SSC D08
Exploring The Literature On Expedition Medicine

Introduction

Born from the necessity of providing medical support to adventurers, expedition medicine has expanded into a vast area of interest for today's doctors, providing a unique environment for practitioners and researchers to gain invaluable knowledge and experience with potential applications to the clinical environment. As with any medical specialty, a division exists within the field of expedition medicine; clinical practice and medical research. In this review, we will explore these aspects of expedition medicine as interlinked, yet vastly contrasting.

The conception of expedition medicine may have been with the introduction of surgeons and physicians aboard ships embarking on exploratory expeditions during the "age of discovery". A notable example includes Christopher Columbus, who was accompanied by three physicians during his voyage to discover America (Lopez, 1976). Over time, value arose from taking medical readings whilst on expeditions. Adding to the growing research into some medical conditions like hypoxia, notable research was completed during the Himalayan Scientific and Mountaineering Expedition of 1960/61, led by Sir Edmund Hillary (Pugh, 1962a; Pugh, 1962b). Over the following decades, the role of doctors on expeditions, and the data being gathered from expedition research has steadily increased in popularity with great benefits seen. Thus, it begs the question of whether expedition medicine should be seen as its own, individual specialty.

Critics would suggest that currently, expedition medicine is a pseudo-specialty, a minute branch of emergency medicine, but very much inclined toward the private sector. Due to the necessary funding and contacts needed to enter the specialty and participate in expeditions; distinct and tangible accessibility issues arise, thus making it an aspect of medicine often overlooked by the lay physician. Adventure and/or medical research expeditions are usually funded by private entities including universities, societies, or tourist companies, so questions surrounding motivation for these do arise.

Several cases identified within the literature shall be discussed including the impact on training, the clinical relevance of the research, barriers to inclusion within expedition medicine, and the potential impacts of expeditions on the local population. With a global increasing interest in the climate crisis, expedition medicine will be considered in terms of its environmental impact, and how any potential damage and carbon footprint may be minimised. The formation of expedition medicine as a discrete medical specialty will be discussed alongside a reflection from the authors on its current standing, areas for improvement within inclusivity and diversity, and resolutions for how the specialty may flourish in the long term.

When conducting this review numerous scientific databases were used from the search engines including Google Scholar and Web of Science. The grey literature was also searched. To ensure broad but relevant coverage, the key search terms “expedition” and “wilderness” medicine, were used alongside specific words such as “high-altitude”, “ethics” and “environment”. Findings were compiled and assessed for relevance.

Clinical Relevance

One advantage of expedition medicine is the training opportunities it presents for medics across all specialities. In 2008, General Practice Training Tasmania introduced the Special Skills Post in expedition medicine, which provided Australian general practice registrars with the opportunity to complete a 6-month placement in the field (Albert et al., 2008). Although uptake was limited, follow-up showed that the placement was well received by trainees, who felt it allowed them to expand their scope of practice. Not only is this beneficial for individual professional development, but it also allows GPs to be better equipped to deal with acute medical problems in settings where support may be limited, skills which are vital for working in a modern NHS facing a staffing crisis (Imray et al., 2015; Deakin, 2022).

Expedition medicine training has also been shown to increase job satisfaction across specialities (Dove et al., 2022). One study retrospectively surveyed doctors and other healthcare providers who had participated in a postgraduate fellowship in expedition medicine provided by various medical schools across the US. Those who had completed the programme reported a high degree of professional satisfaction and academic productivity. At a time when job satisfaction within the NHS is particularly low, expedition medicine opportunities could provide an exciting avenue to re-engage clinicians (Best, 2021).

A feature of expedition medicine research with important applications to clinical practice is the study of hypoxia at very high altitudes (3500m+) (Paralikar and Paralikar, 2010). In a study of 1604 patients admitted to intensive care units, 54% of individuals were noted to be hypoxaemic (defined as a PaO2/FiO2 ratio of 300 mmHg or less) (SRLF Trial Group, 2018). When ascending to a high altitude the partial pressure of oxygen (PaO2) decreases in a predictable pattern (Samuels, 2004), allowing hypoxia to be simulated in a more controlled setting. This opens research avenues to explore human adaptations and potential treatments for hypoxia in critically ill patients.

One such potential treatment is through the use of nitric oxide (NO), which has long been used as a treatment for acute respiratory distress syndrome (ARDS) (Klinger, 2002). The increased concentration of NO and its products at altitude, offer protection against hypoxia in individuals living at high altitudes, as well as in research participants on high-altitude expeditions (Levett et al., 2011). Although more research is needed, a link has been noted between increasing levels of NO and stabilisation of hypoxia-inducible factor 1 alpha (HIF-1α). Formation of HIF-1 leads to upregulation in the genes controlling glucose metabolism, angiogenesis and haematopoiesis (Galkin et al., 2007). Therefore, by providing critically ill individuals with either direct NO or NO products, there may be an opportunity to enhance the hypoxic response in the individual. Further, the consequences of ineffective levels of NO in critically ill patients have been observed in a study which provided the non-selective nitric oxide synthase inhibitor 546C88 to patients with septic shock, reducing the availability of NO to the body. This led to increased mortality in that group (López et al., 2004).

Expedition medicine is typically practised in a resource-limited setting requiring more creative utilisation of available resources (Imray et al., 2015). During an expedition ascending Cho Oyo, at 5900m, a man collapsed with symptoms consistent with a stroke.

The expedition medics had a handheld, portable, ultrasound scanner which allowed for the diagnosis of a left middle cerebral infarct, and subsequent treatment of the man (Wilson et al., 2011). Without the use of MRI or CT, diagnosis and treatment of ischaemic stroke can be limited due to the risk of differential diagnoses with contraindicated treatment (NHS, 2022). This use of ultrasound provides a foundation for future research into stroke diagnosis in a resource-limited setting, e.g. in developing countries, prehospital care and remote/rural areas.

Whilst altitude research has been discussed previously regarding the clinical relevance of expedition medicine, many other extreme environments experienced during medical expeditions also offer applications. After being salvaged from an Antarctic expedition, five drugs were tested for their stability having experienced temperature ranges outside the manufacturer's advice and being considerably past the stated expiry (15-51 months). All drugs tested were deemed stable despite their unregulated storage, providing useful pharmacological and clinical information for future use (Browne et al., 2019). With mounting financial pressure on the NHS and a goal for carbon neutrality by 2045 (NHS Choice, 2022), the prospect of saving money through reducing drug waste provides an appealing avenue to explore. While drug shelf-life extension initiatives such as the Federal Shelf Life Extension Program (ASTHO, 2012) exist, their stipulation for tightly controlled temperature management could exclude mass adoption in locations where this cannot be strictly controlled. However, as evidenced by Browne et al (2019), this factor may not be as detrimental as previously considered. Applying this finding could benefit resource-scarce developing countries where temperature regulation of medicines can prove challenging.

Barriers to Inclusion

Inclusion is at the forefront of developing medical practice, so the barriers preventing equitable access to expedition medicine are therefore necessary to consider. From our literature review, we have identified the three most prominent barriers to inclusion: disability, gender, and class. These barriers are pre-existing in clinical settings but due to the nature of expedition medicine, as will be later explained, their discriminatory effects are amplified.

Systematic exclusion of people with disabilities occurs at multiple points throughout a clinician’s journey towards becoming an expedition medic. Primarily, (RCPSG, n.d) explains that to obtain a diploma in expedition medicine, there are prerequisites such as the ability to demonstrate good health and fitness. Criteria such as these immediately inhibit disabled people from accessing the necessary qualifications to pursue this career. Regardless of qualification and training attainment, Bauer's (2018) findings that access to travel is often severely limited to people with disabilities demonstrate further systemic barriers. Finally, insurance premiums for disabled people are significantly larger (LaPlante, 1993) disincentivising companies from hiring or including this cohort in their expedition.

Keyes et al (2022) reports that there is an under-representation of women in publications within the field, lending wilderness and expedition medicine to be a primarily male-dominated specialty. Furthermore, Pomfret and Doran (2015) observed disproportionately fewer women engaging in mountaineering activities. By extension, it may be hypothesised that women are less likely to pursue expedition medicine due to a lack of experience and skill. This could be

explained by multiple social factors: from the gendered promotion of outdoor activities, to lack of consideration for female-hygiene needs in the wilderness (ie. menstruation). These small factors all contribute to the decreased accessibility of expedition medicine for women.

Petersen (2006) suggests that due to the inherent intersectionality of class, gender, and disability, subsequent class inequality only accentuates existing problems. Lastly, accessing training, buying gear, and having outdoor experience lends itself to a more privileged background, both financially and lifestyle-wise, meaning physicians struggling economically face yet another barrier to expedition medicine compared to their colleagues.

Impact on the Local Population

With an increase in expeditions to remote environments in recent years, the responsibilities expedition doctors have towards local populations have become more clear, both at an individual and a community level. Clinicians may feel obligated to help local people but should remain mindful of their priority to their team (Dobiesz and Sullivan, 2017). Despite this, an awareness of both national and regional laws regarding the treatment of the local community is important. Good Samaritan laws may be in place which protect the practitioner from liability when treating a person in emergencies, these are designed to encourage bystanders to assist, ultimately saving lives. However, these laws can differ vastly by location on the cover they provide (Dobiesz and Sullivan, 2017), therefore clinicians need to be aware of the laws for their expedition. Medical ethics needs to be taken into consideration when guiding practice, especially when considering the question of whether you can treat versus should you treat. The short and long-term consequences of any treatment should be considered as to whether the interventions would remain beneficial if treatment cannot be continued long-term (Smith, 2002; Johnson et al., 2012). Use of limited drugs and supplies may be harmful and risk the health and lives of expedition team members later. Western treatments may also go against the culture of local healers in the area so sensitivity should be considered (Johnson et al., 2012).

With few exceptions, expeditions involve interaction with local populations and as such, must acknowledge the impact of their activities on, and their responsibilities towards, the local population. They must remain culturally sensitive even when this may constrain their activities (Stott, 2019). Expeditions should seek to avoid damaging habitats, respect religious and cultural beliefs, and respect the intellectual property rights of local communities that have contributed to any data (Smith, 2002). Regrettably, best practice is not always adhered to and poor environmental practices are common, resulting in habitat degradation (Kuniyal, 2002). There is also debate as to the ethics of flying people across the world to conduct expeditions, causing significant carbon emissions, particularly as anthropogenic climate change has a significant impact on remote populations and habitats (Allison and Beames, 2010). Cultural insensitivity from expedition organisers and participants has been extensively reported (Allison and Higgins, 2002). Moreover, the concept of Western researchers conducting expeditions in developing countries has been criticised as being neocolonial, due to the imbalance of power between expedition members and local populations (Allison and Beames, 2010). Western researchers gain prestige, publications and funding, whilst local expertise is sidelined. This both widens inequalities and results in lower-quality research, which does not focus on the priorities of the local population (Grove et al., 2020) (Jumbam,

2020). Expedition medics must be mindful of their responsibilities to local populations, to ensure their expeditions are both ethical and successful.

Discussion

While expedition medicine is a rapidly evolving field, the published literature on the topic remains limited. Perhaps most pertinent to this finding is the differentiation between expedition medicine and expedition research. Much of the research produced is conducted retrospectively or describes case studies from experiences during previous expeditions. While all useful contributions, the literature base would benefit from an increased number of medical-research expeditions, where more rigorous protocols and confounding variables can be accounted for - a vital component to medical research where findings may directly affect individuals' health. A further issue identified was the re-occurrence of a select few authors within the literature itself, including the current practice guidelines published by The Royal College of Surgeons of Edinburgh (2019). With only a small number publishing their research, the field lies susceptible to influence by the individual agenda of these actors and the potential for bias ensues. By increasing the diversity and inclusion of researchers contributing, power can be spread more broadly, thus creating a more robust evidence base - an essential component for evidence-based medical practice.

For expedition medicine to become a formal specialty, careful consideration has to be taken to mitigate the ethical shortcomings currently present in the field.

It is key for the healthcare workforce to have a wide variety of representation to provide a better quality of care. This is achieved by accurately reflecting patient demographics to ensure all members of the population are holistically considered without a disproportionate focus on majority groups. Therefore preventing the exacerbation of current inequalities by redistributing access to opportunities and positions of power.

Creating a dynamic and accepting work environment ensures all aspects of Engel’s biopsychosocial model of health are equally valued, fulfilling the requirements of the newer and more desirable sociopsychobio model (Haslam et al., 2019). If clinicians of all backgrounds and abilities can gain equitable access to expedition medicine, it allows the enrichment of their social-lived experience and mental and physical health. In consequence, this leads to better, safer, and more inclusive medical practice. For the NHS to endorse a branch of medicine as an independent specialty, the field’s ability to create an inclusive and accessible environment must be evidenced. Therefore, it is important to debate the extent to which expedition medicine, in its current state, is doing so, or whether it can be realistically adapted to achieve this.

Currently, expedition medicine is restricted in its accessibility only to those who can afford the training and equipment required of it. It could be considered private practice in the sense that most expeditions are funded by private organisations either for research through societies or universities or for tourism purposes. For the future of expedition medicine as a specialty in its own right, the hurdles faced regarding inclusivity should be researched and addressed. Training programmes for other specialties are available to doctors from all walks of life, however, the barriers discussed previously for expedition medicine prevent it from

fulfilling an inclusionary role. A way this could be amended would be by introducing training programmes through the NHS or specific modules at medical school, as well as addressing the discriminatory barriers that exist within wilderness medicine.

Ethical concerns about the impact expedition medicine can have on both local communities and the planet must also be examined. The necessity of travel carbon footprints should be justified convincingly in the case of each expedition proposed. Any neocolonialism concerns in the field should be addressed, with local stakeholders engaged at every stage of the process and the necessity for foreign input into an expedition being fully justified. Finally, the issues around cultural insensitivity and disregard for the local environment are necessary considerations, with international protocols put into place to ensure that expeditions are conducted ethically.

It is important to recognise that forming a specialty in expedition medicine would be detracting resources and funding from other areas of healthcare. Specifically in the UK, removing doctors from the NHS to engage in expeditions benefiting a small population group, can be difficult to justify in the current health climate. For us to promote expedition medicine, the projects chosen for funding must have a significant positive impact on the general population.

To ensure the safety and security of both expedition team members and the medical professionals practising, guidance should be continually updated and closely regulated to ensure best practices in this area. The current guidance is relatively non-specific and leaves a lot of requirements up for debate. There are presently no set requirements or qualifications for expedition medics and so no set standard of care for their patients (The Royal College of Surgeons of Edinburgh, 2019).

Conclusion

Analysis of the existing body of literature has demonstrated a vast array of benefits to establishing expedition medicine as a specialty in its own right. These advantages are far-reaching and are evident not only in the wilderness but also at the bedside. However, particular consideration must be taken to ensure that expedition medicine has the diversity and inclusivity demanded of any modern medical specialty. It must also be ensured that any impact on the local population is constructive, yet our research has demonstrated the clear gaps in the literature across these areas. By conducting primary research in the field, we hope to bridge some of these gaps, ensuring development in a way that is as accessible as possible.

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