

JSP 539

CLIMATIC INJURIES IN THE ARMED FORCES: PREVENTION AND
TREATMENT

2003

Amendment No 1

Page changes:

Remove existing page(s)

iii
2-1 to 2-8
A-1 to A-2
B-1 to B-2
C-1 to C-3
C1-1

3-1 to 3-7

B-1
C-1 to C-15

Insert new page(s)

iii to iv
2-1 to 2-9
A-1 to A-2
B-1 to B-2
C-1 to C-4
C1-1
D-1 to D-4
3-1 to 3-9
A1-1
B-1
C-1 to C-15
D-1

New and revised material is indicated by a marginal line

October 2006

Prepared under the direction
of the Surgeon General
Ministry of Defence

CONTENTS

Chapter		Paragraphs
1	Introduction	0101 - 0105
2	Heat	0201 - 0223
3	Cold	0301 - 0322

ANNEXES

Chapter		Pages	
2	A	Assessment of the risk of heat illness	A - 1 to A - 2
	B	Water requirements during exercise in heat	B - 1 to B - 2
	C	Guidance for medical staff on the management of heat	C - 1 to C - 4
	D	Heat acclimatisation prior to, and on deployment to hot climates	D - 1 to D - 4
3	A	Wind Chill - Its use as a planning guide	A - 1 to A - 2
	B	Meteorological offices maintained at military bases	B - 1
	C	Guidance for medical staff on the treatment of cold-related illness and injuries	C - 1 to C - 15
	D	Cold related illness and injury report form	D - 1

APPENDICES

Chapter		Pages
2	Risk assessment aide memoire	A1 - 1
	Heat illness treatment guidelines	C1 - 1

	Heat illness investigation and rehabilitation flow diagram	C2 - 1
	Heat illness report form	C3 - 1
3	Cold injury risk assessment aide memoire	A1 - 1
	Information sheet for personnel who have suffered cold injury	C1 - 1 to C1 - 2

CHAPTER 2

HEAT

Introduction

0201. In the Army¹ heat illness affects approximately 100 personnel each year (516 Army personnel were admitted to hospital over the period 1993 – 1997). Despite previous attempts to reduce the problem, heat illness continues to occur. Twenty six Army personnel were admitted to hospital with suspected heat illness in the last six months of 2000 and at least a further 50 cases of heat illness required medical intervention (as under-reporting is suspected, there are likely to be further cases, which result in a significant preventable cause of illness in the fighting force).

0202. The recent casualties ranged in severity from mild cases requiring rest and fluid replacement to personnel requiring intensive care in hospital. It is possible that many of these cases might have been prevented by greater awareness of the risk by commanders at all levels. In addition the severity of some of these cases could have been reduced if appropriate first aid measures and evacuation to medical care had been carried out effectively.

Physiology

0203. Heat illness is caused by a rise in body temperature. Control of human body temperature is dependant on the following balance:

Heat Balance Equation

$$\text{Heat storage} = \text{heat gained} - \text{heat lost}$$

0204. Heat will be gained from that generated by exercise and from the surrounding environment, for example, solar radiation. In warm/hot environments heat loss is mainly by evaporation of sweat, although a small amount will be lost by conduction and convection. If the heat gain exceeds heat loss the body temperature will rise and eventually may result in heat illness.

0205. Service personnel are at risk from heat illness because of exposure to a combination of high intensity physical training, high environmental heat loads and

¹Only Army data are available, though clearly heat illness is a risk factor for all Service personnel.

protective clothing (for example, NBC clothing, Combat Body Armour). Commanders have a duty to assess the risks of heat illness arising from military training or operations and to ensure that these risks are minimised as far as is reasonably practicable. Failure to manage this risk may expose individuals and the Ministry of Defence to prosecution under the Health and Safety at Work Act and criminal law.

0206. Personnel at risk of heat illness may also be at risk of sunburn. Minor sunburn causes reduced performance while severe sunburn may cause hospitalisation. Sunburn can be prevented by either working in a shaded area or by covering the skin with clothing. When this is not possible sunblock creams should be used and re-applied frequently.

Definitions

0207. Heat illness has traditionally been divided into heat exhaustion and heat stroke. In practice it is difficult to define the division between the two. For the purposes of this JSP the term 'heat illness' is all embracing and applies to an individual who becomes incapacitated as a result of a rise in core body temperature.

0208. **The key to the prevention of heat illness is an awareness of the risk by commanders.** Any activity involving physical activity, the wearing of protective clothing (particularly NBC or impermeable clothing) or exposure to a raised environmental temperature should be considered to be a high risk activity. Ideally, if there is any doubt as to the level of heat stress, commanders should ensure that they are exposed to the same conditions as their subordinates. The commander's assessment of risk should consider the following factors:

- a. Individual risk factors.
- b. Environmental conditions.
- c. Work intensity.
- d. Water intake.
- e. Clothing and equipment.
- f. Acclimatisation.

Annex A gives further advice on risk factors, environmental conditions, work intensity and clothing; Annex B discusses water requirements; and Annex D advice regarding heat acclimatisation.

Individual risk factors

0209. There is a wide variation in human tolerance to heat stress. In some cases of heat illness it is possible to identify factors that have caused particular individuals to become heat casualties. The following are recognised risk factors:

- a. Obesity.
- b. Lack of physical fitness and/or lack of sleep.
- c. Recent alcohol intake.
- d. Concurrent mild illness for example, diarrhoea, common cold, fever.
- e. Dehydration.
- f. Medication or illegal drugs (for example, ecstasy).
- g. Nutritional status.

0210. Service personnel who are known to be overweight or unfit should not be pushed on during high risk activities if it is clear that they are struggling. Very careful consideration should be given to the suitability of such individuals for overseas deployments to hot environments particularly if they are not able to pass single-Service fitness assessments. Social events should not be planned to precede intense physical activity and personnel should be warned against alcohol excess prior to planned high risk activities. Where there is doubt about an individual's fitness to undertake a high risk activity advice should be sought from a medical officer. 'Soldiering on' through a minor illness is potentially extremely dangerous.

Environmental conditions

0211. Environmental factors influence the effectiveness of the body's cooling systems. The primary method of heat loss is through the evaporation of sweat. The efficiency of this is determined by the temperature, humidity and wind speed. These factors can be integrated into an index of environmental temperature. The index most suitable for

military use is the Wet Bulb Globe Temperature Index (WBGT). The use of this index to help in assessing the risk of heat illness is shown at Annex A. **It must be remembered that the WBGT only forms part of the overall risk assessment and it must not be used in isolation.**

Work intensity

0212. The rate of heat generation by the human body is determined by work intensity. In the UK the primary cause of heat casualties has been loaded marching, especially the Basic Combat Fitness Test (BCFT). Although running generates a higher heat load than loaded marching it is generally undertaken for shorter periods and in light clothing. The use of an estimate of work intensity to determine limits for longer exercise in hot environments is also shown at Annex A.

Rest periods

0213. If prolonged intense physical activity is being carried out, consideration must be given to allowing rest periods for individuals to cool down. The experiences of the Israeli Defence Force show that the provision of a 15 minute rest (in a single session) during every hour of exercise has dramatically reduced the incidence of exertional heat illness (EHI).

0214. Water is the key component of sweat that enables heat loss to occur. Supervised drinking before, during and after a high risk activity is the most important preventive measure that can be undertaken by a commander. Thirst is an inadequate guide to fluid requirements during exercise and therefore it is the commander's responsibility to ensure that his troops drink adequate water before, during and after a high risk activity. All water should be cool, potable and from a guaranteed safe source. Troops continually exposed to a hot environment (for example, on an overseas deployment or on an intense physical course lasting several days) should be advised to drink enough water to ensure that their urine remains pale yellow in colour. A guide to water requirements is at Annex B.

Danger of over-hydration

0215. Although rehydration is an important preventative measure, over-hydration will not further reduce the risk of heat illness and is in itself dangerous. Only in exceptional

circumstances should the daily intake exceed 12 litres since over-hydration can lead to hyponatraemia with potentially severe medical consequences (symptoms of nausea, vomiting, headache, irritation and loss of consciousness), and can be fatal. The hourly rate of fluid intake should not exceed 1.5 litres per hour. Note that Commanders are responsible for monitoring the fluid intake of their personnel – this may require systematic checks particularly where ‘Camelbaks’ or similar fluid delivery systems are used.

Risk assessment.

0216. Prior to **any** activity which may involve a risk of causing heat illness commanders at all levels are to:

- a. Assess the degree of risk associated with the planned activity. Guidance for this is contained in Annex A. Further advice may be sought from Medical Staff or Environmental Health Teams (EHTs).
- b. Determine if the risk of heat casualties from the activity is justified by the objectives of that activity. It is important to assess whether the same objectives could be achieved more safely by rescheduling the activity to another day or time of day or modifying the activity.
- c. Ensure that the personnel involved are suitably briefed.
- d. Ensure that the activity is adequately supervised, and that there are sufficient water and rest periods.
- e. Ensure that each individual is adequately trained in first aid and that a clear and efficient means of evacuation for medical treatment is available.

First aid

Recognition

0217. Any individual who experiences the following symptoms or who demonstrates the following signs during physical activity, in a hot environment or whilst wearing protective clothing, or any combination of these activities should be presumed to have heat illness (see Fig 2.1):

- a. Agitation.
- b. Nausea or vomiting.
- c. Staggering or loss of coordination.
- d. Cramps.
- e. Disturbed vision.
- f. Confusion, collapse or loss of consciousness.
- g. Dizziness.

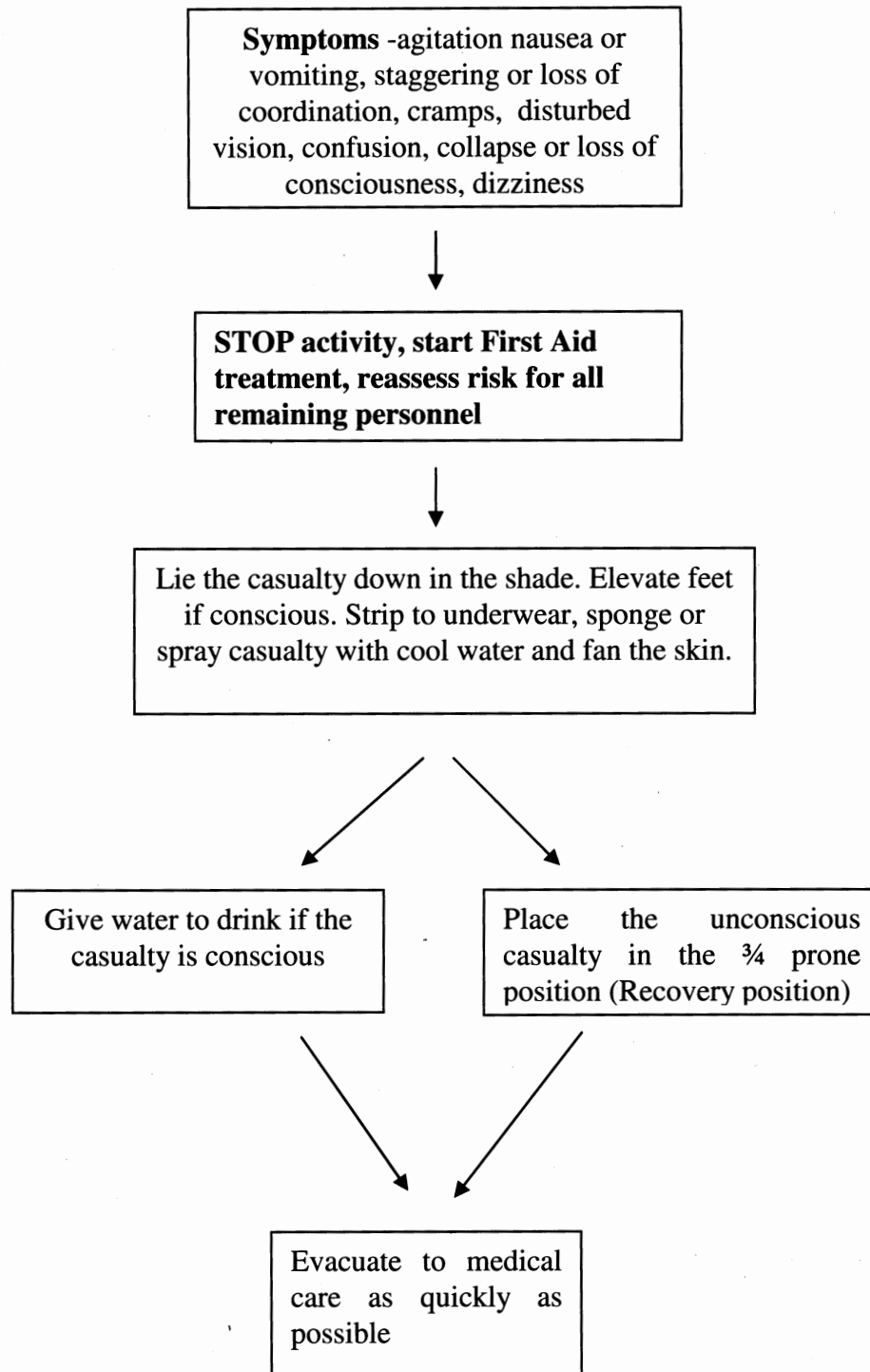


Fig 2.1 Immediate Action Algorithm.

0218. Emergency Treatment

- a. **STOP the activity**, commence first aid, reassess the risk to other personnel involved in the activity. A single case may be a warning that a large number of personnel are at risk.

- b. Lie the casualty down in shade and, if conscious, elevate the feet.
- c. Immediately strip to underwear.
- d. Continuously sponge or spray the casualty's whole body with cool water.
- e. Fan the casualty's skin to improve evaporation.
- f. Give water to drink if the casualty is fully conscious.
- g. If unconscious place casualty in $\frac{3}{4}$ prone position ('Recovery position') as the casualty is likely to vomit.
- h. Evacuate to medical care as quickly as possible.

Medical treatment

0219. Additional advice to Medical Staff is contained in Annex C.

Case reporting

0220. All cases of suspected heat illness requiring treatment (either first aid or formal medical intervention) are to be reported to the single Service Medical Directorates as detailed at Appendix 1 to Annex C.

Education

0221. All personnel are to be made aware of heat illness and methods of prevention and treatment. For Army personnel, this is included in the Individual Training Directives (Army), ITD(A) 8 – Health Training, and for RAF personnel this is detailed in the Common Core Skills (CCS). The tri-Service video No. A3876 'Keep your cool' is also a useful training aid on this subject.

Summary

0222. Heat illness is a recognised hazard of military training. The prevention of heat casualties is a command responsibility both during training and on operations. Retrospective analyses of heat casualty incidents frequently identify an error of judgement by a commander to be a contributing factor.

0223. *Key Points.*

- a. The majority of heat casualties are preventable.
- b. Commanders have a duty to assess the risk of heat illness to their subordinates.
- c. If there is a risk of heat illness commanders must ensure that appropriate personnel, water, transport and medical assistance are immediately available.
- d. Early recognition and treatment will prevent mild cases becoming worse.
- e. All cases of suspected heat illness should be managed as outlined in this Chapter and all cases are to be reported to the single Service Medical Directorates.

Assessment of the risk of heat illness

1. The risk of casualties from work in heat is dependent on work rate, the environmental conditions and the clothing worn. Individual risk factors, such as the physical fitness levels of the personnel carrying out the activity, must also be considered. **If it is judged that there is a risk of heat casualties, it is the commander's duty to ensure that the resources are available to undertake an appropriate risk assessment. All the factors must be considered together in order to obtain a meaningful overall assessment. It is inappropriate just to consider one factor, such as the environmental conditions, in isolation.**

2. **Work Rate.** The majority of heat illness casualties occur in temperate climates where individuals are exercising hard and the excess body heat generated cannot be lost from the body surface at a sufficient rate. Both high intensity exercise, such as running, and lower intensity endurance activities, such as route marches carrying a load, require significant physical exertion with an associated increase in production of body heat.

3. **Environmental Conditions.** The effect of environmental conditions on the risk of heat illness is determined by the air temperature, wind speed and humidity. These measurements can be integrated into the Wet Bulb Globe Temperature (WBGT). This temperature is measured using a WBGT meter (NSN 6685-99-665-9590). The following table gives guidance on the maximum work rates for varying WBGTs.

WBGT Threshold Values

Ser	Acclimatised	Unacclimatised	Maximum Work rate (not to be exceeded)
(a)	(b)	(c)	(d)
1	No maximum limit	32°C	Low. For example, lying, guard duty, driving.
2	30°C	26°C	Medium. For example, marching 2.25 mph 30 kg load
3	27°C	24°C	High. For example, marching 3.5 mph 20 kg load, patrolling, digging, field assaults.
4	25°C	20°C	Very High. For example, marching 5

			mph no load, marching 3.5 mph 30 kg load. This equates to the Army Basic Combat Fitness Test.
5	20°C	Max 30 mins at 20°C	Extreme. For example, running in sports kit.

4. These threshold values indicate the maximum permitted continuous work intensity for Service personnel at a given environmental temperature (WBGT). They are expressed for one hour exposure with a minimum of 30 minutes rest after the activity. They apply to personnel wearing a single layer uniform with sleeves rolled up and without helmets. For personnel who can not pass their mandatory fitness tests the WBGT threshold values should be lowered. There is little difference in heat tolerance between men and women of equal physical fitness. Adherence to the guidance will minimise the risk of heat illness to 95% of normal, healthy personnel. Approximately 5% will not be protected.

5. The table is divided into unacclimatised and acclimatised groups. An individual is considered to be acclimatised if they have undertaken regular exercise for longer than ten days in the same environmental conditions as the proposed activity. Residence in air-conditioned accommodation slows the development of acclimatisation. If exposure to the hot environment has included a substantial period of travel or crossing time-zones the time taken to acclimatise should be assumed to be longer than ten days. Individuals returning to a hot climate from courses or leave should be considered as unacclimatised.

6. If NBC protective clothing or Combat Body Armour is worn the WBGT values for unacclimatised personnel at low and medium work intensity, reduced by 5°C, should be used. It is not safe to perform activities at a high or very high work rate or to run in NBC clothing, at any environmental temperature without specific medical advice.

7. Commanders should anticipate changes in environmental conditions during the course of training for example, the WBGT may be below the threshold for a loaded march starting in the early morning but could be exceeded at the end. If the conditions or the proposed activity falls outside these limits then the duration of activity should be shortened and mandatory rest periods (15 mins/hr) introduced to allow fluid replacement and cooling to occur. Advice can be sought from Environmental Health or Medical Staff regarding work/rest cycles if particular activities fall outside these limits and it is mandatory that the activity occurs.

**ANNEX B TO
CHAPTER 2**

Water requirements for personnel during exercise in heat

1. It is the duty of commanders to ensure that adequate water is drunk before, during and after a bout of exercise in the heat. If personnel are exposed to heat continually for example, on an overseas deployment or during a hard physical course then they should be advised to replace water regularly during the day in order that their urine always remains pale yellow in colour. Assuming normal hydration (indicated by pale yellow urine), a minimum ½ litre (½ a standard water bottle) of water should be drunk two hours prior to a high risk activity followed by a further 1/3 litre 15 minutes prior to the task. On completion of the task one litre of water should be drunk over the next one/two hours.

2. The following table shows the numbers of litres (water bottles) required per hour during continuous work at various WBGTs using the exercise intensities from Annex A. The figures are valid for acclimatised personnel. Unacclimatised personnel require at least the same quantity of water, but note that the table at Annex A specifies reduced exercise intensities for a given WBGT. The water requirement should be spread over the hour period as many individuals find large quantities of water difficult to tolerate unless taken in multiple small quantities.

Ser	WBGT	Exercise Intensity /Work Rate (as detailed in Annex A)			
		Low	Medium	High	V High
(a)	(b)	(c)	(d)	(e)	(f)
1	32°C	1.0 L/hr	1.25 L/hr	N/A	N/A
2	30°C	0.75 L/hr	1.0 L/hr	N/A	N/A
3	27°C	0.5 L/hr	1.0 L/hr	1.25 L/hr	N/A
4	25°C	0.5 l/hr	0.75 L/hr	1.0 L/hr	1.25 L/hr
5	20°C	0.25 L/hr	0.5 L/hr	0.75 L/hr	1.0 L/hr

Individual needs vary by ± 0.25 L/hr (adapted from United States TB MED 507/AFPAM 48-152. Validated by Kolka MA, et al (2003). 'Current US Military Fluid Replacement Guidelines.' NATO Publication (in draft).

3. If personnel are heat acclimatised and regularly consume those meals supplied in full, salt intake from food is normally adequate to meet the body's requirement. Heat acclimatisation conserves body sodium by decreasing sweat sodium (Na) concentration from approximately 50 mmol.L⁻¹ to 25 mmol.L⁻¹. However, at any given level of

acclimatisation the sodium concentration rises as the rate of sweating increases. Actual sodium (Na) intake is likely to vary between 170 mmol.d⁻¹ (from the average diet in the UK) to 380 mmol.d⁻¹ (the value for 10 man Operational Ration Pack Menu A, excluding soup). Thus a sodium deficit will arise if daily sweat losses exceed between 3.5 to 7.5 L.d⁻¹ for unacclimatised personnel, compared with 7 to 15 L.d⁻¹ for acclimatised personnel. The normal military diet, either fresh or military rations, does include sufficient salt, except perhaps in very hot conditions such as may occur in the Gulf region. However, many individuals will not consume a full diet and will therefore become sodium deficient, particularly if working in hot conditions. It is therefore important that individuals do not miss meals and that they fully consume their meals. However, any deficit is usually corrected by salting food to taste and this should be permitted by the provision of additional salt sachets with meals (including ration packs), particularly during the acclimatisation phase. Salt tablets are not recommended without medical supervision nor should personnel be directed to ingest extra salt other than by salting food to taste. Excessive salt intake may cause gastrointestinal discomfort and nausea, adds to the body's water requirement and may be hazardous rather than beneficial.

4. To offset sweat losses during periods of prolonged work (longer than 4 hours) without additional food intake, electrolyte beverages (see below) or water with added salt (at a sodium concentration of 17 – 23 mmol.L⁻¹) should replace plain water. A concentration of 17 mmol.L⁻¹ is achieved by addition of one sachet (1 g) of salt (NaCl) to one litre of water; two sachets to 1.5 litres gives 23 mmol.L⁻¹. Sugar should not be added to drinking water without medical supervision.

5. Avoid fizzy drinks as fluid consumption is limited due to the carbon dioxide gas. Avoid stimulant drinks such as ██████████ which will lead to further dehydration. Isotonic drinks should not be used without specific advice during exercise, but are a useful means of rehydrating and replenishing carbohydrate during recovery. Electrolyte beverages containing sugar will encourage the growth of harmful bacterial in water canteens, which will require treatment with hypochlorite within two days.

Guidance for medical staff on the treatment of heat illness

Definition

1. Heat illness is classically divided into heat exhaustion and heat stroke. In practice a continuum of pathophysiology is seen from mild symptoms such as muscular weakness, headache, excess fatigue to collapse, coma and death. The critical element seems to be cardiovascular decompensation between the demands of thermoregulation and maintenance of critical central circulation. The blood pressure has been shown in some studies to be a reliable determinant of the severity of heat illness.

2. **Body Temperature.** This is an unreliable guide to severity. Individuals with very high rectal temperatures (for example, 42°C) may recover completely with prompt treatment and individuals with less elevated temperatures (for example, 39°C) may suffer complications. Furthermore the first temperature measured may not be a reflection of the peak temperature BUT an elevated core (rectal) temperature is certainly an indication for energetic measures to reduce the temperature.

Initial Treatment

3. The key to treatment is prompt recognition of the condition. The following are recognised symptoms and signs of heat illness: weakness, headache, thirst, nausea, myalgia, fatigue, hysteria, anxiety, agitation, vomiting, cramps, impaired judgement, hyperventilation, paraesthesia, tetany, diarrhoea, stumbling gait, dizziness, collapse, coma.

4. Having carried out an initial assessment of Airway, Breathing and Circulation, the following interventions should be undertaken on any person suspected of suffering with heat illness:

a. **Observations.** Rectal temperature, pulse rate, blood pressure, respiratory rate, assessment of conscious level (for example. Glasgow Coma Scale) and pulse oximetry. Monitoring of fluid balance, including urine output. Blood glucose (BM stick) and urinalysis (dipstick).

b. **Interventions.** Continue active cooling by continuous spraying with cool water and fanning, replacing fluid (probably by intravenous infusion – Normal Saline or Dextrose Saline), additional oxygen and airway protection if

unconscious.

c. **Investigations.** Individuals who are suspected to be suffering from a significant episode of heat illness should have the following investigations : FBC, CRP clotting screen, U+Es and creatinine, LFTs, CK, blood glucose and urinalysis and serum osmolality.

5. Admission to hospital should be arranged for all casualties who do not respond promptly to initial treatment. Certainly all casualties who are or have been unconscious or who have sustained a rectal temperature greater than 40°C should be admitted to hospital. Attention must be given to ensure that aggressive cooling measures and continuous monitoring are maintained during the transfer to hospital and that suitably trained medical, or paramedical staff, accompany the casualty. Sub-acute rhabdomyolysis should be considered in all cases of heat illness.

6. An overview of the guidelines for the treatment of heat illness is shown at Appendix 1.

7. **Fluid Overload – Hyponatraemia.** Hyponatraemia secondary to water overload is an important differential diagnosis to consider in exertional collapse in otherwise fit Service personnel and can look very similar to heat illness. Anyone who becomes unconscious during exertion *and whose rectal temperature has not been raised* should be considered to have symptomatic hyponatraemia until measurement of serum sodium concentration refutes the diagnosis. Where near-patient electrolyte testing is not available consideration should be given to transferring the patient to hospital. There is a raised risk of this condition where large quantities of plain water have been drunk. Patients with serum sodium concentrations below 129 mmol/L are overhydrated by between 2L and 6L. The doctor should be alerted to this diagnosis in a patient with an altered conscious level and very dilute urine. Catheterisation is necessary to determine this in the unconscious patient and the diagnosis is supported by the passage of urine at an ever-increasing rate. If the patient is conscious, they may give a history of excessive water consumption and may complain of feeling bloated or 'swollen'. There may be evidence of pulmonary oedema. The administration of IV fluids to such personnel will worsen their condition, may cause fitting and death. Under no circumstances should fluid be given to unconscious or semi-conscious exertional-collapse victims with hyponatraemia. Most patients will recover spontaneously without any treatment other than fluid restriction and the occasional use of diuretics. High sodium solutions may be given by slow IV supervision under specialist supervision in hospital.

8. **Specialist Referral.** All personnel who have had a significant episode of EHI or required urgent admission to hospital with heat illness should subsequently be referred to

the Heat Illness Clinic at the Institute of Naval Medicine (INM) for further investigation. Referrals should be made to [REDACTED], via the Administrative Officer of the Environmental Medicine Unit (AO/EMU), INM, Gosport, Hampshire, PO12 2DL (Tel: Mil 9380 – 68051, Civ 023 – 9276 - 8051).

9. *Rehabilitation and Return to Duty.* An individual who has sustained one episode of heat illness may be more susceptible to the effects of heat for a variable period in the future. It is important to ensure that all significant heat casualties are appropriately investigated to identify whether they have any persisting heat intolerance. During this period the following physical activity and employment grading limitations are recommended:

a. Mild heat illness not requiring admission to hospital. No biochemical evidence of organ damage. No concurrent predisposing illness (for example, gastroenteritis). **No physical activity for one week.**

b. Heat illness requiring admission to hospital. Biochemical evidence of organ damage. No complications. **No physical activity for one month after biochemical recovery. Reduction in medical grade should be considered in all cases. Refer to INM to assess whether there is any predisposition to heat injury.**

c. Heat illness requiring admission to intensive care. Residual complications. **Medically downgraded and referral for assessment by INM and continued secondary care investigation if clinically indicated.**

d. More than one episode of heat illness. **Medically downgraded, referred to INM and assessment by a military physician for suitability for retention in the Services.**

10. A flow diagram outlining the stages for investigation and rehabilitation is shown at Appendix 2.

11. *Reporting of cases.* The reporting of cases of heat illness through single Service reporting chains is crucial to the monitoring of the effectiveness of this Chapter. It is the duty of all medical officers to ensure that heat casualties treated by themselves or under their authority (for example, by medical assistants) are reported, via the chain of command, to their Service Medical Directorates using the Heat Illness Reporting Form at Appendix 3. Single Service points of contact for heat illness reporting areas shown:

- a. RN and RM. MDG(N) – [REDACTED] Survival and Thermal Medicine, INM, Gosport, Hampshire PO12 2DL.
- b. Army. AMD Health, FASC, Camberley, Surrey, GU15 4PQ.
- c. RAF. CMO(OH), RAF HQ PTC, Innsworth, Gloucestershire, GL3 1EZ.

12. In high risk environments, Command Headquarters are to introduce formal reporting systems for heat illness. Boards of Inquiry should be convened to investigate episodes resulting in multiple heat casualties or fatalities.

13. *Sources of advice and training aids.* Inevitably there will be circumstances that are not covered by this instruction, particularly in the assessment of the risk of heat illness. Advice should be sought through single Service preventive medicine channels. The tri-Service video No. A3876 'Keep your cool' is a useful training aid.

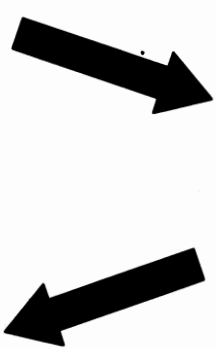
Heat illness treatment guidelines

Immediate Action:

- High index of suspicion (to recognise signs early).
- **STOP** the activity of all (and assess others for signs).
- Airway/Breathing/Circulation.
- Shade.
- **Undress.**
- **COOL** with water & Fan.
- Lie down/Elevate legs.
- Oral fluids, if conscious.
- **Oral glucose, if conscious.**
- Call for assistance (999).

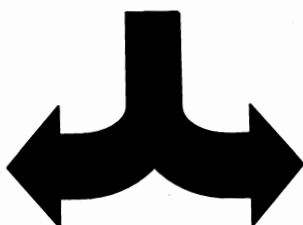
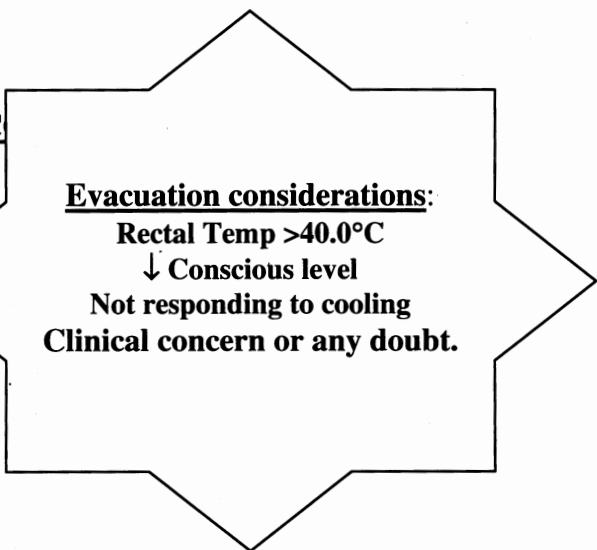
Initial 'Medic' Assistance (Medic on scene):

- Check Airway/Breathing/Circulation.
- **RECTAL** temperature.
- Clinical Observations (Pulse/Resp/Consciousness level).
- IV Access (1-2 litres isotonic crystalloid – normal saline [avoid Hartmans]).
- Maintain cooling procedure.
- Possible role for IV Glucose (50ml Glucose 50%)
- If seizures occur: ¾ prone position.
- 100% Oxygen, when available.



On arrival at Medical Centre/Primary Care Treatment Facility:

- Check Airway/Breathing/Circulation. – Check **RECTAL** temperature
- Continue with cooling (Water and fanning).
- **More detailed clinical observations (for example including EC)**
- **100% Oxygen.**
- IV Access, if not previously established.
- Blood Glucose check.
- Be aware of risk of seizures and treat as required.
- Clinical review: assess and review need for transfer.



Hospital Emergency Care:

- Airway/Breathing/Circulation – as above
- Continue with cooling.
- Rectal temperature on arrival
- Confirm previous treatment - Continue triage and care:
- ‘A’ – Consider intubation and ventilation
- ‘B’ – 100% Oxygen
- ‘C’ – IVI and IV Fluids. Assess fluid balance
- ‘D’ – Assess consciousness level (Glasgow Coma Scale)
- ‘E’ – Urinary catheter/NG tube/CVP line/Arterial line
- Investigations: FBC, U+Es, LFTs (bilirubin, AST, ALT), CK, clotting screen, myoglobin clearance, blood gases and lactate.
- Consider alkalisation.

Unit Treatment

(If Hospital Care option not taken):

- Confirm casualty is fully conscious and alert:
- Keep bedded down for 24 – 48 hrs.
- Continue with observations (urinalysis and visual check).
- Monitor fluid balance.
- Investigations (FBC, U+Es, serum osmolality, LFTs, CK, clotting screen).
- Check blood sugar levels.
- Twice daily urinalysis and visual check for 2 days.
- MO review at days 3, 5, 7 and 10.

Heat acclimatisation prior to, and on deployment to hot climates

1. Benefits of acclimatisation. Living, operating and fighting in hot and humid conditions increases the thermal load on the body, with consequences that can range from impaired performance to serious heat illness. These dangers can be reduced, but not entirely eliminated, by prior acclimatisation and ensuring that fluid losses are replaced by adequate fluid intake. Repeated exposure to exercise in hot conditions will result in physiological adaptations to improve heat dissipation, particularly increased sweat rate and earlier onset of sweating. Expansion of the blood and plasma volumes also improves cardiovascular tolerance to exercise in the heat. Note that acclimatisation increases rather than decreases the water requirement: daily water requirements will increase from 2 - 4 to as much as 8 – 12 litres in extreme conditions depending on physical activity levels. A rehydration strategy is therefore imperative (see Annex B Para.2).

2. Prior to deployment. Building and maintaining a good level of aerobic power (VO_{2max}) is essential. An indirect relationship has been demonstrated between VO_{2max} and the number of days required to acclimatise.¹ For example, acclimatisation in seven days would be expected for individuals with a VO_{2max} of $45 \text{ mL} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ (a 1.5 mile run time of 11 min 30 s) whereas fitter individuals with a VO_{2max} of $51 \text{ mL} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$ (a run time of 10 min 24 s) are predicted to require 6 days. Hence improved aerobic fitness will help to shorten the ten day requirement for acclimatisation requirement stated at Annex A-2 Para. 5. Personnel should be participating in a progressive physical training programme under the supervision of a Physical Training Instructor for approximately six weeks prior to departure. The initial three to four weeks should aim to build or improve aerobic fitness. This should concentrate on intermittent aerobic endurance activities, at an intensity of not less than 65-70 % of heart rate reserve, for periods of 40 min initially, extending to 90 – 100 min. (Heart rate reserve is defined as the difference between predicted maximum heart rate ($220 - \text{age}$) minus resting heart rate). During this period allow at least 2 days full rest per week and vary the exercise modality to use different muscle groups. In the final ten to fourteen days leading up to deployment, the aim is raise core temperature for a minimum duration of 100 minutes per day; this can be checked by visual assessment of sweating. At all times care should be taken to work within the guidelines given at Annex A to Chapter 2 and to ensure plenty of fluids (Annex B Para. 2). The suggested pre-deployment training schedule is given in Table 1. During this pre-deployment phase, although sweat rates should increase over time, the UK diet contains more than enough sodium to replace these losses. Indeed a

¹ Pandolf K et al, Physical fitness in heat acclimatisation. *Ergonomics* (1977); 20: 399-408.

low salt diet is preferable since this will stimulate the sweat glands to conserve sodium more efficiently.²

3. Deployment. Air transit, with the likely consequences of jet lag, lack of sleep and dehydration, is likely to reduce an individual's tolerance to heat stress. It is imperative that NO EXERCISE is undertaken for 24h after arrival in theatre. Personnel should be encouraged to sleep, eat and drink plenty of fluids. Over the next seven days a programme of supervised progressive exercise should be undertaken during times of day where the wet-bulb globe temperature is below that stated in Table 2 below. Water should be drunk in accordance with the guidance at Annex B. If at any time an individual feels dizzy or faint, they should be stopped, placed in the shade, stripped and actively cooled with water as advised at Para 0218. The Table is intended for guidance of fit personnel; those less fit may have to progress more slowly. Exercise heart rate should fall as physiological adaptation occurs despite the progressive increase in thermal load. Note that residence in air-conditioned accommodation will slow the adaptive response. A single bout of exercise lasting 100 min is suggested as this is more effective than two 50 min bouts or two 100 min bouts conducted morning and afternoon.³

4. Re-acclimatisation. It is recognised that individuals may return to the UK for a period and have to re-deploy to theatre. This raises the issue of decay of acclimatisation and re-induction. Personnel must be advised that they need to re-acclimatise following a brief (two week) period in the UK. The period of acclimatisation will depend on the duration of the period of leave, the environmental temperature in the UK at that time and the fitness of the individual. The decay of acclimatisation will be reduced if personnel continue to take regular exercise. Ideally a minimum of one training session should be conducted in the first seven days⁴ followed by five further sessions in the second week of leave (as advised for week 5 in Table 1). The suggested time required to re-acclimatise is four to seven days. This is based on advice from a recent draft Heat Stress Standard,⁵ which reiterates earlier published advice.⁶ Given the relative youth and physical fitness of Service Personnel to the general population, the four-day minimum period should be sufficient. It is suggested that, after the initial 24hr period of inactivity, the procedure for days 5-8 in Table 2 be followed.

² Allsopp AJ et al (1998). The effect of sodium balance on sweat sodium secretion and plasma aldosterone concentration. *Eur J Appl Physiol* 78: 516-521.

³ Lind A, Bass DE (1963). Optimal exposure time for development of acclimatisation to heat. *Fed Proc* 22: 704-708.

⁴ Report TTCP/HUM/97/002 Assessment of potential ergogenic aids for special operations. Annex B Page 54.

⁵ Heat stress standard developed for use in the Australian environment. Australian Institute of Occupational Hygienists, August 2002.

⁶ Bass D (1963). Thermoregulatory and circulatory adjustments during acclimatisation to heat in man. In: J D Hardy (ed) *Temperature, its measurement and control in science and industry* Vol 3 Part 3. NY Reinhold.

Table 1. Suggested pre-deployment training schedule to be conducted under the supervision of Physical Training staff.

Week	Activity	Intensity (%HRR)	Frequency (times per week)	Duration (min)
1	Intermittent exercise	60-70	3	40
2			4	60
3			4	80
4			5	90
5	Continuous aerobic activity	50-60	5	100
6			7	

Footnotes:

1. HRR – Heart rate reserve.
2. Weeks 1-4 are to build or improve aerobic fitness; weeks 5-6 are to raise core temperature.
3. Use different exercise modalities to rest muscle groups.

Table 2. Suggested acclimatisation procedure on arrival in theatre. Note that the WBGT temperature needs to be monitored at the location used for the training activity.

Day	Dress	WBGT (°C)	Duration	Activity
1	NO ACTIVITY. REST, EAT, DRINK AND SLEEP (for 24h)			
2	T-shirt and shorts	26 - 30	1 x 50 min	Walk at 3 mph allowing for fluids ad libitum.
3	T-shirt and shorts	26 - 30	2 x 50 min	Walk at 3 mph allowing for fluids ad libitum; rest for 15 min; resume walking.
4	T-shirt and shorts	26 - 30	100 min	Walk at 3 mph allowing for fluids ad libitum.
5	T-shirt, combat jacket, lightweight trousers	26 - 30	2 x 50 min	Walk at 3 mph allowing for fluids ad libitum; REMOVE JACKET and rest for 15 min; resume walking.
6	T-shirt, combat jacket, lightweight trousers	26 - 30	100 min	Walk at 3 mph allowing for fluids ad libitum.
7	T-shirt, combat jacket, lightweight trousers and webbing (10 kg)	26 - 30	2 x 50 min	Walk at 3 mph allowing for fluids ad libitum; REMOVE JACKET AND WEBBING rest for 15 min; resume walking.
8	T-shirt, combat jacket, lightweight trousers and webbing (10 kg)	26 - 30	100 min	Walk at 3 mph allowing for fluids ad libitum.

CHAPTER 3

COLD

Introduction

0301. Cold environments represent a significant hazard to the unprepared. There have been two deaths in Service personnel from cold related illness and injuries since 1991 and 15-20 personnel are medically discharged from the Services each year for cold injury. Cold related illness and injuries are preventable and all commanders need a sound understanding of the principles of working in cold environments.

0302. Military personnel are at risk from cold related illness and injuries because of exposure to the combination of operational and training requirements in adverse environmental conditions, both in hostile isolated locations at home and abroad. Commanders have a duty to assess the risks of cold injury as a result of military operations and training and must ensure that these risks are minimised as far as is reasonably practicable.

0303. Cold illness and injuries occur as a result of the effects of cold wet and cold dry conditions on the body. This Chapter will cover the following cold related illness and injuries which fall in to four broad categories:

a. *Primary - Generalised.*

(1) Hypothermia (low body core temperature).

(a) Mild.

(b) Moderate.

(c) Severe.

b. *Primary - Localised.*

(1) Freezing Cold Injury - Frostnip

(2) Freezing Cold Injury (freezing of body tissues) - Frostbite.

(3) Non-Freezing Cold Injury (after prolonged cooling of the tissues without freezing).

c. *Secondary.*

(1) Cold Sensitisation.

d. *Other illness and injuries related to cold environments.*

(1) Snow blindness.

(2) Other miscellaneous conditions.

Physiology

0304. The body normally maintains a stable core temperature of 37°C. Control of human body temperature is dependent on the following balance:

Heat balance equation

$$\text{Heat storage} = \text{heat gained} - \text{heat lost}$$

0305. This stability is achieved by balancing the rate of heat production (mainly from internal metabolic heat generation) with the rate of heat loss and also by altering the temperature of the body's external tissue layers (skin and muscle). The rate of heat loss through convection and conduction depends on the temperature difference between the skin and the environment. The rate of evaporative heat loss, through breathing and sweating, depends on the external ambient humidity. Air movement (air over the body or the body through the air) increases both types of heat loss. This is commonly referred to as 'wind chill' or relative air movement, and is further detailed in Annex A.

Prevention

0306. The key to the prevention of cold related illness and injuries is an awareness of the risk by commanders. Any outdoor activity undertaken in adverse cold environments constitutes a risk. The commander's assessment of risk depends on the following factors:

a. Individual preparation.

b. Environmental temperature.

- c. Wind chill.
- d. Work intensity.
- e. Clothing and equipment.
- f. Individual risk factors. Afro-Caribbean personnel are particularly susceptible to localised cold injury. Additional guidance on susceptibility can be obtained from the sources in paragraph 0322 (Further Information).

0307. Training. All units are to ensure that training in the prevention and first-aid management of cold injuries is provided to individual personnel during basic training, and commanders at all levels during appropriate leadership courses and prior to assuming a training post. Periodic refresher training is also to be conducted especially immediately prior to training or operations in a cold climate. Medical personnel are to be trained in the prevention and management of cold injuries (appropriate to their level of competency and responsibility) during initial specialist training and periodically thereafter. There are many sources of training material. Examples are as follows:

- a. SSVC Video 3904 – ‘Deadly by Degrees’.
- b. SSVC Video 3102 – ‘Health in Cold Climates’.
- c. SSVC Video 3942 – ‘Ice Cold War - Local Cold Injury’.
- d. Additional presentations and videos are also available from members of the Cold Injuries Working Group (see paragraph 0322 (Further Information)).

0308. Environmental temperature. The following general recommendations are made:

- a. Extra care is needed during outdoor training when the still air temperature (SAT) is less than -5°C .
- b. When operating in extreme conditions a method needs to be established for accurately forecasting the weather. If an exercise is to include hill or mountain climbing, it is essential that the nearest MOD Met office is contacted. A list of MOD Met offices is attached at ANNEX B.

0309. Wind Chill Index. A wind chill index chart is attached at Annex A. This shows how temperature is affected by even moderate wind speeds and calculates the equivalent air temperature in terms of its cooling effect.

0310. Work intensity. Inactivity in open areas exposed to the wind and cold may predispose an individual to the effects of the cold. Additionally, the sweating produced after periods of exertion and the diversion of blood to muscles and skin, away from the body core, may lead to excessive cooling thus predisposing to cold related illness and injuries.

0311. Clothing and equipment. Inadequate dress and equipment will increase the risk of cold related illness and injuries.

a. **Headwear.** Correct headwear must be worn when the SAT is lower than -10°C, as at this temperature ears will begin to suffer the early effects of frostbite. Helmets and berets offer minimal protection against frostbite and do not significantly reduce heat loss from the head. It is advised that headovers or specific cold weather hats should be worn to provide protection.

b. **Layered Clothing.** The use of layered clothing with an outer windproof layer and close, but not tight fitting cuffs, is the best way to dress in cold climates, as it follows the 'layering' principle. Layers of clothing need to be removed immediately prior to, and during, physical exercise in order to limit sweating and the danger of a resultant loss of insulation.

d. **Footwear.** Boots should not be laced tightly in cold conditions. Socks should be changed when waterlogged. Socks that are old or over-compressed have reduced insulating properties. Feet should be inspected regularly. Boots and socks with enhanced thermal protection are available upon the recommendation of the unit medical officer. The procurement authority is JSP 336, 3rd Edition, Volume 12, Part 3, Pamphlet 1, Section 2, paragraph 205b. Demands are to be submitted through the unit imprest account using AF P1923 cleared ag

e. **Footwear.** Units should determine whether personnel considered to be at risk of cold injury are issued with enhanced thermal protection at the start of training.

d. **Hand Protection.** Gloves (with separate fingers) cannot provide sufficient insulation to the fingers to permit indefinite use in SATs below 0°C and mittens (four fingers in a single compartment) are preferred. Hand protection should be

worn when the SAT falls below +5°C and should be mandatory below a SAT of -5°C or when high winds are expected. A spare pair of mittens should always be carried as cold and wet handwear contribute to cold injuries.

e. **Eye and Skin Protection.** Snow-blindness and sunburn may occur in cold environments and can happen in cloudy as well as in bright sunlight conditions. High Factor (25+SPF) sunscreen is necessary, as are glacier goggles (with side shields), for snow and ice work.

f. **Sleeping System.** Sleeping bags must be kept dry and insulation matting used as standard. They must be adequate for the temperature range likely to be encountered. The use of Gore-Tex bivvy bags is recommended.

Individual risk factors

0312. Service personnel who are unwell, unfit, hungry or who have a history of previous cold-related injury or illness, however mild, will be at increased risk of developing cold related illness and injuries.

a. **Nutrition.** As an example, normal energy requirements for a resting adult male increase from 2500 kcal to 5000+ kcal at -20°C. It is therefore vital that daily rations are increased accordingly. Survival rations are specifically designed for cold weather and should always be carried in case of emergency.

b. **Fluids.** Operations in cold conditions can lead to severe dehydration just as rapidly as in tropical environments. Cold weather increases respiratory water loss and when static will increase urinary fluid loss. The carriage of extra fluid (and fuel to melt snow) is necessary to avoid dehydration. Alcohol is not to be used in the first aid treatment of cold casualties as it can worsen their condition. In addition, all troops need to be informed of the dangers of alcohol abuse during cold weather.

Risk assessment

0313. Prior to any activity which may involve a risk of cold related illness and injuries, commanders at all levels are to:

a. Assess the degree of risk associated with the planned activity. Guidance for this is contained in Annexes A and B and a Risk Assessment Aide Memoire is provided at Appendix A1-1. Further advice may be sought from Medical Staff or Environmental Health Teams (EHTs).

- b. Determine if the risk of cold casualties from the activity is justified by the objectives of that activity. It is important to assess whether the same objectives could be achieved by rescheduling or changing the activity.
- c. Ensure that the troops involved are adequately briefed and prepared.
- d. Ensure that the activity is adequately supervised, and that there is the provision for adequate intake of food and water, and that shelter is prepared for rest periods.
- e. Ensure that each individual is adequately trained in first aid and that a clear and efficient means of evacuation for medical treatment is available.
- f. Ensure that any standing orders or instructions regarding training limits are up to date, thoroughly understood and observed by all.

First aid

0314. Once a cold casualty has been identified they must not be allowed to become colder. Arrangements must be made for urgent casevac to medical facilities. Specific treatment will depend on the condition involved (Annex C).

0315. The cardinal principles of first aid apply, that is to remove the individual from immediate danger and prevent any further casualties from occurring. Other more serious illnesses or injuries may require attention before the cold related illness or injury. Therefore the following should always be assessed first and associated problems treated as they present:

- a. Airway
- b. Breathing
- c. Circulation

0316. If the casualty is unconscious but breathing, place him/her in the recovery position. If the casualty's clothing is wet, provided dry clothing and warm protected shelter is also available, remove wet garments and replace them. If not, leave wet clothes on and cover with waterproof material and additional insulation if available. Provide hot sweet drinks and food as soon as the casualty is conscious and can swallow.

0317. Always consider the other members of the group or party. If one individual has been affected by a cold illness or injury then there is a high likelihood that others may also be victims.

0318. Other illness and injuries related to cold environments:

a. ***Acute Altitude or Mountain Sickness.*** The biggest killers associated with high altitudes may well be a combination of extreme environmental conditions (causing hypothermia and exhaustion), falls and avalanches. Acute Mountain Sickness (AMS) is one of the most significant dangers faced by those taking part in high-altitude expeditions. These dangers are preventable if simple precautions, as advised by medical staff, are taken.

b. ***Seasonal Affective Disorder (SAD).*** In the high latitude (sub-polar) regions, long periods of darkness may have a debilitating effect. SAD is a recognised condition characterised by low mood and social withdrawal. Recreation may help but the condition improves as daylight lengthens. Consideration should be given to evacuating any individuals who are severely affected from theatre.

c. ***Carbon Monoxide (CO) Poisoning.*** Care is required when cooking in confined spaces (such as under canvas and in snow holes) or when vehicle engines are running in a static location, due to the significant risks of CO poisoning.

d. ***Accidents:***

(1) Slips and falls are more common in icy conditions and personnel should make a conscious effort to take care when travelling in vehicles or outside on foot. Additional time should be allowed for outdoor activities in cold environments.

(2) Muscle and tendon injuries are more common when a person is cold. Inactive muscles are even cold in warm weather. When muscles are cold their action is inefficient and it may be uncoordinated. Joints are also stiffer. An active warm up with stretching will reduce the risk of injury and enhance performance.

e. All personnel should additionally be aware of the risks of injury to unprotected skin by touching very cold metal and from the effects of fuel

splashes.

Case reporting

0319. The reporting of all cold related illness and injuries through single Service reporting chains is crucial to the monitoring of the effectiveness of this instruction. All cases of suspected cold injury requiring treatment (either first aid or formal medical intervention) are to be reported. The report form at Annex D is to be initiated by the chain of command and forwarded to medical personnel for completion and then sent to single-Service collation points as follows:

- a. RN and RM. Head of Survival and Thermal Medicine, INM, Gosport, Hampshire PO12 2DL.
- b. Army . Scientific Officer, Occupational Medicine Department, HQ ATRA, Trenchard Lines, Upavon, Pewsey, Wilts SN9 6BE
- c. RAF. SO1(OH), RAF HQ PTC, RAF Innsworth, Gloucestershire, GL3 1EZ.

0320. Additionally, cases of cold injury are to be reported through established single Service systems, for example:

- a. Royal Navy: Complete accident report form NSIR-01 forwarding to:

NSINC
CINCFLEET HQ
MP 4.3
Leach Building
Whale Island
Portsmouth
Hampshire PO2 8BY

Facsimile: BT: 02392 625887 Mil: 93832 5887
Phone: BT: 02396 625151/625882 Mil: 93832 5151/5882
E-mail: Fleet e-nsinc mailbox

- b. Army. Army Incident Reporting Cell (AINC)

Phone BT: 01980 628458 Mil 94321 8458

- c. RAF Raise Incident Report in accordance with JSP 375 Volume 1, Chapter 14 and Volume 2, Leaflet 14. RAF Form 7454 and RAF Form 7454A are to be completed and passed to the Establishment Health and Safety Adviser within 48 hours of the incident, injury or illness.

In high risk environments, JSP 539 is to be incorporated as a mandatory reference to Exercise and Operational mounting instructions

Investigation.

0321. The appropriate single-Service command investigation authority is to lead on the investigation of cold injury incidents with assistance from medical staff (for example Environmental Health Technicians) if required. Boards of Inquiry are to be convened to investigate episodes resulting in multiple cold injury casualties or fatalities.

Further Information

0322. Further information on the prevention, management and reporting of cold injuries may be obtained from the following sources:

- a. Joint Service.
 - (1) DMSD SO1 OM. (Main Building {9621} 83619)
- b. RN/RM.
 - (1) INM-Head of Survival and Thermal Medicine Department. (Portsmouth {9380} 68043).
 - (2) Fleet Environmental Health Advisors, MDG(N), West Battery, Whale Island, Portsmouth, (9380 22285/20032).
- c. Army.
 - (1) LAND SO1 Health. (Salisbury Military {94331} 2427).
 - (2) AMD SO1 OM. (Camberley Military {94261} 2934).
 - (3) AMD SO1 EH Pol. (Camberley Military {94261} 2934).
 - (4) HQ Army Recruiting and Training Division. Occupational Medicine Department: (Upavon Military {94344} 5769/8211/5626).
 - (5) Land Accident Prevention and Investigation Team (LAIT). (Netheravon Military {94321} 8599).
- d. RAF.
 - (1) HQ PTC SO1 OH (RAF). (RAF Innsworth {95471} 5841).
 - (2) HQ PTC SO2 EH (RAF) (RAF Innsworth {95471} 5867).

Cold Injury Risk Assessment Aide Memoire

Ser (a)	RISK FACTOR (b)	REASON (c)	SUGGESTED INTERVENTIONS (d)	PRACTICABLE	
				(e) Yes	(f) No
1	Activity Is any water crossing/immersion likely	Risk of cold injury is increased when static, particularly if this follows a period of arduous activity Immersion/ wet clothes greatly increases risk of CI	Is shelter available for static periods? Can long static periods be avoided? Can immersion be avoided? Have plans been made to allow changing into dry clothes after immersion?		
2	Duration of activity	Exhaustion increases CI risk	Can rest periods be incorporated (in shelter)?		
3	Environmental conditions	Risk of CI <5degrees SAT Wind / wet conditions greatly increase risk	Has nearest MOD met office been consulted? Has SAT been calculated taking into account wind chill? (JSP539 3A-2) Can training be carried out in warmer conditions?		
4	Supervision	Trainers and DS provide a vital means of preventing CI / early detection of CI	Are DS and training staff adequately trained and competent? Is there adequate medical support / medevac plan?		
5	Preparatory education	Knowledge of risk factors, signs and symptoms should reduce susceptibility and encourage early identification.	Have all troops received a presentation on CI or watched the training video?		
6	Water Intake	Dehydration can occur rapidly in cold conditions	Is there adequate water available throughout the intended activity?		
7	Food intake	Energy requirements increase markedly in cold conditions	Have increased calorific requirements been taken into account?		
8	Alcohol	Alcohol increases susceptibility to CI and gives a misleading feeling of warmth.	Alcohol should be avoided for the duration and preceding 24 hours of activity.		
9	Dress	Correct clothing will reduce CI risk Temperatures in UK/Germany may be as high risk as Nordic training	Is correct clothing/sleeping system issued(JSP539 3-3) Do all troops have spare dry clothes?		
10	Predisposing factors Are the personnel well rested/ hydrated/ fed? Are troops physically fit? Are any troops suffering illness? Have any troops had a previous CI?	Lack of sleep/food/fluids/poor fitness/illness predispose to CI. Those with previous CI are at much greater risk.	Can the activity be postponed until personnel have rested? Can personnel be provided with food and water prior to undertaking the activity? Can unfit/ill people be excluded from the activity Extra care must be taken if including any personnel with previous CI.		

**ANNEX B TO
CHAPTER 3**

Meteorological offices maintained at military bases

Ser	Meteorological Office	Tel Ext No:
(a)	(b)	(c)
1	DERA Aberporth	3443
2	RAF Akrotiri	6570
3	AAC and RAF Aldergrove	0339
4	RAF Wideawake, Ascension	6863
5	RAF Benson	7418
6	DERA Boscombe Down	2131
7	RAF Brize Norton	7536
8	RAF Coningsby	7507
9	RAF Coltishall	7285
10	RAF Cottesmore	7337
11	RAF Cranwell	7262
12	RNAS Culdrose	2423
13	AAC Dishforth	4547
14	RAF Gibraltar	416
15	AAC Gutersloh	2497
16	RAF HQSTC	2555
17	DERA Hebrides Ranges	4520 (Part-Time)
18	RAF Kinloss	2818
19	RSA Larkhill	5515
20	RAF Leeming	7316
21	RAF Leuchars	2200
22	RAF Linton on Ouse	7377
23	RAF Lossiemouth	3059
24	RAF Lyneham	6311
25	RAF Marham	4136
26	AAC Middle Wallop	4390
27	RAF Mount Pleasant, Falklands	3553
28	RAF Northolt	4324
29	FWOC Northwood	38576
30	RAF Odiham	7883
31	RNAS Prestwick	4307
32	RAF Shawbury	7275
33	RAF St Mawgan	2042
34	RAF Valley	7447
35	RAF Waddington	6522
36	AAC Wattisham	8227
37	DERA West Freugh	8800
38	RAF Wittering	2292
39	RNAS Yeovilton	5428

Guidance for medical staff on the treatment of cold-related illness and injuries

Introduction

1. Few doctors see more than a handful of cases of cold injuries¹ during their careers. The scant literature detailing modern treatment regimes for Freezing Cold Injuries (FCI) and Non-Freezing Cold Injuries (NFCI) is not readily accessible. These treatment protocols are intended to provide those without specialist knowledge of cold injury with a sound approach to their management, from the point of injury in the field, back to their long-term follow-up. Whilst not intending to restrict the freedom of clinical decision-making, those wishing to depart from the best practice recommended here should only do so if they are clear in the knowledge that such departure can be justified from evidence.

Hypothermia

2. Hypothermia is said to exist when the core temperature is below 35°C and develops when the rate of heat loss from the body exceeds the rate at which the body is producing heat. It can occur in severely cold environments, but occurs more commonly in moderately cold environments.

3. Temperature measurements are best performed using an accurate rectal method and not infrared tympanic membrane or peripheral monitoring devices.

4. There are three distinct types of hypothermia:

a. **Immersion.** Usually caused by a severe cold stress, often rapid, for example, in a sailor washed overboard in cold seas.

b. **Exhaustion.** Most frequently caused by a combination of wind and wet conditions with moderately low temperatures. Usually found in mountaineers or hillwalkers. It is often less acute but may be mild to severe.

c. **Urban.** Usually the cold is relatively mild but prolonged. It occurs most

¹ Cold Injuries include: Hypothermia, Freezing Cold Injuries (FCI) and Non-Freezing Cold Injuries (NFCI).

commonly in the elderly or those who are malnourished.

5. Hypothermia is traditionally divided into three degrees of severity: mild, moderate and severe. However, for the purposes of management and treatment it is more practical to group moderate and severe hypothermia together as one group.

a. **Mild Hypothermia.** The core body temperature is between 32.2°C and 35°C. The individual is usually conscious and feels intensely cold. There will be strong involuntary shivering, peripheral vasoconstriction, tachycardia and an increase in cardiac output. An increase in urine production may aggravate or cause dehydration (cold diuresis). Commanders should be alert to the early signs and symptoms, which can be as subtle as mood changes, locomotor impairment and tiredness.

b. **Severe Hypothermia.** The core body temperature is < 32.2°C (moderate – core body temperature 28°C to <32.2°C and severe being <28°C). This is a life-threatening emergency. The shivering response is often absent, which can be used as an indicator in determining the severity when the use of thermometers in the field may not be practical. If the shivering response is present hypothermia is likely to be mild rather than severe. The limbs are stiff with muscle and joint rigidity and there is usually impaired consciousness with confusion. Heart rate, blood pressure and respiration may be extremely difficult to detect and it may even be difficult to determine whether the casualty is still alive. Pupillary reflexes may be difficult to elicit. The skin may be oedematous and have a marble appearance.

6. The prevention of immersion hypothermia depends on the wearing of adequate impermeable clothing (for example, immersion suits) which will prevent the ingress of water, keeping the underlying insulating clothing dry, should immersion occur. Treatment of immersion hypothermia may involve immersion in a warm water bath (40°C max) but this must be **restricted to conscious individuals only**.

7. **Treatment.** The immediate action to be taken when hypothermia is suspected is to prevent a further fall in core temperature by seeking shelter and insulating the casualty from further heat loss. Conventional plastic/polyurethane bags are far more effective and practical than 'space blankets'. The subsequent management will depend on the severity of the condition. Rapidly rewarming severe hypothermia in the field can be dangerous as it can precipitate ventricular fibrillation due to myocardial irritability. This is an extremely difficult complication to reverse.

8. The following algorithm, which is also represented diagrammatically in Fig 3.1, is recommended for field conditions:

- a. ASK if the casualty is hypothermic? Are there other injuries?
- b. Are they shivering? If YES hypothermia is mild, if NO hypothermia is severe.
- c. If MILD: Remove from wind, rewarm passively and evacuate when warm. Hot sweet drinks can be offered to the casualty if they are conscious and can swallow, but not alcohol.
- d. If SEVERE: Insulate from further heat loss. Do not forget to insulate the head. Do not allow victim to walk. Evacuate slowly with care rather than haste by stretcher, preferably by air, to hospital. If the casualty suddenly becomes pulseless and unconscious commence CPR and maintain this until the casualty reaches hospital.
- e. If UNCONSCIOUS and shows signs of life: Maintain airway. Do not commence CPR. Insulate from further heat loss and evacuate as in para d. above. Commence CPR only if there is a sudden deterioration in the casualty's condition: maintain CPR until the casualty reaches hospital.
- f. If UNCONSCIOUS and appears dead: Are there other obvious causes of death, for instance severe injuries? If not and hypothermia appears to be the cause do not commence CPR. Insulate from further heat loss and evacuate as in paragraph d. above.

9. These are only guidelines and individual circumstance may need to be taken into account by the rescuers and a decision taken appropriate to that circumstance. Personnel suffering from severe hypothermia require admitting to hospital for further assessment and treatment as required. Definitive specialised hospital treatment is beyond the scope of this JSP and should be sought from appropriate medical textbooks.

10. Prevention of exhaustion hypothermia is by the correct wearing and use of clothing - with ventilation during work and extra insulation during rest. Regular hot meals should be eaten and headgear should be worn.

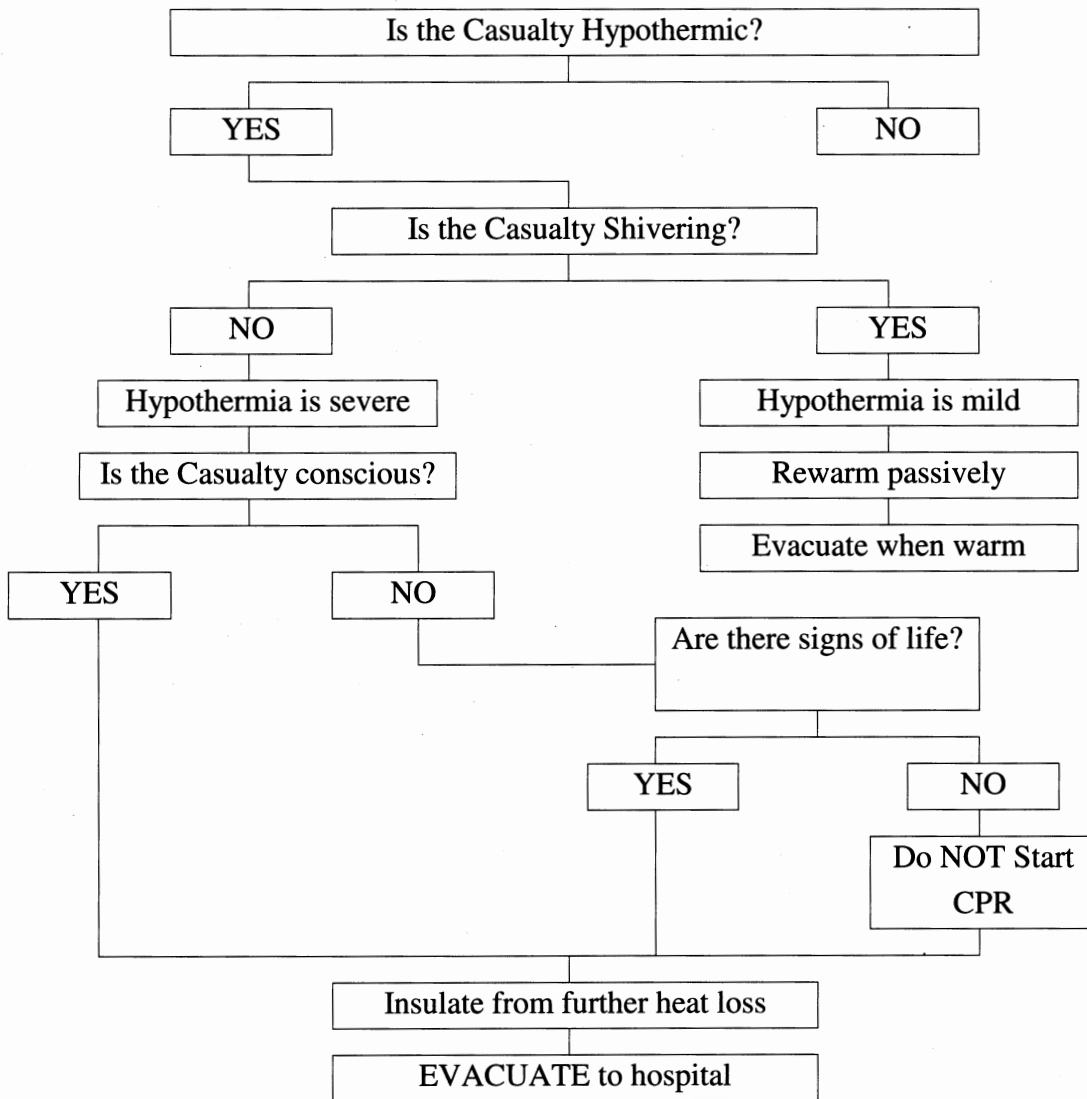


Fig 3.1 Decision Algorithm for Initial Treatment of Hypothermia Under Field Conditions

11. Freezing and non-freezing cold injuries.

a. **Differential Diagnosis.** It is important to establish whether the dominant injury in a given limb is freezing (FCI) or non-freezing (NFCI) in nature, as this determines the preferred method of rewarming (and whether the diagnosis of frostnip can be considered). Many injuries are mixed, but the overwhelming majority fall readily into one of the diagnoses when the dominant injury is established. Thus, a predominantly non-freezing injury with small demarcated patches which appear to have been frozen should be treated as a non-freezing cold injury, whilst the non-frozen areas proximal to a substantial freezing cold injury should result in treatment as a freezing injury.

- b. Cases of freezing cold injury which have already been thawed can give rise to confusion. In most instances, a detailed history will disclose tell-tale information, such as the presence of ice in the sock or against the skin, indicative of FCI, for example.

Freezing cold injury (FCI)

12. The different forms of FCI should be thought of as a continuous spectrum rather than distinct entities, with frostnip being the forerunner of frostbite. Signs and symptoms may therefore be considered as early and late:

- a. *Early Signs.*

- (1) The affected part will feel very cold and may be painful.
- (2) If freezing continues a tingling sensation may be experienced followed by numbness.
- (3) There may be a complete loss of feeling when the affected part is moved.
- (4) A visual inspection will reveal a white blanched area blending into pink tissue.

- b. *Later Signs.*

- (1) The skin tissue becomes very white and wax-like in appearance. There is usually a distinct line of demarcation between white and pink tissue.
- (2) Sensation will be lost with the skin taking on a wooden feel.
- (3) Eventually (usually after rewarming) the skin may become bruised in appearance with the formation of blisters.

13. It is important to note that the degree of severity is often not apparent until a few days after the injury.

Frostnip

14 Frostnip is defined as follows: '*a freezing cold injury which resolves completely*

within 30 minutes of starting rewarming of the injured part'. The condition of frostnip can, therefore, only be diagnosed on the successful outcome to treatment. Complete resolution requires that there are no residual signs or symptoms at all when no more than 30 minutes of rewarming have been applied; residual numbness, visible redness, or remaining coldness and pallor after 30 minutes or more of rewarming all confirm a diagnosis of superficial frostbite, not frostnip. This definition must be applied rigorously, and without trying to give the patient or trainer 'the benefit of the doubt'. Furthermore, a second episode of frostnip occurring in the same limb as a first episode in the same winter must be treated as if it were superficial frostbite, rather than recurrent frostnip.

15. Any personnel with frostnip (the first episode that limb and winter) may be retained in the field, at the discretion of medical personnel and the command. However, extreme care must be taken to ensure that they do not risk further problems of cold injury. If there is any evidence that they are continuing to suffer from such problems, then they must be removed from the field and treated as if they have suffered from superficial frostbite. Frostnip must never be used as an opportunity to 'talk down' a cold injury in order to retain the person in the field. Medical staff should be aware of the severe problems which often result from recurrent minor cold injury, which normally produces cumulative disability.

16. Unit medical personnel should ensure that anyone who has suffered frostnip is reviewed by them when they return from the field, and that the injury (and its site) is recorded in the patient's medical documents. Personnel with frostnip should also be reviewed on return from a deployment, and if there is any doubt as to their continuing fitness for cold exposure, they should be referred to the INM Cold Injury Clinic (CIC).

Frostbite

17. Frostbite follows a period of freezing of exposed tissue, the longer the exposure or the colder the apparent temperature (wind chill) the deeper the tissue damage. The risk of finger frostbite is low above air temperature of -10°C , irrespective of wind speed, but below -25°C there is a pronounced risk, even at low wind speeds. The broad indicators of the different degrees of FCI are shown in Fig 3.2.

18. Any area of the body may be affected but some are more prone to freezing:

- a. **Face.** Nose, chin, ear lobes, lips and tongue (due to drinking or sucking snow or ice).

b. **Upper Limbs.** Fingers (particularly the trigger finger) and the elbow and wrist if in a prolonged fire position in the snow.

c. **Lower Limbs.** Particularly the toes, the sole of the foot and heel. It may also affect the knee if in a prolonged kneeling fire position in the snow.

d. **Genitalia.** Particularly if running or skiing without adequate insulation (for example, windpants).

	Frostnip	Frostbite			
		Mild Superficial	Moderate 1	Moderate 2	Severe Deep
Appearance	Waxy	White, Numb			
Oedema	+/-	+	+	++	+++
Erythema	+	+	++ (> 5 days)	+	+++
Cyanosis	-	+	+	+++ (> 5 days)	+++
Outcome	Recovery	Recovery	Recovery with paraesthesia Hyper-sensitivity	Skin loss. Anaesthesia. Hyper-sensitivity	Deep necrosis. Scarring. Neuralgia.

Fig 3.2 Indicators of the severity of FCI.

Prevention

19. Prevention is paramount and relies upon education, correct use of equipment, constant awareness and implementation of a 'buddy' system for checking each other.

First aid treatment

20. The initial management of frostbite in the field depends on the availability of secondary care. If frozen tissue is allowed to thaw and refreeze then the outcome is considerably worsened, therefore the injury should remain untreated if there is any danger of re-freezing.

21. A history needs to be taken to find out the likely degree of frostbite. The

affected individual should be sheltered from the wind ensuring that he/she is properly clothed. Under no circumstances should brisk rubbing of the frozen part or direct heat by flames, steam or exhaust gases be used to thaw frost-bitten tissue. The routine use of protective topical ointments is not recommended. Smoking can delay or even inhibit recovery and therefore must be strongly discouraged.

22. It should always be remembered that frostbite is associated with whole body cooling and hypothermia, which must be given priority in the treatment. Always be aware that other less noticeable areas of the body may be affected by FCI.

The decision to evacuate

23. All cases of NFCI should be evacuated from the field, allowing only slow rewarming to take place during transportation, and taking care not to damage affected extremities. The only cases of FCI which can be retaining in the field are those which pass the rigorous application of the diagnostic criterion for frostnip: all others should be evacuated with the affected limbs immobilised and protected from further injury. Because casualties with cold injury are likely to be hypothermic or at risk of hypothermia, they should be kept warm, and during evacuation care should be taken to ensure that their survival is not compromised by hypothermia.

Primary care management of freezing cold injury

24. Whether or not rewarming has commenced in the field, all cases of freezing injury should be thoroughly rewarmed by immersion of all the chilled part in stirred water at 38–42°C. It is not possible to predict how long rewarming will take, but the objective is to bring all tissue temperatures, even at depth, to a minimum of 30°C. A useful rule of thumb is to immerse until you are sure that all tissues have reached that temperature, and then to continue immersion for a further 30 minutes to be sure. It is essential that the water temperature is maintained between 38°C and 42°C at all times, and that this is confirmed using a thermometer. If adding hot water during immersion, care must be taken to ensure that the skin does not come into contact with poorly mixed hot water, which could cause a thermal burn. A topical anti-bacterial (such as a skin scrub preparation) should also be diluted into the water bath.

25. The only reason for delaying rapid rewarming is if freezing has occurred to depth in the arm or leg. In such cases, thawing the deep tissues can result in massive destruction. This is because melting of ice crystals results in volume expansion; when such melting occurs within deeper fascial planes, there is no room for this expansion, so tissue pressures rise to well above arterial pressure, and complete ischaemia occurs. If there is any danger of this occurring, fasciotomy should be performed prior to rewarming.

If this cannot be performed by a surgeon, then surgical advice should be sought, and surgical follow-up will be required to close wounds and repair skin defects.

26. Thawing FCI can be an intensely painful experience, and pain can ensue when thawing is complete. Conventional and narcotic analgesics should be provided, as necessary. In extreme cases, personnel should be prepared to titrate the pain with intravenous morphine, although that is very rarely needed. Oral administration of alcohol (in the form of a double or treble measure of suitably diluted spirits) will reduce the need for analgesia, will encourage the patient to continue with other treatment, and may also improve outcome. A loading dose should be given during thawing, and this should be continued twice daily when attending for whirlpool baths.

27. All cases in which there is a significant amount of dying or dead tissue should be considered for systemic antibiotics and anti-tetanus prophylaxis. Anyone with damaged or contaminated areas of frostbite, for example, frostbite complicating a gunshot wound, should be started on both immediately. The regime to be followed is that normal for contaminated gunshot wounds. When FCI is severe, the risks of anaerobic infection are significant, and in the past gas gangrene and tetanus have killed many of those with the worst cold injuries.

28. The mainstay of continuing treatment for FCI is the whirlpool bath, into which affected parts are placed for 30 minutes twice daily. The bath should contain water maintained at a temperature of 38–42°C with an appropriate anti-bacterial diluted into it (just as for rewarming, para 9). Exposure in a warm environment and early mobilisation should be encouraged, and whenever possible the latter should be instituted under the supervision of a physiotherapist. Smoking should be prohibited.

29. Early (that is to say: before 5 months after injury) surgery is only indicated in the following circumstances:

- a. Infection, particularly anaerobic or resistant to non-surgical approaches
- b. Freeze-thaw-refreeze injuries, which are notoriously destructive of tissue
- c. When FCI is a complication of another injury, such as a gunshot wound.

30. If in any doubt, advice should be sought from INM CIC before proceeding to surgery. Those undertaking surgery within 6 months of the injury should also be aware that wound healing during that period is severely compromised, so any surgical interference may lead to chronic problems.

31. Standard procedure, particularly in the field, sick bays and normal hospital facilities, is to leave all blisters intact, and not even attempt to aspirate them. This is to minimise the risk of infection. Specialist units may consider using a modified Chicago protocol, in which some blisters are aspirated or debrided. However, the risks and consequences of infection should always be borne in mind. Photographs should be taken as soon as possible after injury, soon after thawing, and frequently thereafter. Although high-quality clinical photographs are preferred, any photograph is better than none. Photographs should also accompany the patient when reviewed at the INM CIC.

32. Those with FCI (other than frostnip, see paragraphs 14–16 above) should be evacuated once their condition has stabilised. Care should be taken to ensure that they return to an appropriate speciality for continuing treatment. All those evacuated with FCI should be reviewed at the INM CIC between three and five months after injury, accompanied by good copies of their photographs (which will be retained by the clinic).

Non-freezing cold injury (NFCI)

33. NFCI becomes more likely with lower temperatures (but above a temperature of about -0.55°C , the temperature at which tissue fluids can freeze), dampness or water, dependency (gravitational), immobility and increasing duration of exposure. It commonly occurs in the absence of any water.

34. Regular routine foot care is essential; even if it fails to prevent NFCI, it will delay and lessen the effects.

35. *Signs and Symptoms of NFCI.* During exposure it is characteristic that there is a local neurological disturbance, most commonly numbness, rather than just a feeling of cold. Hands and feet are more commonly affected. The casualty will usually present with a painful swollen limb. If the feet are affected the casualty may give a history of wearing waterlogged boots.

Primary care management of non-freezing cold injury

36. The affected limb (feet or hands) should be dried. In contrast to those with FCI, patients with NFCI should have their affected extremities rewarmed slowly, by exposure to warm air alone, and must not be immersed in warm water. Analgesia using amitriptyline (see para 26 below) may still be required. The early period after re-warming can be exquisitely painful in NFCI even without any obvious tissue damage. Narcotic analgesics do not remove that pain, but it is no longer unpleasant. Regional analgesia (for example, spinal or epidural procedures) can give complete pain relief, but only for limited

periods of time.

37. Once rewarmed, the affected extremities should be treated by exposure to air and early mobilisation (again, ideally under the supervision of a physiotherapist). Resting bedclothes on the feet may cause persistent pain, so a bed cradle is valuable. If there is any visible evidence of tissue damage, the affected areas should be photographed to record the progress of the damage. Smoking should be prohibited.

38. Amitriptyline (10–75 mg in a single dose at night) is the drug of choice for the treatment of pain following NFCI. Conventional analgesics are normally completely ineffective, narcotic analgesics only modify the response to the pain, and non-steroidal anti-inflammatory drugs appear to be of no value either. Administration of amitriptyline should start as soon as pain is felt, as there is evidence that such early treatment may reduce the incidence of later intractable pain. Amitriptyline may cause marked drowsiness (of which the patient must be warned), but this usually wears off after the first few days. Recent studies indicate that amitriptyline may cause hypertension². Accordingly, blood pressure should be checked prior to the use of amitriptyline, and every month (or more frequently) during treatment. In the most severe cases, with tissue damage, similar measures should be adopted as for FCI (paras 12, 14, 15 above), with twice-daily cleansing with a dilute antibacterial preparation instead of whirlpool baths.

39. All those with NFCI should be evacuated as soon as practical, once their condition is stabilising. Care should be taken to ensure that they return to an appropriate speciality for continuing treatment. All those with NFCI, requiring any treatment more than first aid, should be reviewed at the INM CIC between three and five months after injury, accompanied by copies of any photographs taken (which will be retained by the clinic).

Hospital care

40. Surgeons who see patients with cold injuries are encouraged to delay surgery until all areas have declared their intention very clearly, and demarcation is complete. With the exception of the very small number of patients who have an indication for early surgical intervention (para 14 above), operations should be delayed until at least six months after the initial injury, and should only aim to tidy up the consequences of auto-amputation. If finger amputations are intended, the advice of a specialist in hand surgery should be sought, so as to minimise resulting shortening and maximise function.

41. There is little evidence of the superiority of any treatment regimen over the

²For example, Prescribers' Journal 40(2): 169-174, 2000.

standard conservative approach advocated above. However, modifications of the protocol first advocated by the Chicago Burns Centre, using topical aloe vera, have become popular in North America. Consultants who wish to adopt this approach are encouraged to consider the revised protocol detailed by Murphy et al³, however this is dependent on a very high standard of asepsis to eliminate the risk of infection. Mobilisation and activity should be encouraged, with the active involvement of a physiotherapist.

42. The only treatment which should **never** be considered in someone who has suffered prior cold injury is sympathectomy (temporary blocks or permanent surgical methods) for the treatment of chronic pain or hyperhidrosis. Such treatment should be discussed with INM CIC at the earliest possible opportunity, and invariably before the start of any treatment, even a trial block. If the patient complains of chronic pain, the drug of first choice is amitriptyline. Other approaches worth considering include hypnosis, acupuncture, and transcutaneous nerve stimulation.

43. Treatment of severe hyperhidrosis is also not easy. Whilst topical application (by spray or roll-on) of aluminium and similar salts can eliminate sweating for short periods, and may thus be useful for critical tasks, this is unsuitable for frequent use. Given that sympathectomy is not permissible, the only more permanent approach is likely to be local injection of botulinum toxin⁴. Unfortunately, at present this is certainly impractical for the feet and unsuitable for the hands as well, because of associated local muscular paresis, although this may change in the future.

Follow-up and Medical Grading

44. There is no requirement that all cases of cold injury are referred to the INM CIC. However, unless the patient has made a complete and uneventful recovery from a single episode of frostnip, they will almost certainly need a period of restricted employment, making referral to CIC worthwhile. It is much better to refer patients after their first episode of injury, rather than deferring consultation until after a second episode, when they are much more likely to have sustained long-lasting or permanent sequelae.

45. Once a patient has returned to their ship/establishment/unit, re-exposure to the cold and/or wet should only be attempted with caution. In general, those who have suffered significant FCI, and **all** those who have had NFCI, will need to be kept in sheltered environmental conditions (for example, working indoors in heated buildings only) for at least the winter after they sustained their injury. Following that, they can

³ J Trauma Injury Infect Crit Care 48: 171-178, 2000.

⁴ Brit Med J 320: 1221-1222, 2000.

normally be progressively re-introduced to the cold, although should they show signs of sequelae, re-introduction should be terminated at once.

46. Although in some circumstances, patients may be retained in medical category P2, it is usual to temporarily downgrade them to P7R (for Army personnel, PES = CPND Geo) immediately after their injury, and to keep them in such a reduced medical category until they have been reviewed at the INM CIC. The PES of personnel undergoing initial training (both Phase 1 and Phase 2 for Army) should be discussed with the single-Service Occupational Physician responsible for providing advice to training establishments. Those who show significant sequelae, which limit their employment and reduce their deployability, should remain in a restricted medical category, with the endorsement that they should not deploy to extreme cold, or Norway, or even temperate winter conditions, as appropriate.

Information for Patients

47. Patients who are sent on sick leave, or who may otherwise present to civilian medical services, should be given an information sheet (a specimen is at Appendix 1). They should be encouraged to seek support from knowledgeable service medical sources, who will have a much better understanding of their problems. The INM CIC provides those leaving the Armed Forces with known sequelae of cold injury with different information sheets, to assist in their long-term management.

Cold Sensitisation

48. It is important to stress that a common sequel of even mild cold injury is that of cold sensitisation, which resembles secondary Raynaud's disease. Cumulative cold injuries readily result in very severe cold sensitisation, which may be lifelong and render the individual unfit for further military service. It is prudent to ensure that anyone who has suffered a recent cold injury is kept away from further cold exposure until it is clear that they are not cold sensitised.

Snow Blindness

49. Medical Officers must be aware of the treatment of snow blindness (photokeratitis) which results from ultraviolet burns to the cornea and conjunctivae. The risk is highest in environments where UV light is reflected (for example, by snow). Although it may be exquisitely painful, it is usually self-limiting with recovery in one or two days. Treatment with Amethocaine and Cyclopentolate or Homatropine eye drops and an eye-patch for comfort is recommended.

Miscellaneous

50. Other conditions to remain vigilant for whilst on exercise are; sunburn, carbon monoxide poisoning and dehydration. Most are easily avoided by those who are well prepared.

51. In addition, all troops need to be informed of the dangers of alcohol abuse during cold weather. Alcohol can worsen cold injuries and therefore plays no part in cold weather survival.

52. **Hand Arm Vibration Syndrome (HAVS).** Exposure to vibration causes cold and vibration sensitivity manifested by an intense Raynaud's phenomenon. It may take from a few months to over a year to develop. Prevention includes using ergonomic vibration dampers, maintaining warm hands and limiting vibration to 30-minute periods with 10 minutes rests. All cases of HAVS require consultant referral for an appropriate PULHHEEMS assessment and grading.

Advice and Referral Information

53. Questions and referrals should be addressed to the INM CIC:

Medical Advice

54. Clinical advice on the acute and chronic management of freezing and non-freezing cold injuries, and on the health effects of cold environments can be obtained from:

- a. *Medical:* Head of Survival and Thermal Medicine or Cold Injuries Clinic, Institute of Naval Medicine, Alverstoke, GOSPORT, Hants PO12 2DL.

Tel: (Civ) 023 - 9276 - 8043.
(Mil) Portsmouth Naval Base (9380) + last 5 digits.
(Out of normal working hours Tel: (Civ) 023 927 68020
asking for Dr Oakley)

Fax: (Civ) 01705 504823.

E-mail: [REDACTED]

b. *Administrative:* AO EMU or Cold Injuries Clinic,
Institute of Naval Medicine, Alverstoke, GOSPORT, Hants PO12 2DL.

Tel: (Civ) 023 927 68051.
(Mil) Portsmouth Naval Base (9380) + last 5 digits.

Fax: (Civ) 023 - 9250 - 4823.

Signals: INM ALVERSTOKE marked FOR HSTM

Cold Related Illness and Injury Report Form

ALL BOXES ARE TO BE COMPLETED continue overleaf if more space required.

*Delete those not applicable (NA = Not Applicable)

CASUALTY DETAILS

Unit		Sub Unit		Unit home Barracks	
Service Number		Surname		Initials	
Rank		Regt/Corps/ Trade		D.O.B.	
Gender	Male / female*	PES Grade (FE/LE etc)		Duty	Exercise / Ops / Sport / Other *

INCIDENT DETAILS

Date of Incident		<i>Time (Local)</i>	
Date first reported for Medical Care (if applicable)			
Name of Location incident took place		Wind speed (or estimate)	
Activity undertaken		Temperature (°C)	
Weather conditions		Wind Chill Index	

CLINICAL DETAILS

Diagnosis	Frostnip*	Frostbite*	Non Freezing Cold Injury *	Hypothermia*
Clinical details (e.g. severity, limbs affected)				
Casualty Temp	(°C)	Where was temp taken?	Rectal / Axilla / Oral / TM*	Time temp was taken Hrs
Signs/ Clinical Measurements	Pulse: B/P:		BM: O ₂ Sats:	
Subsequent Action (treatment, medication etc.)				
Disposal (Admit MRS / Hospital etc.)				
Altitude Sickness,	Yes / No / NA*	Trauma		Yes / No / NA*
Carbon Monoxide (CO) Poisoning	Yes / No / NA*	Other associated conditions		

PREDISPOSING FACTORS

Previous Cold Injury/ Illness	Yes / No / NA*	Unfit	Yes / No / NA*
Alcohol	Yes / No / NA*	Sleep Deprivation / Exhaustion	Yes / No / NA*
Dehydration/ dehydrating illness	Yes / No / NA*	Wet clothing (not from immersion)	Yes / No / NA*
Remaining static	Yes / No / NA*	Medication / Drugs	Yes / No / NA*
Immersion	Yes / No / NA*	Suitable clothing/ sleeping system etc	Yes / No / NA*
Safety briefing undertaken prior to incident	Yes / No / NA*	Regular physical (buddy buddy) checks	Yes / No / NA*
Prior training on avoidance of cold injury	Yes / No / NA*	If yes, what training?	
Briefing undertaken on suitable clothing for environmental conditions	Yes / No / NA*		
Other Relevant Factors (equipment, shelter, ill health etc)			

Name of MO / NO / CMTbn / RMA:.....

Signature:.....

Unit

Date:.....