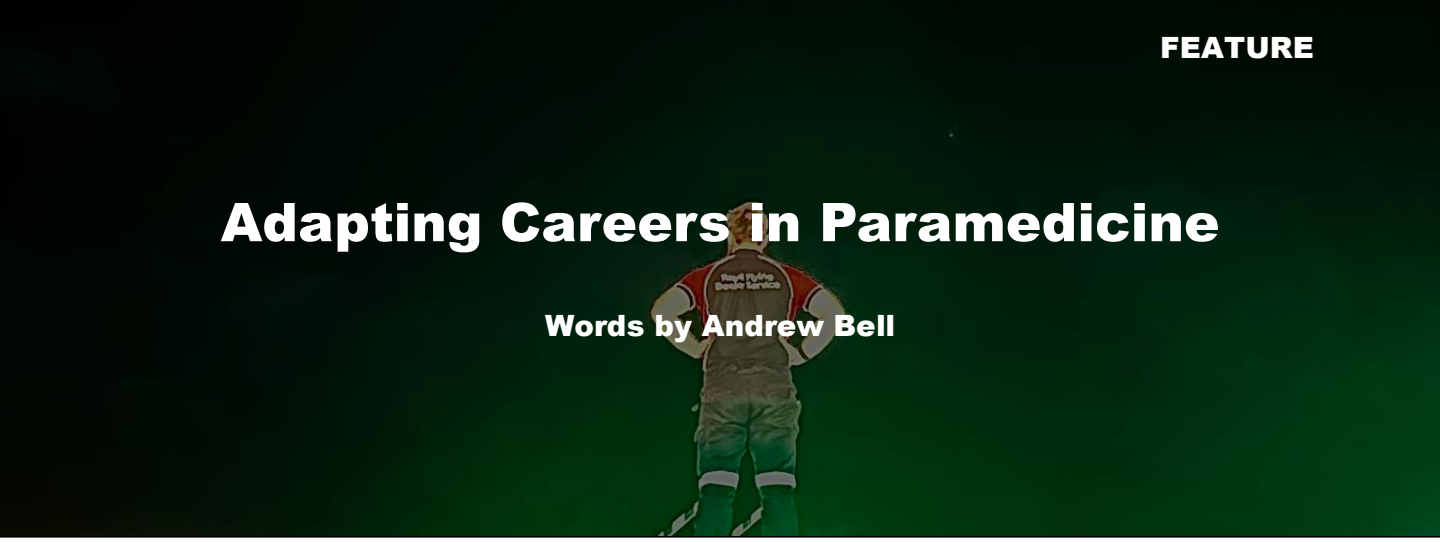
Adapting Careers in Paramedicine



Words by Andrew Bell

Paramedicine… the very meaning of the word is fluid and difficult to define. Recently published articles looking have looked to provide a more academic and rigorous definition, however the term continues to evolve due to consistent growth of ideas, environments, skills and knowledge. A major reason for this difficulty in nailing down an exact descriptor is the constant state of change within the profession. New and innovative opportunities are being afforded to Paramedics in this exciting and growing world of careers in healthcare.

Gone are the days when 'Paramedicine' equated to 'Ambulance', and while the majority of Paramedics in Australasia are still currently employed by the state and national based jurisdictional ambulance services, the statistics gathered by the professions regulatory body AHPRA clearly indicate a significant move in medical professionals registered as 'Paramedics' into non-jurisdictional career pathways. These pathways have utilised Paramedics for some time, particularly the resource and industrial sectors where Paramedics have provided acute care at the point of injury in remote settings and austere environments for years. However, there are also an abundance of new and evolving pathways, particularly in the community, extended care and primary care sectors, were the unique and flexible skills set of Paramedics are being recognised and utilised to provide a high level of care across a broad range of clinical environments and scopes of service delivery.

One such 'alternative pathway' is being developed in the Royal Flying Doctors Western Operations Branch, where Paramedics have been introduced to the organisations workforce, initially in a role specific to individual resource sector contracts, but with opportunities to develop and grow as intrinsic members of the organisations 'Industrial Health Care Team'. The team is being integrated into the broader RFDS model and has recently begun work alongside Doctors, Nurses and even Emergency Services Officers to break down the traditional silos of professional healthcare clinical education and operational service delivery. This allows the service to begin the process of creating a synergetic clinical team with the strengths of all the various aspects of the different medical professions being harnessed to produce a more effective and high-quality service delivery model for the end user, the patients. Essential to this ability to integrate and provide an opportunity for Paramedicine to showcase its value and effectiveness in a multi-disciplinary healthcare workforce is

the empowerment by the organisation to let Paramedics 'do what they do best'. Operating in dynamic, and unscheduled environments, often remote or austere in nature and requiring a mix of problem-solving, critical thinking and situational awareness.

The RFDSWO model is only one such example of the use of the 'Paramedic Mindset' in developing and delivering solutions to complex medical service delivery models. Other areas of interest include, but are not limited to, the use of Paramedics in remote community clinics, the delivery of Search and Rescue capability across both national and international jurisdictions, and the use of Paramedics in hospital pathways traditionally the domain of Nurses and Doctors. What is most important is that Paramedicine as a profession and those of us that practice as Paramedics, continue to recognise the opportunities as they present, have the presence of mind to apply our unique and ever evolving skill set to those opportunities, and then deliver the highest quality of service in order to showcase the abilities of our ever growing and evolving profession.

The future of our profession is firmly in our own hands and with the diverse and ever expanding options available to us what is key is that we continue to push for excellence in everything that we do, whether it's on an offshore platform, in the air, on the sea, or anywhere in between.

Eating Choices of Paramedics whilst on Shift

Words by Steph Thompson

Let me introduce myself- my name is Steph Thompson, a Dietitian by trade who has followed a zig zagged path ending up working with Government Marine organisations providing onboard clinicians, to support crews and other voyage participants whilst out at sea. This is ironic as back in 2015 when I was given the choice of topic for my Nutrition and Dietetics Honours Thesis, I found myself drawn to the one focusing on the eating choices of paramedics whilst on shift. A topic seldom explored.

There have been numerous research papers on the eating habits of shift workers, but not specifically paramedics, who as first responders are the only emergency service that has no protected meal breaks.

One of my co-authors was Dr Bill Lord, I believe some of you may know him. The finished product ended up being a published in The Journal of Nutrition and Dietetics. 'Qualitative study of Queensland paramedics' perceived influences on their food and meal choices' during shift work.'

Fast forward to 2023 and I had the pleasure of meeting Sunny Whitfield while he was convening the AWEMS conference. Out of interest Sunny asked me to send him my article and then upon reading it, he invited me to write a 1000-word summary about it, so I'd better get on with it and stop using up my word allowance!

When it comes to food and meal choices, this study aimed to explore the perceived influences paramedics felt shaped their choices, specific to their unique working environment. Most food choices relate to factors unique to the individual such as social, behavioral and personal determinants. Within the work setting, environmental influences have been identified specific to the industry. Workload, time of shift and the availability of food retailers are considerations for paramedics. Paramedics, on a rotating shift pattern have been shown to have higher incidences of chronic disease than the general population. The nature of their work means that regular meal breaks cannot be assured.

Fifteen paramedics working on a rotating shift roster in Queensland agreed to participate in this qualitative study conducted via a telephone interview. Initial questions focused on demographics including gender, age category, length of service and job role. Further questions regarding lifestyle, shift structures, food procurement, preparation and consumption were open ended. Interviews were audio recorded, transcribed verbatim and data analysed

Four main themes emerged, these were physiological, psychosocial, physical environment and organisational environment. Specific to the Paramedic profession were organisational environment and physical environment.

In the organisational environment, the structure of the meal breaks significantly influenced food choices as emergency call outs and increased workloads has led to more disrupted or missed meal breaks. Non-perishable, transportable and minimal preparation food was favoured. These food types could be eaten at a convenient time should breaks be interrupted or eaten in an ambulance if a break had been missed.

Participants felt that eating events were opportunistic and purchasing foods while out on the road or instructed to take a meal break away from the rostered station was often inevitable. The partner who was working in the ambulance was another consideration, if one shift work partner purchased food during the shift, it was quicker for the other to purchase food too.

The 'meal windows' were mostly viewed as a 'non-working period' rather than an eating opportunity and they did not view eating as something they could enjoy.

Concerns were raised that not eating food for an extended period could potentially be unsafe and detrimental to their health.

The physical environment, being based out of an ambulance was another unique influence on food choice. The lack of facilities to store, prepare and consume foods meant that preferred foods were pre-prepared or purchased and were transportable, non-perishable and conducive to being eaten while driving.

Food in an ambulance environment where patients receive treatment was not preferable, however, some would take foodstuffs into the ambulance but made choices that they deemed as more sanitary. All participants had at some point had to eat either pre-prepared or purchased food whilst in the ambulance. There was a real fear of not being able to access food while on shift and many food choices were based on the opportunistic work environment where they found themselves 'scoffing' food down as they went from job to job.

In summary, due to high workloads, participants ensure the foods taken to work or purchased during shift can be eaten when an opportunity arises and require no preparation. A lack of facilities to store or prepare foods, means food (either brought from home or purchased) must be transportable, easy to eat, non-perishable and require minimal preparation.

Also, the fear of interrupted breaks meant that participants changed their personal food choices to accommodate their colleagues to ensure both ate within the limited time frame. This highlights how missed and interrupted breaks changed the participants' views of food, making it into an opportunistic necessity rather than a pleasurable experience.

Participants were conscious that long periods without consuming food could potentially be detrimental to their health and ability to perform. Chronic fatigue and burnout can affect safety and a paramedic's ability to perform. A 'protected' meal break may not only enable healthier food choices but also reduce the levels of fatigue and minimise the effect on safety and performance of paramedics. The ability to make healthier food choices, in this unique working environment, will assist with lowering the burden of nutrition-related diseases, which have been identified in this population.

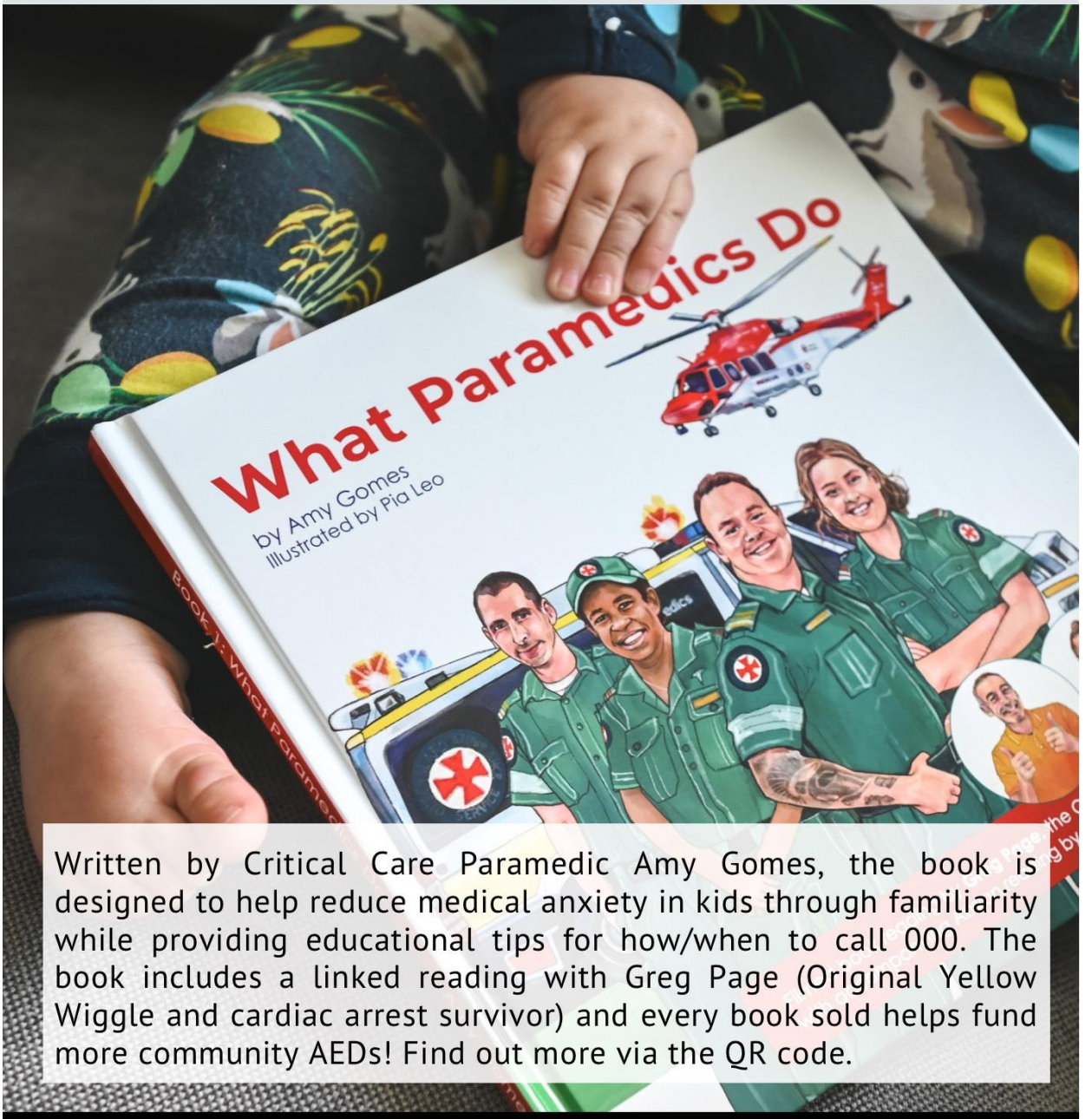
Research to investigate suitable foods that would cater to the paramedic 'work environment' is recommended.

In conclusion, this study is the first to explore the specific influences on the food choices of a group of paramedics in Australia relating to their unique working conditions. The environment in which paramedics work means they have no control over where they will eat, when they will eat or if they will eat. This has implications for their ability to make 'healthy food choices'.

As paramedics, I hold you all in the highest regard, you are the first responders- the ones who see the worst, are exposed to all manner of situations and must think on your feet immediately. All I can say is, thank you and stay safe out there.

WHAT PARAMEDICS DO

BY AMY GOMES



Written by Critical Care Paramedic Amy Gomes, the book is designed to help reduce medical anxiety in kids through familiarity while providing educational tips for how/when to call 000. The book includes a linked reading with Greg Page (Original Yellow Wiggle and cardiac arrest survivor) and every book sold helps fund more community AEDs! Find out more via the QR code.

www.onelittleheart.com.au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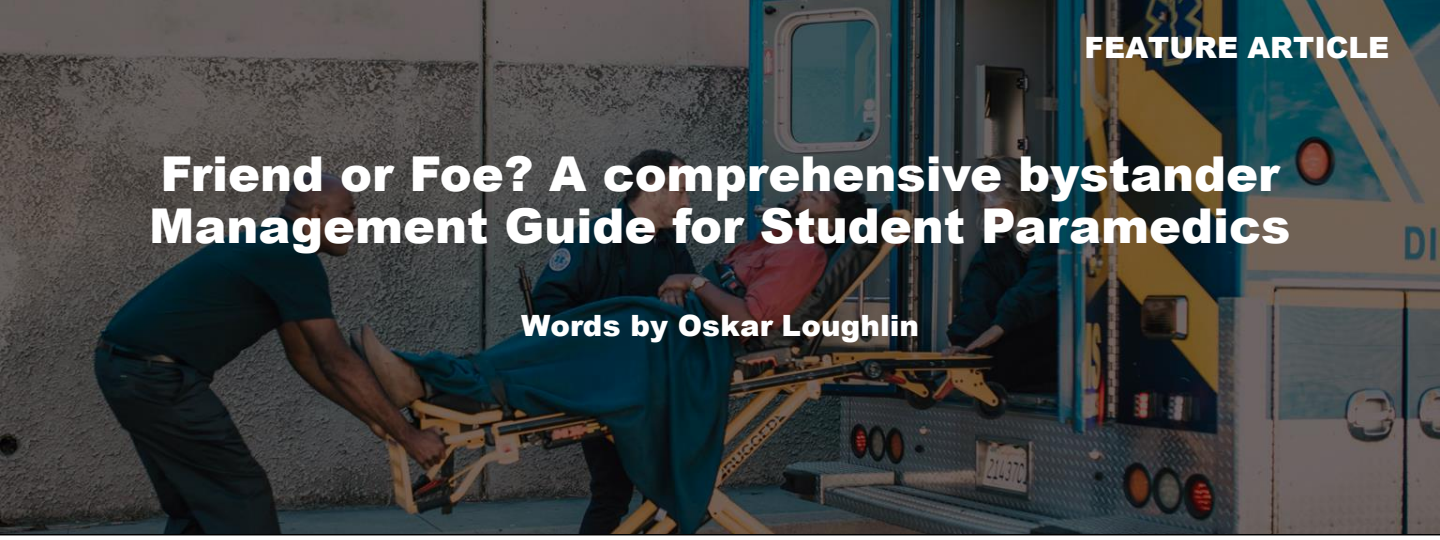

Friend or Foe? A comprehensive bystander Management Guide for Student Paramedics

Words by Oskar Loughlin

Human beings are by far the most diverse species of primate. I challenge anyone who disagrees with this statement to spend a single day in the back of an ambulance. Quickly you will see, if you haven't already, that no two situations, cases or patients are perfectly identical. This diversity in population is one of many reasons why paramedics continue to be coined generalists. As generalists, paramedics must possess the ability to address these diversities as they arise, free of bias, and with poise.

One of the more challenging forms of diversity we encounter is the diversity of reaction. People will react and behave in wildly different ways when their friend or family member requires medical attention. Some will benefit the overall outcome, some will have a more deleterious effect, others will become the second patient, and many will become a combination of all three. How do we as students of paramedicine account for this? The current dogma would have you believe that the ability to deal with these situations is a function of experience. This is true. Despite this, a framework that can be used to systematically redirect an authentic or simulated bystander's influence holds promise. Are they a friend or are they a foe when it comes to the betterment of your patient? To fill this void a comprehensive bystander management guide for student paramedics has been proposed.

Step 1. Establish who the person is to the patient. "How do you know the patient?"

(Make it an open-ended question and don't assume! A close-ended "Is this your father?" is a quick way to make things awkward when it turns out to be their partner). Overall knowing who the person is to the patient is a great way to begin to categorise their intentions. However, even a close family member can have a net negative effect on the outcome. Remember this.

Step 2. Analyse their verbal content and body language.

Look for signs of emotional distress, helpful intention, aggression and/or general distraction and manage according to

Step 3a. Emotional Distress.

These bystander presentations will often range in severity, however, even the most distressed responses are not necessarily indicative of any type of psychopathology in the short term (1). With this said, coping styles in these situations will range from the emotionally expressive to the reticent and reserved (1). More than ever reflective listening and paraphrasing become pivotal

in the management of these bystanders. However, the need to get back to the patient should be highlighted to the bystander. Consider, asking the bystander to collect some of the patients' belongings ahead of the trip up to the hospital. Understand that this person may become the second patient and request backup as appropriate.

E.g. "I can see that you're quite upset *patient's name* must be very special to you. Right now, we are doing everything we can to help them out and when I can, I will be right with you. For the time being, can you collect some belongings that *patient's name* might want with them at the hospital?"

Step 3b. Helpful Intention.

These bystanders may have a piece of paper with them, or they may be standing near the patient looking over your management. While they may appear emotionally well, being action-orientated is indeed a coping style for many people (1). With this in mind, it is important to check in with them. Following this, an atypical secondary assessment that is adjusted for the bystander perspective can be completed. The O-MAPLE scaffold has been devised for this purpose. E.g., If you're up for it, can I ask you some questions about your friend?

•Onset- When did all this start?

•Medications- Are they on any medications?

•Allergies- Do they have any allergies?

•PMhx- Do they have any past medical history?

•Last-ins/outs- Have they been drinking and eating normally?

•Events prior- Has it been a normal day for you both? Did anything different happen?

Step 3c. Dangerous or Aggressive.

These patients may be aggressive towards paramedics or towards the patient. Risk stratification determines that when these bystanders are present, they become your primary focus. D is for danger. Utilise consequence management where possible however don't hesitate to call for police backup early on and evacuate the scene as necessary. E.g. "Sir/Madam I can see you are quite upset. I'm asking you to leave this premises as you are interfering with our ability to attend to your friend. At this stage, police are on the way and what you do from now on, will determine how they will deal with you."

Step 4. Relay the information to your partner.

Closed-loop communication will often be the best way for this information to be relayed. With roots in military radio transmission, closed-loop communication is pivotal in the communication of vital patient information (such as information disclosed in the O-MAPLE secondary survey) (2). Closed-loop communication may be useful in these bystander interactions when your partner is in earshot of a conversation you've had, and you want to confirm they've heard. The process works as follows. 1) You communicate a message to your partner (utilising their name if possible), 2) your partner accepts the message with acknowledgement of receipt via verbal confirmation, seeking clarification if required, and 3) you verify the message has been received and interpreted correctly, thereby closing the loop (2). This provides a way for medical information and situation reports relating to the bystander to be relayed with consistency and without flaw.

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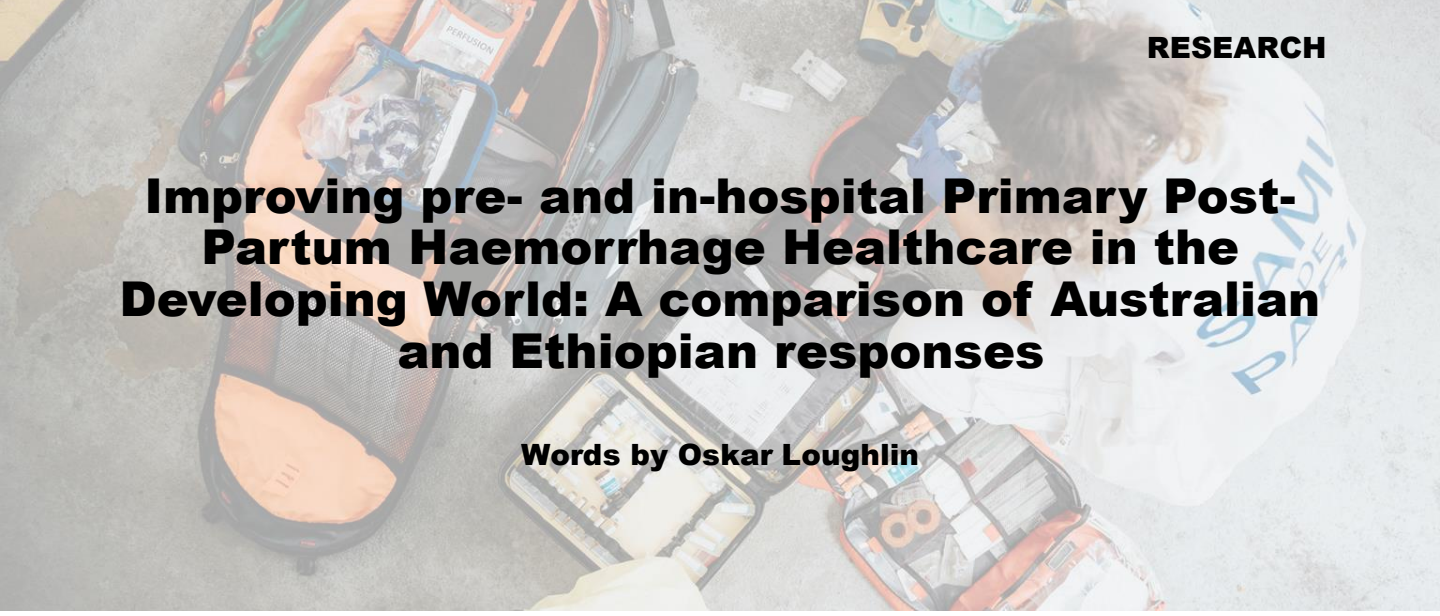

Improving pre- and in-hospital Primary Post-Partum Haemorrhage Healthcare in the Developing World: A comparison of Australian and Ethiopian responses

Words by Oskar Loughlin

Introduction

Postpartum haemorrhage (PPH) (defined as a maternal blood loss exceeding 500mL after childbirth), is a critical concern for maternal health worldwide (1). Despite global concern, disparities in antepartum, intrapartum, and postpartum PPH responses are evident across nations. As such, the following essay will compare the Ethiopian and Australian PPH healthcare responses from a pre and in-hospital perspective. With Australia reporting a maternal mortality ratio (MMR) of 5.5 per 100,000 births (6% from PPH), and Ethiopia an alarming 412 per 100,000 (25-30% from PPH), understanding and addressing these discrepancies is crucial to decreasing the outcome of disparity (2, 3). From these understandings, a set of recommendations tailored to Ethiopia's needs will be provided.

Ethiopia: An Introduction

Ethiopia is a developing nation subject to funding, education and resourcing-related limitations which continue to impact their maternal healthcare response (4). The following will highlight the paucities in Ethiopian PPH care that manifest because of these limitations.

Antepartum

Overall, Ethiopia mothers (EM) who are non-compliant with antenatal care (ANC), possess a six-fold greater likelihood of PPH following childbirth (5-7). Despite this, a large cohort multilevel study found only 36.78% (66.93% urban, 28.41% rural) of EM attended four or more ANC appointments during their last pregnancy (8).

Intrapartum

90% of EM tend to birth within their home, often in the absence of a skilled birth attendant (SBA) (9). This tendency is linked to the belief that SBA are non-essential (42%), non-customary (36%), too costly (22%) or too far (8%) (9). As a way of increasing hospital utilisation, the Federal Ministry of Health of Ethiopia introduced free ambulance transportation specifically for EM in active labour (10). However, insufficiencies in resource utilisation, community education and ambulance attendant training, meant limited MMR improvements were observed (10).

Postpartum

Pre-hospital, the Maternal Health in Ethiopia Partnership (MaNHEP) implemented a three-staged intervention, aimed at increasing the use of misoprostol (common per oral uterotonic use for its cost and storage

advantages) during third-stage labour, through training and cultural communications (11). While the community administration of misoprostol increased, the use of fundal massage remains under established pre-hospital (11). Furthermore, active management of third-stage labour using uterotonics, cord tractioning, and fundal massage is performed often in Ethiopian hospitals, but with low efficacy (32.8% of PPH cases) (12). Despite this, Ethiopia's essential medications list for in-hospital treatment is highly researched and aligns closely with Australian standards (Appendix 1.1) (13).

Australia: An Introduction

Unlike Ethiopia, Australia's healthcare system is well-established and highly utilised. Moreover, significant budget contributions ($354 million in 2021-22) have been made to improve Australian maternal health (14-20). The following will highlight the effectiveness of Australia's PPH response.

Antepartum

94.8% of Australian mothers (AM) who gave birth in 2021, attended 5 or more ANC appointments (3). ANC appointments prove vital in determining a mother's risk of PPH. Using haematology and ultrasound, key risk factors relating to a mother's uterine atony, placental problems, coagulopathy, and bleeding tendency inform ante- and intrapartum interventions (Appendix 2.1) (21).

Intrapartum

In Australia, pre-hospital intrapartum management of PPH is characterised by early community recognition and rapid escalation to hospital or Paramedic care (22). Across the nation, the average ambulance response time is 30 minutes, accompanied by an average of 53.3 ambulance-qualified clinicians per 100,000 individuals (24). With 97% of AM opting to birth within hospital, the adequacy and utilisation of ambulance/hospital care are apparent (23).

Postpartum

In Australia, pre-hospital management of PPH is facilitated by Ambulance clinicians who, according to their clinical practice guidelines, treat PPH using a variety of techniques and procedures. These include manual haemorrhage control measures (fundal massage, external aortic compression, bimanual compression), blood or fluid intravenous transfusions, along with the administration of high-flow oxygen, tranexamic acid, and uterotonic medications (ergometrine or oxytocin depending). (14-20). In hospital, PPH management builds upon the above measures, with escalation to second-line uterotonic drugs (intramuscular Carboprost), massive haemorrhage control protocols (administration of fibrinogen concentrate, cryoprecipitate, and calcium gluconate), and surgical procedures (laparotomy, hysterectomy, intrauterine balloon tamponade or bilateral uterine artery ligation) performed as necessary (15).

A New PPH Management Plan for Ethiopia

Overall, key discrepancies between Australian and Ethiopian PPH healthcare have been identified at the antepartum, intrapartum, and postpartum stages. As such the proposed Ethiopian management plan is three-tiered. Because economic limitations underpin many of Ethiopia's healthcare issues, the following healthcare plan will be financially assisted through the Australian Government Direct Aid Program (AGDA) (24). An established Australian Embassy financial tool that assists developing nations to improve their healthcare (24).

Firstly, Ethiopia's ANC compliance (36.78%) and SBA (10%) rates are aspects of Ethiopian PPH care that can be improved (8,9). Uganda historically battles similar ANC compliance issues as Ethiopia (25). Uganda's successful approach included promoting ANC through word of mouth and radio advertisements, resulting in significant compliance improvements (65% vs. 11%) (25). Given Ethiopia has demonstrated adaptability to cultural communications (TV spots, mobile van videos, poetry contests for Misoprostol), implementing similar ANC-focused cultural campaigns holds promise (11,25). Additionally, fostering a cultural shift that supports SBA and ambulance utilisation is imperative for enhancing PPH outcomes in Ethiopia. Emulating Tanzania's strategy of birth plan discussions during ANC (which involves discussion around delivery location and the importance of skilled care, transportation, and blood donors), could elevate postnatal care rates which are critical for PPH management (26). This approach would synergise with Ethiopia's existing complimentary ambulance service, the likes of which will be built upon in the following recommendation.

Secondly, the response capacity of the Ethiopian ambulance service needs to increase if PPH outcomes are to be positively affected. However, in developing nations, upskilling the health professional workforce is difficult due to financial and societal limitations (27). The non-pneumatic anti-shock garment (NASG) is a mechanical device that reduces blood flow to the uterus treating hypovolemic shock from PPH (28). Its use in 1,066 health facilities across Ethiopia, saw significant reductions (80%) in mortality from PPH (29). Despite this, Ethiopian Ambulances are yet to receive the NASG (30). As the product is low-cost (0.50 USD) and can be reused up to 144 times, its implementation into the complimentary ambulance service is highly advisable (30).

Thirdly, Ethiopia's in-hospital response to PPH requires development if maternal outcomes are to improve. While Australia and Ethiopia's essential medicine lists appear to be closely aligned, gaps in Ethiopian hospital PPH care are evident (12,13,15). The implementation of the maternal early warning system (MEWS) could provide an adequate framework for Ethiopian clinicians to work with when managing PPH (31). MEWS is a framework that assists clinicians during maternal emergencies, using the patient's physiological parameters, the clinician can determine the patient's likelihood of deterioration, with subsequent treatment interventions provided as indicated (31). Conclusion

To conclude, the Ethiopian PPH healthcare response would benefit from the above management plan as it targets the antepartum, intrapartum, and postpartum insufficiencies of Ethiopia's healthcare system. Utilising AGDA, the Australian embassy could overcome Ethiopian economic insufficiencies and bridge the gap between Ethiopian and Australian PPH care.

Appendices

Appendix 1.1: Ethiopian Essential Medicines List

1	Clomifene citrate	Tablet, 50mg
2	Ergometrin	Injection, 0.2mg/ml
3	Magnesium sulphate	Injection, 50% in 20ml
4	Misoprostol	Vaginal tablet : 0.025mg
5	Misoprostol + Mifeprostone	Tablet, 200mcg + 200mg
6	Pethidine Hydrochloride	Injection, 50mg/ml
7	Dinoprostone (Prostaglandine E2)	Tablet, 3mg
8	Oxytocin	Injection, 10unit/ml
9	nifedipine*	Tablet, 10 mg. *salbutamol 2mg tablet can be use alternatively
10	tranexamic acid	Injection: 100mg/ml in 10ml ampule
11	Caffeine citrate	Injection: 20 mg/ mL
12	Dexamethasone *	Injection, 4mg/ml *bethamethasone will be used alternatively
13	Norethistirone	Tablet, 5mg

MOHE, 2020

Appendix 2.1. Postpartum Haemorrhage Risk Factors

Prepartum	**Uterine atony** Previous PPH Baby >4 kg Multiple pregnancies Increased body mass index Infection **Placental problems** Placental abruption Placenta previa Placenta accrete **Coagulopathy** Amniotic fluid embolism Maternal sepsis **Bleeding tendency** Inherited Acquired (receiving anticoagulant therapy)
Antepartum	**Uterine Atony** Induction of labor Labor >12 h **Placental problems** Placental abruption **Coagulopathy** Amniotic fluid embolism Massive transfusion **Genital tract trauma** Instrumental Delivery Caesarean Section Uterine rupture
Postpartum	**Uterine Atony** Prolonged third stage of labor Retained placenta **Coagulopathy** Amniotic fluid embolism

McLintock et al., 2020

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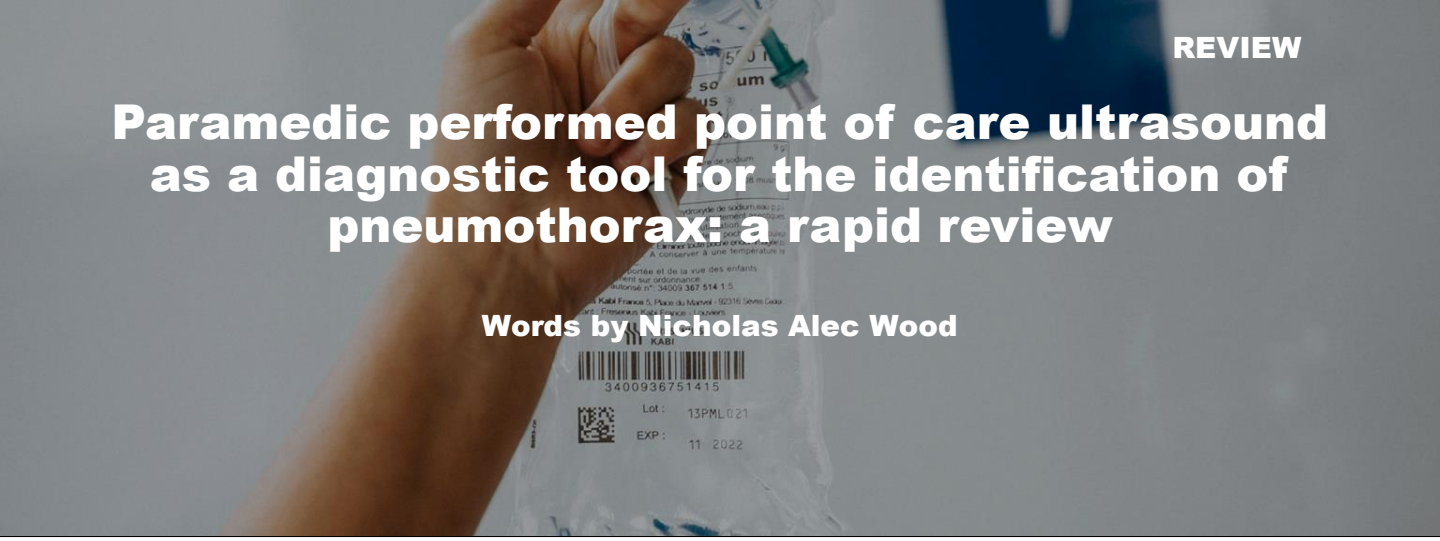


Paramedic performed point of care ultrasound as a diagnostic tool for the identification of pneumothorax: a rapid review

Words by Nicholas Alec Wood

Introduction

Previous research found POCUS to be feasible for paramedics to perform with sufficient quality and expertise for interpretation (1-2). No reviews in the last 7 years have focused on the specific confines of POCUS being used by paramedics as a diagnostic tool for pneumothorax. Thus, the aim of this review is to evaluate the ability and quality of paramedic performed POCUS for the diagnosis of pneumothorax.

Background

Many paramedic advances in scope of practice and clinical innovation are derived from advanced skills from other professions. (3) The use of POCUS in the prehospital setting has previously been a diagnostic tool reserved for physicians (4). The role of non-physician practitioners utilising POCUS has been argued to improve the quality of prehospital care (5). The benefits of expanding the use of POCUS as a diagnostic tool for paramedics may improve patient treatment and management (4).

In the presence of a pneumothorax, the potential for a tension pneumothorax [TPT] to develop can lead to life threatening hemodynamic instability (6). Identification of a pneumothorax in the prehospital setting primarily relies on clinical assessment; however, the sensitivity of clinical assessment such as chest auscultation has been shown to be 58% and in a moving ambulance a significant decrease of sensitivity of 9% (6). Furthermore, even in the most controlled prehospital environments clinical assessment skills and knowledge such as percussion, inspection of tracheal deviation, auscultation and palpation is extremely difficult to identify a life-threatening condition such as a TPT (7). In the austere aeromedical environment increased ambient noise and vibration during flights impact clinical assessment skills (3,7). Likewise, in the prehospital road environment darkness or weather elements can also further impact the ability to accurately use clinical assessment skills (4). X-ray and computerized tomography are generally unable to be performed in the prehospital setting, requiring time and equipment that cannot be made readily available (2). POCUS has been used in-hospital to increase practitioner sensitivity in identifying pneumothoraces (8). Furthermore, in comparison to chest radiography POCUS has been shown to have a specificity as high as 99% (6). POCUS has potential to improve the ability of paramedics to validate clinical assessment findings and improve pneumothorax diagnosis (9).

A key element in the care of patients in the prehospital setting is the decision for urgent treatment and interventions, as well as subsequent transport to an appropriate healthcare location (4). These decisions are

based on the initial evaluation and assessment undertaken by paramedics (4). In the prehospital environment failure to identify a pneumothoraces increases the potential for this condition to worsen during transfer into a tension pathology resulting in respiratory distress and hypotension (6, 8). The treatment of a TPT in the prehospital setting is challenging due to the pressure to accurately and promptly identify and make a clinical decision to treat as the presence of a TPT is a fatal condition if left untreated (6). The standard treatment for a TPT in the prehospital environment is a needle decompression, however, the high potential for fatality of this condition if left untreated has resulted in over-diagnosis and over-treatment resulting in unnecessary harm to patients (8). The ability to be able to accurately and quickly identify a TPT through the use of POCUS supports paramedics in their clinical decision making, improving patient outcomes through timely and appropriate intervention and transfer to a healthcare facility (4).

POCUS has been shown to be a cost-effective method to screen patients for potentially life-threatening injuries (6). Advancements in technology have provided more compact handheld ultrasound equipment that is ideal for the prehospital setting (2). Correctly identifying the presence of a pneumothorax can avoid unnecessary invasive interventions, whilst also providing indications for treatment (8). Early recognition has also been shown to have a direct correlation with patient outcomes (8). Hence, the ability and feasibility of paramedics to be able to utilise POCUS in the prehospital environment has the potential to improve identification of a pneumothorax or TPT.

Methods

The review followed a rapid review format, utilising systematic review methods to obtain an assessment of what is already known.

Eligibility criteria

The articles were screened by a single author, the inclusion and exclusion criteria are shown in Table 2. Only peer-reviewed articles published in the last 7 years from 2016 to 13th September 2022 were screened. Only articles in the English language were included and had accompanying full-text available. Eligible studies included primary research such as randomised control trials, non-randomised control trials, cohort studies, case-control studies, cross sectional studies and case reports or case series. Secondary studies such as systematic reviews and meta-analyses were included. Non primary research such as mechanistic studies, editorials and expert opinion were excluded to improve the rigour of articles included. Only articles which addressed prehospital ultrasound performed by paramedic or equivalent qualification were included (see Figure 1). Articles which only specified physician performed ultrasounds were excluded (see Figure 1).

Search strategy

Four databases were searched (CINAHL Plus with Full-Text, MEDLINE ALL, Cochrane Library and PubMed). The search utilised three topic areas for research, which included 'Paramedic', 'Ultrasound' and 'Pneumothorax'. Search terms were grouped into three areas based on relevance and similarity to the topic areas (see Table 1).

Table 1 Summary of search terms combining the 3 search concepts

First Topic: Paramedic	Second Topic: Ultrasound	Third Topic: Pneumothorax
"Paramedic"	"Ultrasound"	"Tension pneumothorax"
"EMS"	"Sonography"	"Pneumothorax"
"Emergency medical service"	"Sonogram"	"TPT"
"Prehospital"	"Ultrasonography"	
"Pre-hospital"	"Point-of-care ultrasound"	
"Ambulance"	"POCUS"	
"Emergency medical technician"		
"EMT"		
"Paramedicine"		

Study selection

A total of 128 potential articles were screened based on title and abstract for eligibility after the removal of duplicates (n=12), time of publication (n=280) and non-English language (n=33). 60 articles which met inclusion from the title and abstract with full text available were then screened in full for eligibility using the inclusion and exclusion criteria outlined in Table 2 (see Figure 1). Three articles were excluded due to full text being unavailable.

Assessment of quality of evidence

Of the selected studies that met eligibility criteria, each article was assessed using a checklist developed by the Critical Appraisals Skills Programme [CASP] (10-14). The framework developed by Harbour & Miller (15) was used in conjunction with the CASP checklists to determine a score and grade for the level of evidence of the research (see Table 4). The framework developed by Harbour and Miller (15) was chosen as it provides a system that allows for recommendations based on the available evidence to be weighted accordingly, whilst also maintaining the link between the strength of available evidence and grade of recommendation (15). Furthermore, the framework aims to ensure that grading system incorporate a clear methodological assessment of quality, quantity, consistency and applicability of the evidence (15). Finally, the framework provides a clear and explicit guideline to allow users to comprehend the link between the strength of evidence and the grade of recommendation (15). Thus, in conjunction with this framework the utilisation of the CASP checklists aimed to reduce the level of bias within the review and to validate the levels of evidence and strength of the available evidence.

Table 2 Inclusion and exclusion criteria	
Inclusion	Exclusion
Peer reviewed	Full-text not available
Full-text available	Non-paramedic or physician only research
English language	No mention of pneumothorax diagnosis or interpretation
	Non prehospital ultrasound
Study type:	
- **Systematic reviews**	Study Type:
- **Meta-analyses**	- Mechanistic Studies
- **Randomised control trials**	- Editorials
- **Non-randomised control trials**	- Expert Opinion
- **Cohort studies**	
- **Case-control studies**	
- **Cross sectional studies**	
- **Case reports or case series**	
Paramedic performed ultrasound	
Prehospital ultrasound	
Education of paramedic ultrasound	
Diagnosis or interpretation of pneumothorax	

Results

Study selection

The review identified 453 articles, of these, 6 articles were included, and 2 articles were excluded after further appraisal. One article mentioned paramedics but only in minimal detail and the evidence was solely physician based (16). The second article whilst relevant to paramedics using POCUS, did not discuss pneumothorax in detail (17). A further 3 articles were added from references of the 6 articles (see Figure 1). The study selections are displayed in a PRISMA flow diagram (18) in Figure 1.

All 9 articles were critically analysed using a CASP Checklist (10-14) and were given a score and grade based on the level of evidence using the framework developed by Harbour and Miller (15), shown in Table 4. One article did not receive a grade due to a high-risk of bias (7). A summary of the key findings of each article is displayed in Table 4.

Results of studies

Impact of training and education:

All nine articles addressed the impact of training and education of paramedics (1-9). The systematic reviews provided a range of education and training levels from intensive to minimal (1,2). Two studies had proportionally less training and education (6,9). The remaining articles outlined a proportionally increased length and intensity of training and education (3-5,7,8).

Correlation of experience to accuracy:

All nine articles assessed the accuracy of paramedics performing POCUS, with a mixed display of results (1-9). In studies where the paramedic population had increased experience and clinical scope of practice, accuracy could be compared to physician-performed POCUS (3-5,7,8). However, in less skilled paramedics or novice users of ultrasound, decreased accuracy was seen (6,9). Both systematic reviews also found a correlation with experience, scope of practice and accuracy (1,2).

Feasibility

Only one article stated that paramedic POCUS as a diagnostic tool for pneumothorax was not feasible (9). The key barriers of this study pointed to the need for higher level education and training (9).

Implications of key findings

The purpose of this rapid review is to look at two key points for the use of POCUS by paramedics in the prehospital environment for the identification of a pneumothorax or TPT. Firstly, is this clinical skill and advanced scope of practice feasible for paramedics to perform in the prehospital setting. Secondly, are paramedics able to perform the skill accurately and thereby improve the identification of a pneumothorax or TPT in the prehospital environment.

The three key themes provide an opportunity to discuss the barriers, enablers and implications for future paramedic utilisation of POCUS to identify a pneumothorax or TPT. Firstly, the impact of the type and extent of training and education on the ability to accurately perform POCUS provides implications for future paramedic training and education programs. Secondly, the correlation of experience on accuracy provides implications for the suitability of paramedics that would potentially perform this clinical skill. Finally, the positive reports of the feasibility of paramedic POCUS provides implications for paramedic services to assess the need and potential benefit this clinical skill may offer their clinicians in the prehospital environment.

Table 3 Summary of research themes

Theme 1: **Impact of training and education**	Mixed training and education: 2 articles (1,2) Increased training and education: 5 articles (3-5,7,8) Decreased training and education: 2 articles (6,9)
Theme 2: **Correlation of experience to accuracy**	Mixed experience: 2 articles (1,2) Increased experience: 5 articles (3-5,7,8) Decreased experience: 2 articles (6,9)
Theme 3: **Feasibility**	Feasible: 8 articles (1-8) Not feasible: 1 article (9)

Discussion

The feasibility and accuracy of paramedic performed POCUS examinations was shown in all articles to be highly dependent on the training, education and experience of paramedics.

The level of education and training provided to paramedics was shown to be an integral point that distinguished the quality of POCUS performed. Two of the articles utilised a significantly shorter duration of education and training. Khalil et al. (6) found that through a short education and training program, paramedics reported increased levels of comfort and utilisation of POCUS in simulation. However, the study lacked the power to find a significant difference in the ability to correctly diagnose a TPT. Becker et al. (9) found that the quality and ability of paramedics to perform POCUS in the clinical environment to be poor. A key barrier identified was the level of training and education provided to paramedics (9).

In contrast, three studies found that paramedic performed POCUS to be of a similar level to that of expert sonographers, reviewers and physicians (3,7,8). However, these studies were comprised of highly skilled paramedics who were working within an increased scope of practice as advanced retrieval practitioners or aeromedical retrieval. Highlighting the correlation of training, education and experience in the ability of paramedics to perform POCUS as a diagnostic tool for pneumothorax. These findings were supported by both systematic reviews who outlined the relationship between education, training and experience in regard to the quality of scans and level of interpretation (1,2).

Pietersen et al. (4) looked at 100 paramedics and EMTs, which was a significantly larger sample size than the other studies. The study found that through a combination of hands on and didactic training, paramedics and EMTs performed thoracic ultrasound with a high feasibility and image quality. An additional key finding was a change in suspected diagnosis, treatment, management, or choice of receiving facility in 6-11% of patients (4).

Implications on Practice

In the prehospital environment the presence of a pneumothorax can increase the development of life-threatening conditions such as a TPT (3). This review provides paramedic practitioners with an understanding of the potential benefits in identification, and thus treatment and management POCUS can provide in the prehospital setting (6,7). The findings of this review are particularly useful for paramedics who work in an extended scope of practice and are trained in the use of POCUS or have the opportunity to be trained in its use. The ability of paramedics to perform POCUS in the prehospital environment provides an opportunity to improve the care of patients through an enhanced diagnostic tool which can have significant impacts on prehospital treatment and management (3,4,6,7). Furthermore, as the feasibility of paramedic performed POCUS examinations has been shown there are clear implications for future paramedic practice (1-8). Namely the need for paramedic services and education providers to develop a sound curriculum which provides the necessary education and training to ensure a high level of accuracy and usability of POCUS in the prehospital environment (1-9). The results of this review highlight the significant positive impacts of training and education that are both comprehensive and extensive on the ability of paramedics to perform POCUS in the prehospital environment (3-5,7,8). Thus, future programs and research should seek to ascertain the optimum combination of education and training to validate and implement the use of this diagnostic tool as an advanced scope of practice.

Limitations

Several limitations are present within this review. Firstly, the limitation of the English language created a degree of publication bias in limiting potentially relevant studies. Additionally, the limit of date of publication whilst providing an up-to-date summary of current evidence, potentially has overlooked relevant evidence. Future research should look to undertake a review including a broader range of languages and date of publication to inform the need for primary research such as focussed large scale randomised controlled trials.

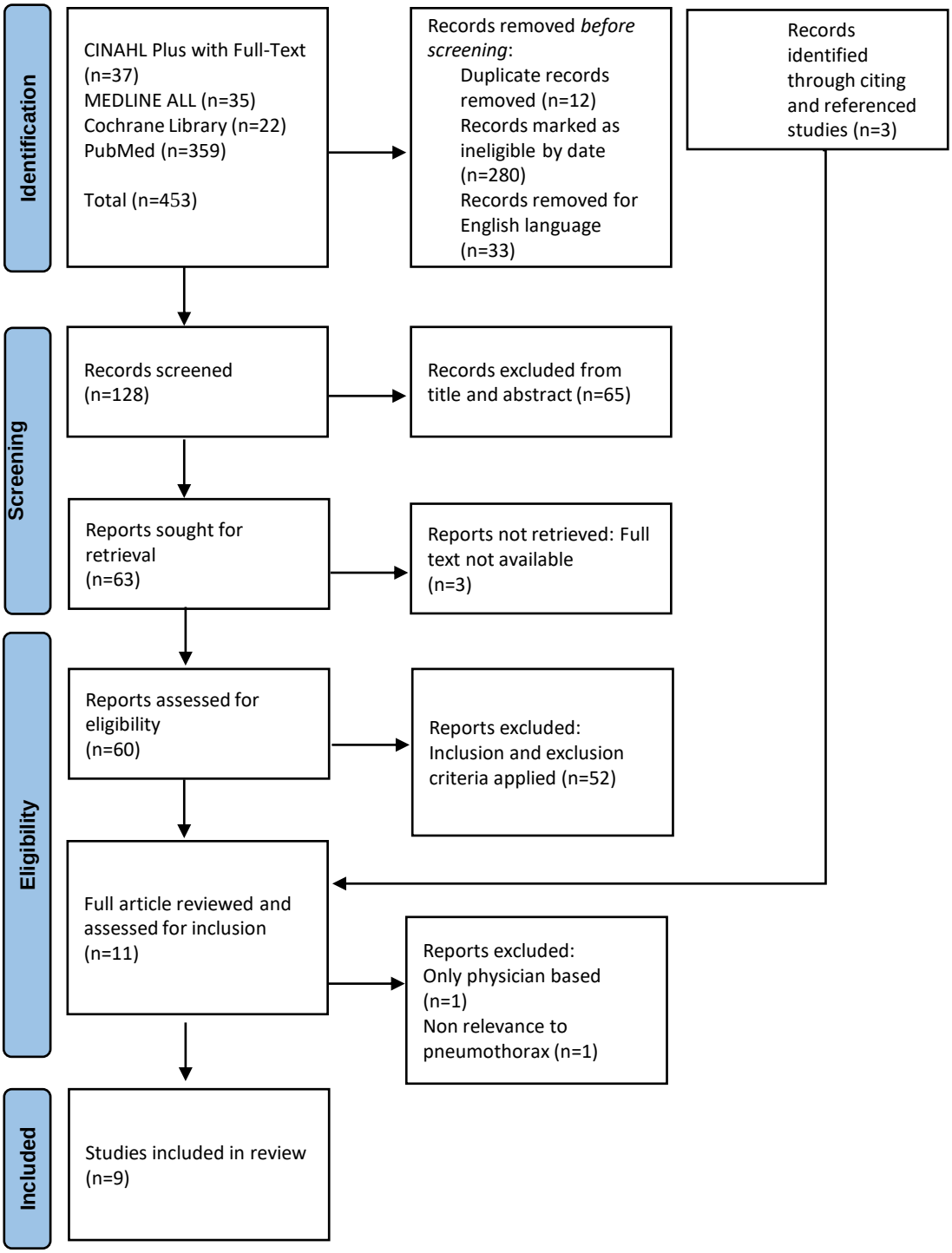
In order to strengthen the interpretation of the results in the review and implications for practice, all nine articles were assessed against a CASP checklist (10-14) and the Harbour and Miller framework (15). Several of the articles looked at before-and-after results which incur a higher degree of bias in the interpretation of the key findings (3-5, 7-9). Two articles consisted of systematic reviews, however, both articles did not solely focus on paramedic performed POCUS, or the use of this as a diagnostic tool for pneumothorax or TPT (1,2). Potentially increasing the bias to advocate for the use of POCUS in the prehospital setting. Only one article (6) received a grade of 'A' as the only randomised control trial, however, no articles met the Harbour and Miller (15) criteria for a score of '1++' (see Table 4). Indicating a lack of high-quality evidence in relation to the review topic.

The results of the included studies are also limited by potential publication bias with studies with positive or significant results more likely to be published, in turn increasing the potential for an overestimation of the effect size. As a result of the lack of high-quality evidence the key findings of this review are limited by the quality of studies included. A clear need for future high-level research in the form of large scale randomised controlled trials is needed to inform future paramedic practice of POCUS for diagnosis of a pneumothorax and/or TPT. The review was additionally limited in that only one researcher was involved in the process. In order to minimise the selection bias of included studies in the review a clear inclusion and exclusion criteria was utilised (see Table 2). The inclusion and exclusion criteria were utilised to maximise the potential primary research articles whilst including high level secondary research such as systematic reviews and/or meta-analyses. However, the potential for a degree of selection bias remains. Furthermore, as the author is currently studying to become a paramedic there could be potential author bias due to an interest in this field.

Conclusion

This review provides an overview of the current literature regarding the use of paramedic POCUS as a diagnostic tool to identify a pneumothorax. In summary, paramedics performing POCUS were shown mostly to do so with an acceptable degree of accuracy and quality. The implementation of this skill was shown to be feasible, with all studies, highlighting the importance of education and training to obtain a high accuracy and quality. Paramedicine is a rapidly growing and advancing profession due to the need and the ability of paramedic practitioners to utilise advances in scope of practice and clinical innovation to improve patient outcomes. Prehospital care is a dynamic and challenging environment that requires paramedic practitioners to make time critical decisions based off the available diagnostic tools at their disposal. Therefore, the ability to improve the diagnostic ability of paramedics to identify, treat and manage a pneumothorax or TPT through POCUS in the prehospital environment as an extended scope of practice provides a clinical innovation that can potentially improve patient care and outcomes.

Figure 1. PRISMA flow diagram



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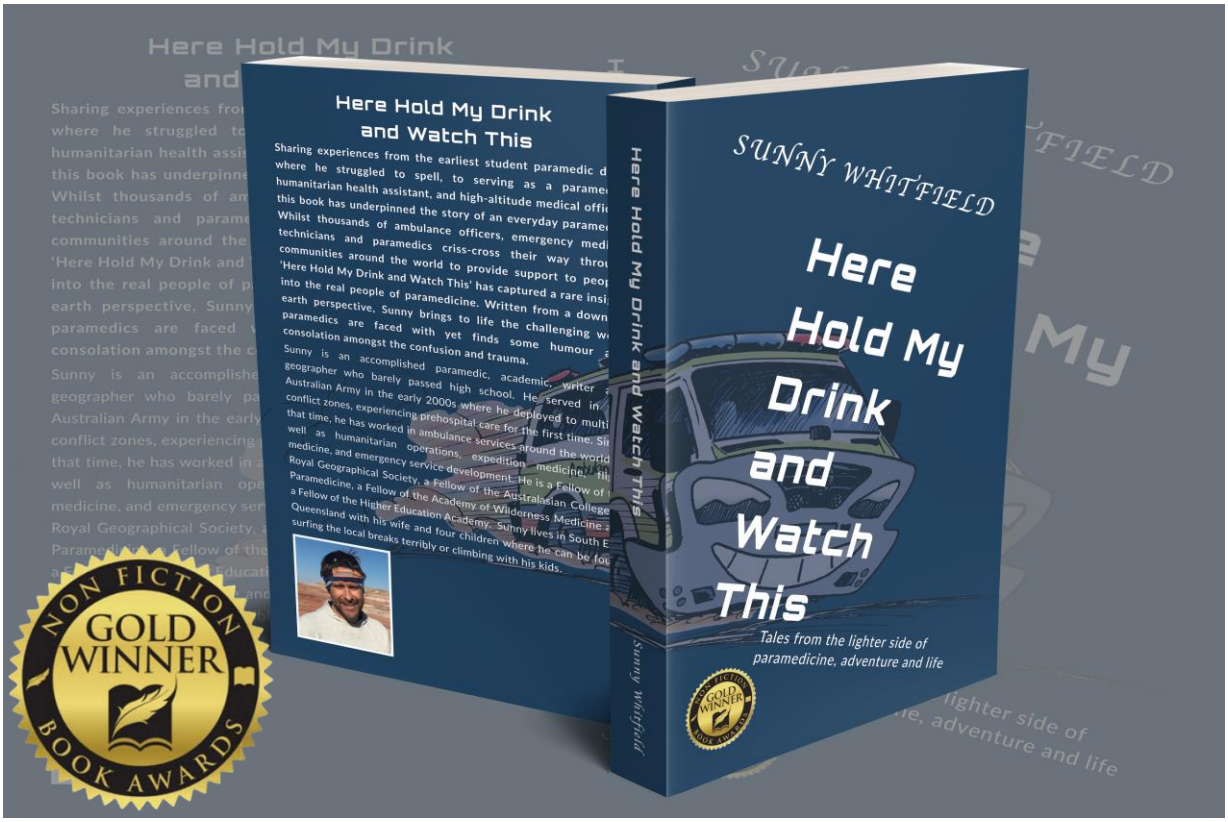

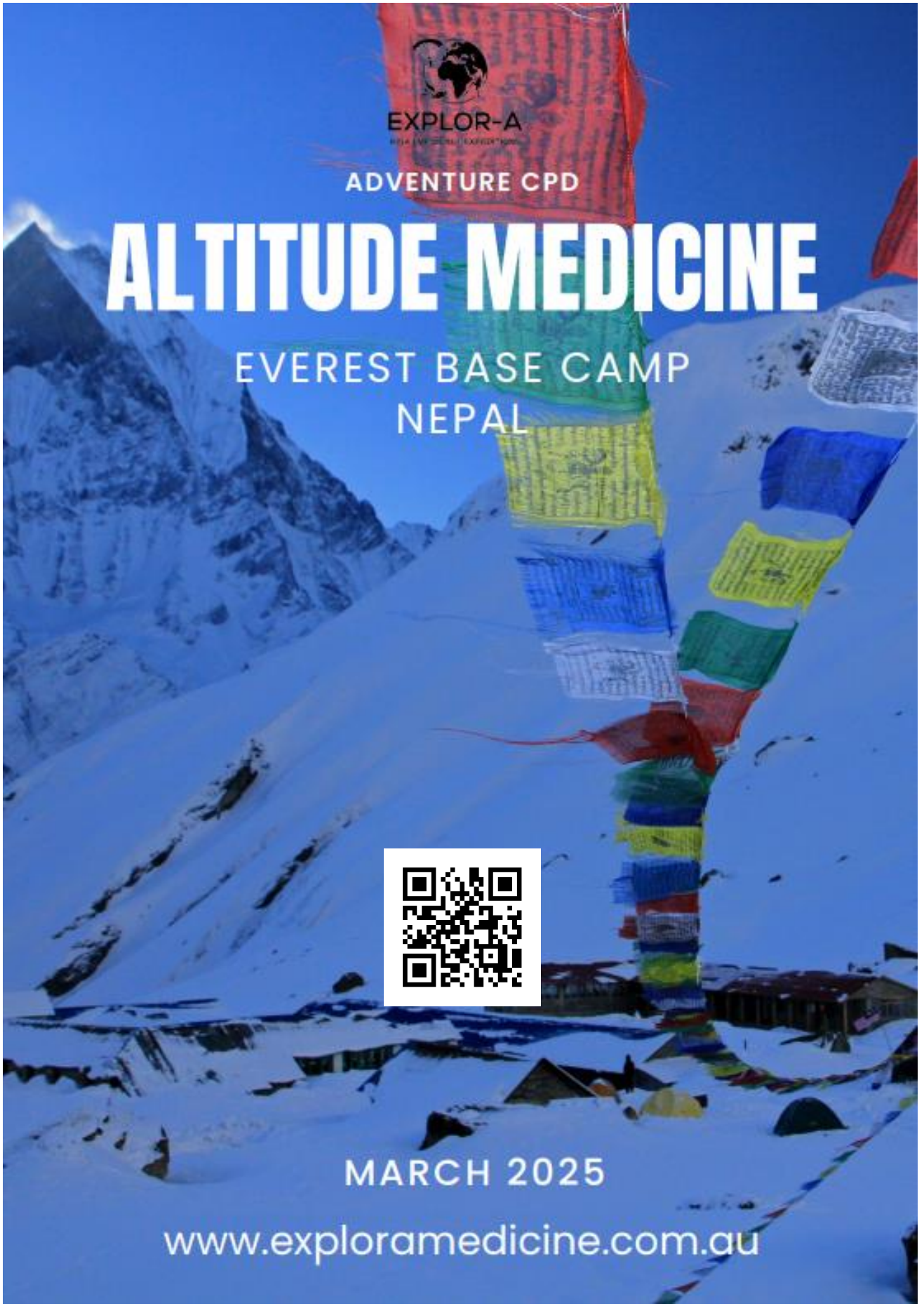
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Name	**Date reflection completed**

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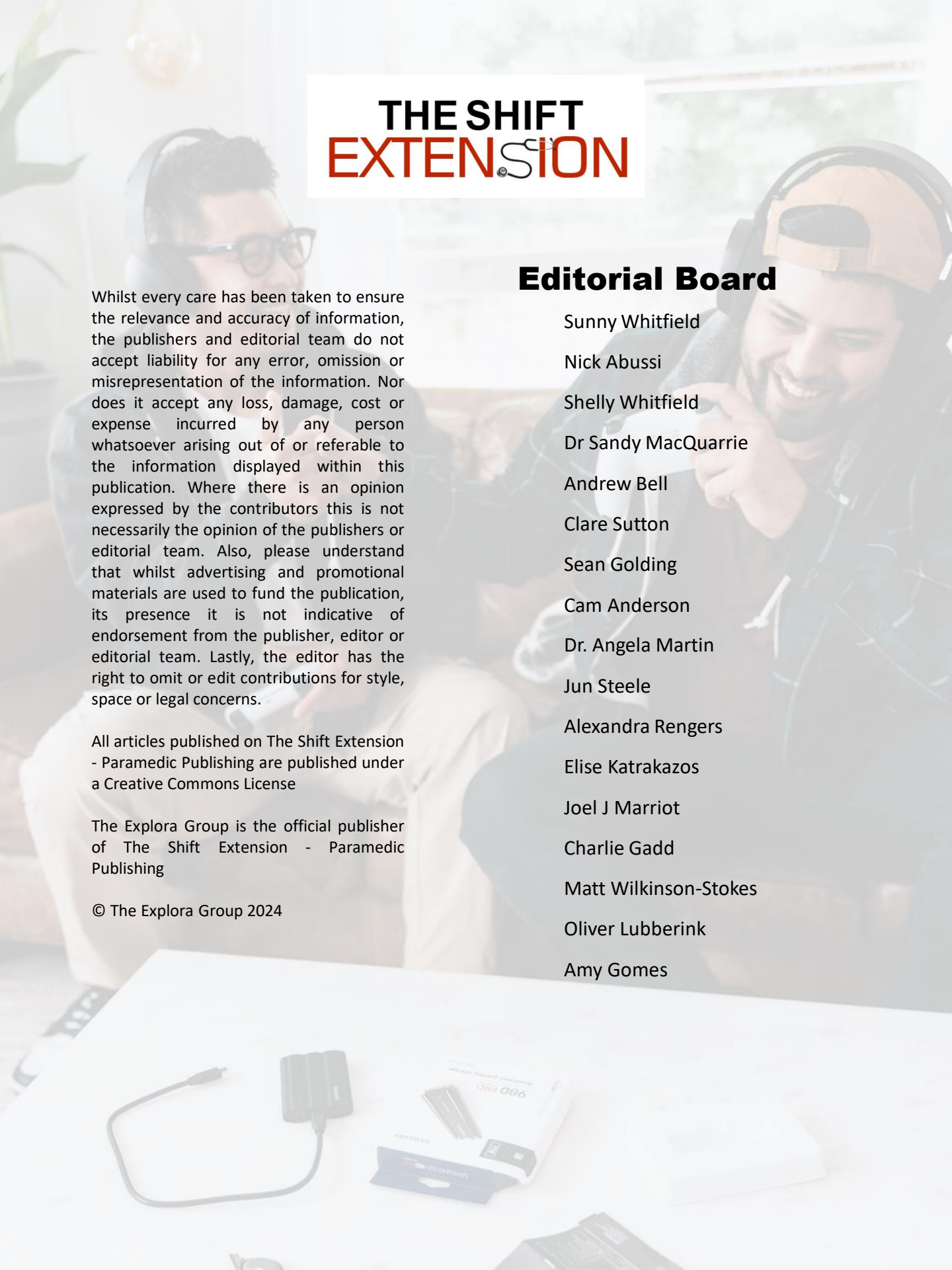

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