

WHAT'S IN THE BAG?

MEDICAL KITS FOR EXPEDITIONS

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INTRODUCTION

Pre-trip planning and packing are some of the least glamorous aspects of any expedition. Yet, it is crucially important, allowing medics to focus on the experience, rather than worrying about potential medical disasters whilst on tour. The most important question is usually not 'what to pack?', but rather 'what *NOT* to pack?'

To answer this question, the expedition medic needs to ask a few more questions: what, where, when, who and how? The answers to these questions are used to formulate a medical risk assessment, based on the risk rating scale (Table 1), which then facilitates appropriate planning of the medical kit.

WHAT?

It is important to know what activity will be practised, and what the main objective of the trip will be. Whilst some injuries or illnesses are common with any activity, several sports-specific issues exist. For example, the most common kitesurfing injuries are ligament injuries or fractures of the ankle, foot or knee whereas skydivers are more likely to suffer shoulder injuries or compression fractures of the spine, and lacerations represent 41% of all surfing injuries. Blisters are extremely common in off-road runners, whilst SCUBA divers are exposed to potentially marine envenomation. Climbers frequently suffer finger 'pulley' injuries - and possibly severe

		<i>Potential severity if events occurs</i>					
		<i>Multiple deaths (10)</i>	<i>Single death (8)</i>	<i>Major (6)</i>	<i>Significant (4)</i>	<i>Minor (2)</i>	<i>Delay in completing (1)</i>
<i>Likelihood of event occurring</i>	<i>Certain (10)</i>	100	80	60	40	20	10
	<i>Very likely (8)</i>	80	64	48	32	16	8
	<i>Likely (6)</i>	60	48	36	24	12	6
	<i>Possible (4)</i>	40	32	24	16	8	4
	<i>Unlikely (2)</i>	20	16	12	8	4	2
	<i>Very unlikely (1)</i>	10	8	6	4	2	1

Table 1: Risk rating scale used to formulate a medical risk assessment.

trauma in the case of a fall. BASE jumpers have a severe injury rate 10 times that of skydivers, with wingsuit flying responsible for more than 80% of BASE jumping fatalities. Knowing what to expect will determine the type and quantity of splints, dressings, analgesia, suturing materials, blister packs and other specialist treatments to pack.

WHERE?

The destination provides crucial information on terrain, climate, expected natural hazards and local infrastructure, as well as local customs regulations. Expeditions to altitude will require specific medications to manage altitude illnesses, such as acetazolamide, nifedipine and dexamethasone. Trips to the snow may require local anaesthetic



eyedrops to help with snow blindness, creams for sunburn, and specialised equipment to manage hypothermia and avalanche victims. The jungle can be one of the most hostile environments on the planet, with local fauna and flora seemingly out to kill any human that ventures into it. Snake and spider bites, scorpions, bullet ants and poison dart frogs are just a few examples of the hazards that should be considered when packing for such a trip. Tropical or endemic diseases also create a host of new headaches for the expedition medic to deal with. Water-based activities, such as SCUBA diving, present additional logistical challenges – such as the requirement to provide oxygen as part of a comprehensive medical kit, and adequate waterproofing of the kit. Climate should also be considered: temperature, humidity, wind and precipitation not only determine anticipated injuries and illnesses, but may also affect the potency and usability of medical supplies.

Expected natural and human hazards, such as earthquakes and civil unrest, may affect what should be (or not be) packed and how it should be packed. It is unwise to advertise a medical kit publicly – unless the

expedition is in an isolated environment (such as Antarctica) where the kit should be easily and quickly identifiable by the expedition members. Information about the local infrastructure is essential. Transport options may affect the risk assessment and evacuation options. The quality, distance to and availability of local medical services will determine whether the medical kit should be designed to stabilise a seriously injured patient for a short trip to the local hospital, or for more lengthy treatment until an aeromedical repatriation has been initiated – which may be weather dependent and could be several days or even weeks (in the case of Antarctica).

The availability of a local ‘fixer’ who can navigate language and other barriers may determine whether it is feasible to resupply medical items in-country, or whether adequate spare supplies should be packed with the initial kit. Finally, the medic needs to be familiar with local customs regulations, especially with the importation of potentially restricted or banned medications or items. It is very important to note that what may be perfectly legal in one country, can be illegal in another (local

foreign office websites are useful resources). Similarly, airline regulations regarding items such as automated external defibrillators (AEDs) may vary, and occasionally change – so medics should be aware of the latest updates.

WHEN?

In addition to information regarding the expected climate and weather, knowing when the expedition will take place allows the medic to plan their pre-expedition risk assessment and packing schedule. Several factors are dependent on the date and duration of the trip: medication expiry dates, number of supplies, timing of orders and application for importation permits (if required). However, perhaps the most important aspect is the pre-expedition health check of all participants. Medics need enough time to send out a medical questionnaire, request additional information if required and plan the medical kit according to the participants’ medical status. Ideally, there is enough time for the medic to educate participants about potential risks, basic first aid, mitigation strategies and emergency action plans, prior to the expedition.

WHO?

It is tempting to think that all extreme athletes or participants in extreme expeditions are young, fit and healthy. However, this is not true. Whilst some extreme sports certainly require a minimum level of physical fitness, the popularity of extreme sports is growing rapidly, and with increasing participation comes increasing injuries and pre-existing conditions. The cost of some trips, such as guided Mt Everest expeditions, mean that those who can afford it are often older, with associated age-related co-morbidities. Technological and medical advances in the treatment of certain conditions, such as diabetic pumps, increasingly allow sufferers to participate in higher-risk activities. It therefore crucial that the expedition medic is aware of the underlying medical conditions of all the expedition members, as well as their regular medications, and any allergies they may have. If specialised equipment is used (such as a diabetic pump), the participant should demonstrate its use, have enough consumables for the trip (at least twice as much as anticipated) and have a solid back-up plan in case of failure. If there is any doubt or concern about underlying conditions, further information, testing or clearance from specialists should be requested – this is particularly important for example if the expedition member has a cardiac condition and plans a trip with higher than usual levels of activity. The medical kit should be adapted to include any additional medications that may be required to manage complications.

HOW?

Preparation of the medical kit starts with preparation of the expedition team members, who should be advised to have comprehensive medical travel insurance, covering the exact activity and location of the trip. It is worth noting most general travel insurance will not cover activities such as off-piste skiing, SCUBA diving, mountaineering, trekking at high altitude and many other extreme sports - therefore additional cover should be requested. Participants should ensure the medical cover includes search and rescue activities, and full aeromedical repatriation from the remote environment. Prophylactic vaccinations should be up to date and malaria prophylaxis trialled in advance, if necessary. It is particularly important to

ensure participants are covered for tetanus and rabies (depending on the destination) since it is not logistically feasible to carry temperature-sensitive vaccines (that should be stored in a refrigerator) in the medical kit. Tetanus has a case fatality ratio of 10 - 90% and rabies is almost 100% fatal, once clinical symptoms are present. All expedition members should have a dental check-up before they leave – dental emergency is one of the most common reasons for withdrawal from an expedition. If required, expedition members should be advised about training programs to maximise their physical fitness – ideally, this advice should be delivered by an expert in the field, and be sports-specific.

A few basic principles apply when packing an expedition medical kit:

- try to take items that have dual functions (for example, paracetamol can treat pain and fever, iodine can be used to purify water and clean wounds, tampons can be used as sanitary products or as a treatment for epistaxis, codeine can treat pain, diarrhoea and a cough - as long as it is legal in each country visited during the expedition!)
- the medic should be able to safely administer each medication in the kit, and should have access to information that will help them do this - such as the British National Formulary (BNF), available as a free app. Also check medication interactions in the kit: for example, ciprofloxacin and ibuprofen can reduce seizure threshold for epileptics - therefore ensure all regular medications taken by expedition members have been checked for interactions with anything in the medical kit. The BNF app can assist with this.
- divide the medical kit (including personal kits) between expedition members and forms of transport – in case kit gets lost or damaged during travel.
- keep medications and sterile consumables in their original packaging and pack in clearly labelled transparent polycarbonate or plastic boxes, with an easy-to-read inventory attached to the lid of each box. Ideally, the inventory should indicate items with imminent expiry dates, so that these can be used before those that will last longer. In events where formal doping control are performed, ensure any World Anti-

Doping Association (WADA) restricted or banned substances are clearly labelled in red, and Therapeutic Use Exemption (TUE) forms are included with the medical kit.

- ensure the name and quantity of used kit is clearly documented, and have a plan for re-stocking or rationing if supplies are starting to run low. Remember, dressings can be improvised, but medications cannot, so rather bring too much than too little – unless the medic is confident supplies can be reliably restocked in-country.
- Ensure the emergency action plan is laminated and attached to the emergency medical bag, for easy access in an emergency.
- Use combination padlocks for bags with controlled medications to ensure authorised access only.
- Use tablets instead of capsules, since tablets are sturdier and breakages are less messy.
- Generic medications are cheaper than brand names.
- Feel free to consult your local pharmacist if you are unsure about anything – they are experts at this!

THE MEDICAL KIT

It is not practical or advisable for the medic to carry a single large medical kit. The reasons for this are logistical: firstly, a complete expedition medical kit is too large for a single expedition member to manage on their own. Secondly, a single kit may be lost or stolen and leave the team without any medical supplies, whereas a



Figure 1: An example of a waterproof personal medical kit bag.

Personal	Personal regular medications	At least twice the amount they expect to use, divided into two sets: one set carried in their hand luggage, the other ideally given to a 'buddy' to carry
	Ensure contact lens wearers bring spare glasses	Conjunctivitis and keratitis can ruin an expedition for contact lens wearers
Analgesia	Paracetamol (or ibuprofen)	For pain and fever
Gastro-intestinal	Loperamide	For diarrhoea - especially during transport
	Consider anti-emetic (such as scopolamine) or metoclopramide	For travel sickness For nausea
	Oral rehydration tablets / sachets	For salt and electrolyte replacement
Anti-allergy	Chlorpheniramine (or non-drowsy option)	For allergies
	Epipen (if any history of anaphylaxis)	For anaphylaxis
Taping	Zinc Oxide tape	For sprains, dressings and general use
	Crepe Bandage (or Cohesive bandage)	For sprains
Dressings	Tincture of iodine	For wounds and water purification
	Gauze dressings	For larger wounds
	Band-Aids	For small wounds
Blisters	Compeed (or other blister kit)	For blisters
General	Gloves	To prevent contamination
	Safety pins	For blisters and general use
	Vaseline	For chafing and dry lips
	Whistle	To call for help
	Pen knife	For general use – <i>remember to remove for flight!!</i>
	Head Torch	
Personal hygiene	Hand sanitiser gel – cannot have too much!	
	Toilet paper – cannot have too much!	
Prophylaxis	Suncream	To prevent sunburn
	Insect repellent	To prevent mosquito bites
	Malaria tablets (if appropriate)	To prevent malaria
	Acetazolamide (if appropriate)	To prevent altitude illnesses
	Chlorine dioxide tablets	To purify water (better than iodine)
Information	Insurance policy number	On a small laminated card, to be kept on their person at all times. A second copy should be carried by the expedition medic, and a copy could also be uploaded to the cloud, in case it is lost.
	24 hr emergency assistance number	
	GP contact details	
	Local emergency numbers	
	Passport and visa details	
	Any medication allergies	
	Medic Alert bracelet (or alternative)	In case of a history of anaphylaxis
Additional items to be carried by the medic	Salbutamol inhaler	For bronchospasm
	Tampons	For sanitary use or epistaxis
	Paper and pen / pencil	Useful for when electronic communication is unreliable

Table 2: List of items in the personal medical kit.

Emergency	<i>Epipen / Adrenaline</i>	<i>For anaphylaxis</i>
	<i>Hydrocortisone</i>	<i>For severe allergies and asthma</i>
	<i>Chlorpheniramine</i>	<i>For mild to moderate allergies</i>
	<i>Salbutamol inhaler</i>	<i>For asthma</i>
	<i>GTN spray and aspirin (depending on the participants)</i>	<i>For angina</i>
Analgesia	<i>Paracetamol</i>	<i>For mild to moderate pain and fever</i>
	<i>Diclofenac (oral/rectal/IM)</i>	<i>For mild to moderate pain</i>
	<i>Co-codamol, methoxyflurane (Penthrox), morphine</i>	<i>For severe pain – CHECK THE REGULATIONS OF EACH COUNTRY YOU WILL BE TRAVELLING THROUGH OR IN!</i>
Antibiotics	<i>Amoxicillin-clavulanic acid</i>	<i>Broad spectrum antibiotic</i>
	<i>Doxycycline / Clarithromycin (alternative in penicillin sensitivity)</i>	
	<i>Azithromycin</i>	<i>For traveller's diarrhoea – beware quinolones and tendon pathologies in athletes!</i>
	<i>Ciprofloxacin</i>	
	<i>Metronidazole</i>	<i>For amoebiasis and other protozoal infections</i>
	<i>Consider ceftriaxone</i>	<i>For severe infections, including meningitis</i>
Dermatological / topical	<i>Mepyramine cream</i>	<i>For mild allergic rashes</i>
	<i>1% hydrocortisone cream</i>	<i>For significant allergic rashes</i>
	<i>Clotrimazole cream</i>	<i>For fungal rashes</i>
	<i>Fucidic acid cream</i>	<i>For bacterial infection (including prophylaxis)</i>
	<i>Antiseptic liquid</i>	<i>For skin cleaning</i>
	<i>Chloramphenicol eye ointment</i>	<i>For conjunctivitis (beware storage conditions)</i>
Dressings and Wounds	<i>Steristrips, skin glue, stapler, suture kits (including local anaesthetic cream and injection supplies)</i>	<i>For wounds - do not use stapler on face, neck, hands or feet!</i>
	<i>Gauze (non-sterile and sterile)</i>	<i>For wound cleaning</i>
	<i>Variety of dressings (non-adherent, hydrocolloid, semipermeable films, antimicrobial)</i>	<i>For wound dressing</i>
Sprains and Fractures	<i>SAM splints (variety of sizes)</i>	<i>For simple splinting</i>
	<i>Zinc Oxide tape / Clingfilm / crepe bandages (or cohesive bandages) / triangular bandages</i>	<i>For improvised splinting</i>
	<i>Portable lightweight Kendrick traction devices (or similar)</i>	<i>For expeditions with higher risk of significant lower limb trauma</i>

kit distributed amongst members ensures resilience. Thirdly, if team members have to split up for any reason, it is important to ensure each team member has access to at least a basic medical kit. The exact organisation and distribution of the kit is flexible and every expedition medic has their own preference. There is no absolutely correct way of doing this. What follows is an example of a typical kit, divided into four sections: personal medical kits, the mobile medical bag, the emergency medical bag, and the base camp medical kit. Some medics may want to include more or less (depending on their own experience, abilities and 'comfort zone'), and this kit should change



Table 3: List of items in the mobile medical kit.

Figure 2: An example of a water resistant mobile medical kit bag.

Personal protective equipment	Gloves, surgical masks, etc	May need to be adapted, based on current epidemics!
Emergency medications	See 'Mobile medical bag' - may need additional medications (such as amiodarone, diazepam, ketamine), depending on the nature of the expedition, whether resuscitation is feasible and local customs regulations	Ensure a full second set of emergency medications are available in this bag, and replace any used items immediately. Separating the two sets of emergency medications ensures at least one set is available in case a bag gets lost or damaged.
Specialist medications (expedition-specific)	Acetazolamide, nifedipine, dexamethasone	For expeditions to altitude, to manage altitude illnesses
	Acetic acid / Fluoroquinolone / steroid ear drops	For otitis externa - especially in SCUBA diving expeditions
	Standby treatments for malaria	For emergency treatment of suspected malaria in malaria-prone areas - check CDC and WHO websites for latest updates
Airway and breathing kit	Oropharyngeal and nasopharyngeal airways (different sizes)	For basic airway management
	Supraglottic airways (Igel), tube holder and lubrication	For more advanced airway management
	McGill's forceps	To remove foreign bodies
	Intubation equipment (including rapid sequence induction drugs)	Only pack this if the medic is very competent with intubation, timely medical evacuation is available and local regulations allow travel with these drugs
	Bag-valve mask and 10cc syringe to inflate and deflate the mask for travelling	For assisting breathing
	Hand-held suction	For removing fluids from the airway
	Decompression needle and chest wound dressing	For pneumothorax
	Pocket mask	For mouth to mouth ventilation
Bleeding and Circulation	Mini-tracheostomy kit (or improvised alternative)	For emergency surgical airway management
	Tourniquet	For control or arterial bleeding in a limb
	Haemostatic dressings (Celox)	For bleeding control in sites where tourniquets are not feasible
	Tranexamic acid	To prevent fibrinolysis in major trauma
	Wound closures and dressings	See the 'mobile medical kit' contents
	Intravenous access, syringes, needles	To administer medications.
Diagnostic Equipment and instruments	IV fluids, giving sets, normal saline	For fluid replacement only - wound irrigation can be done with clean drinking water, unless it is very deep, in which case sterile solutions are better. The amount of IV fluid will depend on logistics
	Thermometer Stethoscope Manual blood pressure cuff Diagnostic set (mini sets are ideal for expeditions) and tongue depressors Pulse oximeter Glucometer Forceps, tweezers and scissors Scalpel and blades Disposable razors	This may change, depending on the nature of the expedition. Manual equipment is better, since it does not require spare batteries, and may be more reliable in extreme temperatures. If using electronic, bring spare batteries.
Emergency equipment	Automated External Defibrillator (AED)	If logistically feasible (see discussion above). Miniature models are now available, facilitating mobility with travel (Figure 5)

Table 4: List of items in the emergency bag.



Figure 3: An example of a water resistant emergency medical kit bag.

Figure 4: An example of a mini Automated External Defibrillator (AED) compared to an iPhone for size.

depending on the type and duration of expedition, the number and type of participants and the pre-expedition risk assessment and mitigation planning.

Personal medical kits (Figure 1):

Each expedition member should have their own medical kit, consisting of the items listed in the Table 2.

The mobile medical kit (Table 3, Figure 2):

The mobile medical kit should contain a comprehensive set of medical supplies, to manage any medical incident – except major trauma or cardiac arrest. However, this kit should only have enough supplies for a few days, to keep it small enough to be mobile. Any used items should be replaced from the base camp kit as soon as possible. All categories of medications and consumables should be packed in separate sections, and clearly labelled, for easy access.

The Emergency bag (Table 4, Figures 3 and 4):

This bag contains medical supplies to manage medical emergencies, and should always be available **with** the mobile medical kit – depending on the type of expedition, it may be part of, or separate from the mobile bag, but always stored in the same area. The expedition-specific risk assessment will determine the content of this bag and will most likely have to be adapted for each individual expedition. For example, the decision whether to take an automated external defibrillator (AED), definitive airway management equipment and portable oxygen will depend on the

availability of timely evacuation and definitive care options. There may be no point in resuscitating someone in a remote jungle, desert or mountain environment, if medical support is limited to a several-day walk to the nearest hospital. Even in environments where aeromedical retrieval is theoretically possible, unpredictable weather, local terrain and local resources may limit the options. Additionally, it may be logistically unfeasible to carry extensive emergency medical supplies (such as portable oxygen or AEDs) on lightweight mountaineering expeditions, or temperature-sensitive medications in deserts, jungles or polar regions. In these cases, the risk assessment and mitigation exercise should include careful communication with the participants to ensure they are aware of and accept the fact that resuscitation will not be an option.

The base camp medical kit:

This bag contains all the spare supplies to be able to replenish the personal, mobile and emergency medical kits. How much to bring depends on the type and duration of the expedition, number of participants, risk assessment and logistical constraints. This bag should be very well organised and labelled. At base camp, medications and consumable supplies could be directly dispensed from this bag, so that the mobile and emergency medical bags remain fully stocked and ready to be grabbed in an emergency. However, when teams are away from base camp, they will carry the mobile and emergency bags with them and used

medications and consumables should be restocked from the main kit when they return to base camp. Use ziplock bags to dispense medications and write clear usage instructions on stick-on labels. Expedition-specific, larger specialist equipment are also kept at base camp (see Table 5 & Figure 5).

CONCLUSION

Packing the medical kit for an expedition does not have to be a daunting task. A structured approach, starting with a comprehensive risk assessment, and building on a standardised base medical kit such as the one described here, allows the expedition medic to pack a comprehensive, but individualised medical kit for each trip. Pre-trip communication with participants to elicit their medical history and share information regarding risk assessment and mitigation during the trip is crucial, as is the requirement for the medic to know where to find and how to use each item in their kit. It is important to divide the kit into sections and distribute it amongst participants, as well as ensuring each participant has their own personal medical bag. Meticulous organisation of the kit, as well as diligent documentation and re-supply, ensures reliability when it is needed most - in an emergency. Appropriate pre-trip planning and rationalisation of the emergency bag ensures the medic does not have to make difficult decisions (such as whether to resuscitate or not) under pressure, and can fully participate in the expedition, rather than worrying about what might possibly go wrong.

Specialist equipment	Portable altitude chamber (e.g. Gamow bag)	For expeditions to high altitude (if logistically feasible)
	Portable oxygen or oxygen concentrator	If logistically feasible (especially important in SCUBA expeditions, but nitrox tanks can be used instead)
	Portable warming devices, blizzard bags, activated heat vests	In polar expeditions to treat hypothermia
	Portable stretchers and shelters	For back-country ski and wilderness expeditions
	Transceivers, avalanche probes and shovels	For avalanche rescue in backcountry ski expeditions
	Other specialist medical equipment	Expedition-specific and if logistics allow
	Dental kit	For expeditions where a medic is competent in dental emergency management
	Malaria detection kit	For expeditions to malaria-prone areas

Table 5: List of items in the base camp medical kit.



Figure 5: An example of the base camp medical kit organisation for an expedition to Mt Everest.

Further reading

1. Wagner TD, Paul M, Tukul CA, Easter B, Levin DR. Preliminary Evidence-Based Method of Medical Kit Design for Wilderness Expeditions Modeled by a High-Altitude Expedition to Mount Kilimanjaro. *The Journal of emergency medicine*. 2022;62(6):733–49.
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