Ministry of Defence

JSP 539

HEAT ILLNESS AND COLD INJURY:

MEDICAL MANAGEMENT

Part 2: Guidance

JSP 539 V3.3 Feb 21

Foreword

Part 2 of this JSP provides guidance in accordance with the policy set out in Part 1 of this JSP; the guidance is sponsored by the Defence Authority for Healthcare and Medical. It provides policy-compliant business practices which should be considered best practice in the absence of any contradicting instruction. However, nothing in this document should discourage the application of common sense.

It is also important note that this extant version of the JSP covers **only the Medical management of cold injury.**

The Defence Authority for Health, Safety and Environmental Protection sponsors the Prevention elements associated with Heat Illness and Cold Injury (in JSP 375 Volume 1 Chapter 41 and 42 respectively).

The Medical Treatment of Heat Illness is now in JSP 950 leaflets 2-4-4 (Acute Medical Treatment of Heat Illness) and 2-22-4 (Heat Illness Rehabilitation and Specialist Investigations).

Surgeon General
Defence Authority for Healthcare and Medical

Preface

How to use this JSP

1. This JSP is the Joint Service code of practice for the medical management of cold injury. JSP 375 Chapters 41 & 42 cover prevention of heat illness and cold injury respectively whilst the medical treatment of heat illness is in JSP 950 leaflets 2-4-4 (Acute Medical Treatment of Heat Illness) and 2-22-4 (Heat Illness Rehabilitation and Specialist Investigations. The JSPs will be supported, where necessary by single Service instructions and other guidance. They cannot cover every possible eventuality; however, they support the principles which should be applied at all times in order to minimise the risks and mitigate the effects of heat illness and cold injury. Commanders, and those advising Command, should note that it is entirely possible to be at risk from both heat illness and cold injury within the same theatre of operations.

2. The JSP contains only guidance on the initial medical management and treatment of cold casualties. Clinical Guidelines for Operations should also be consulted especially for management in Secondary Health Care.

3. The JSP is structured in two parts:

   a. Part 1- Directive, which provides the direction that must be followed in accordance with statute or policy mandated by Defence or on Defence by Central Government.

   b. Part 2 - Guidance, which provides the guidance and best practice that will assist the user to comply with the Directive(s) detailed in Part 1.

Training

4. **All personnel.** All personnel are to be made aware of:

   a. Heat illness.

   b. Cold Injury.

   c. Methods of prevention.

   d. Identification.

   e. First-aid management.

5. **Individuals.** Individuals are to receive education and training during:

   a. Basic training.

   b. Periodic mandatory training in accordance with single-Service policy.

   c. Targeted refresher training, to be conducted immediately prior to operating in environments, or undertaking tasks, including in the UK and other temperate areas, where there is a risk of heat illness or cold injury.

6. **Commanders and training staff.** Commanders and training staff at all levels should receive appropriate update training:

a. During leadership courses.

b. Prior to assignment to a training post.

7. **Defence Medical Service (DMS) personnel.** DMS personnel are to be trained in the prevention and management of climatic illness/injury, including medical planning (appropriate to their level of competency and responsibility). This should be part of initial medical training for DMS personnel, with appropriate refresher training periodically, thereafter targeted by Career Employment Group and clinical speciality.

8. **Wet Bulb Globe Temperature (WBGT).** Training on the use of the WBGT monitor is to be provided during the following courses:

a. DMS Defence Medic training[1].

b. All Arms Physical Training Instructors Course.

c. Specialist Training for RN, RM, Army and RAF Physical Training Qualifying Courses.

d. BSc Environmental Health for Environmental Health Technicians.

9. **Mounting instructions and planning directives.** JSP 375 Chapters 41 & 42 together with relevant sections of JSP 539 are to be incorporated as a mandatory reference in Exercise and Operational mounting instructions and planning directives. It should be emphasised that heat illness and cold injury frequently occurs in the temperate environment of the UK and Northern Europe.

10. **Approved training material.** Current and approved training material (written and audio-visual) that supports this JSP can be sourced through the British Defence Film Library catalogue accessed via https://www.defencegateway.mod.uk/ and the Millie online portal via http://millie2.web.logis.r.mil.uk/Account/Logon.

Coherence with other Defence Authority policy and guidance

11. Where applicable, this document contains links to other relevant JSPs, some of which may be published by different Defence Authorities. Where particular dependencies exist, these other Defence Authorities have been consulted in the formulation of the policy and guidance detailed in this publication.

Further advice and feedback – contacts

12. For further information on any aspect of this guide, or questions not answered within the subsequent sections, or to provide feedback on the content, contact:

[1] After Jan 18 there will be no further Defence Medic courses delivered. Training requirements for replacement course being scoped by JMTRA.

Job title/email	Domain	Telephone
DMS HQ Group Medical Policy: DH Med Pol SG-DMed-Med-Pol-GpMailbox@mod.gov.uk	Policy	Mil 94422 4657 Civ 01543 434657

Amendments table	Version
Forward and Preface updated to reflect the removal of Heat Illness Treatment (section 2) to JSP 950 leaflets 2-4-4 and 2-22-4.	3.3 Feb 21
Section 2 redacted in full.	3.3 Feb 21
Preface	
Forward and Preface – Updated to reflect the changed application of JSP 539 to cover ONLY the medical management of Heat Illness and Cold Injury (where JSP 375 Vol.1 Ch.41 & 42 offer guidance on the prevention of climatic illness and injury).	3.2 Nov 20
11. Update to guide references	3.1 Jan 19
13. Update contact details	3.1 Jan 19
Section 1	
7. Highlight risk assessment must be conducted in accordance with JSP 375	3.1 Jan 19
7.a. State risk assessment must be recorded on MOD Form 5015	3.1 Jan 19
36.a. Comment that WBGT should be monitored at location of greatest heat risk	3.1 Jan 19
36.b. Highlight WBGT Index Upper Limit applies for duration of exercise activity	3.1 Jan 19
51. Key points: Risk assessment must be in accordance with JSP 375 and recorded on MOD Form 5015 WBGT Index Upper Limits apply for entire duration of activity and should be measured at site of maximal heat risk	3.1 Jan 19
Annex A. Reiterate risk assessment must be in accordance with JSP 375 and recorded on MOD Form 5015	3.1 Jan 19
Annex C. Reiterate WBGT Index Upper Limits apply for entire duration of activity and should be measured at site of maximal heat risk	3.1 Jan 19
Annex E. Table E-1. Reiterate WBGT Index Upper Limits apply for entire duration of activity and should be measured at site of maximal heat risk	3.1 Jan 19
Annex F. 2. Update calibration support detail.	3.1 Jan 19
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Section 1 – Heat: Guidance for Defence Personnel	
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Individual risk factors aligned with medical section	3.0 May 17
Table 1 - Individual Risk Factors added	3.0 May 17
Summary added	3.0 May 17
Key Points added	3.0 May 17
Annex A – Commanders Heat Illness Risk Assessment Checklist revised	3.0 May 17
Annex B – Heat Illness First Aid Treatment Guidelines revised	3.0 May 17
Annex C – WBGT Index Limits table simplified	3.0 May 17
Annex D – Max work rate examples separated from WBGT Index Limits table	3.0 May 17
Annex E – Guidance for reducing heat illness risk on the MATT2 annual fitness test (AFT) and RAF loaded march added	3.0 May 17
Section 2 – Heat: Guidance for Medical Personnel	
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Responsibilities outlined	3.0 May 17
Individual risk factors aligned with medical section	3.0 May 17
Table 1 - Individual risk factors added	3.0 May 17
Table 1 – aligned with revised Individual risk factor as found in JSP 375 Vol.1 Ch.41	3.2 Nov 20
Table 2 - Heat Illness Signs and Symptoms added	3.0 May 17
Table 3 - Heat Illness Investigations added	3.0 May 17

Annex A - Exertional Heat Illness First Responder Treatment Guidelines revised	3.0 May 17
Annex B - Exertional Heat Illness Treatment Guidelines Role 1 And Role 2/3 revised	3.0 May 17
Section 3 – Cold: Guidance for Defence Personnel	
Section 3 – Redacted in full – in light of text in JSP 375 Vol.1 Chapter 42	3.2 Nov 20
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Table 1 - Individual Risk Factors added	3.0 May 17
Table 2 - Wind Chill Chart replaced	3.0 May 17
Summary added	3.0 May 17
Key Points added	3.0 May 17
Annex A – Commanders Cold Injury Risk Assessment Checklist revised	3.0 May 17
Annex B – Hypothermia First Aid Treatment Guidelines revised	3.0 May 17
Annex C – Freezing Cold Injury First Aid Treatment Guidelines added	3.0 May 17
Annex D – Non-Freezing Cold Injury First Aid Treatment Guidelines added	3.0 May 17
Section 4 – Cold: Guidance for Medical Personnel	3.0 May 17
Table 1 renamed to Table 4 – in light of Snr HM Coroner comments: PFDR: 6Nov19	3.2 Nov 20
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Responsibilities added	3.0 May 17
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Hypothermia entries reviewed and revised	3.0 May 17
Table 2 - Staging and management of accidental hypothermia added	3.0 May 17
Annex A - First Responder: Initial Treatment of Hypothermia Under Field Conditions revised	3.0 May 17
Annex B - Emergency Doctors and Professional Rescuers: Treatment of Hypothermia added	3.0 May 17
Frostbite entries reviewed and revised	3.0 May 17
Table 3 - Summary of Field Treatment of Frostbite (>2 hours from definitive care) added	3.0 May 17
Non-Freezing Cold Injury (NFCI) extracted from NFCI Tiger-Team Report	3.0 May 17
Annex C – Management of Pain in Non-Freezing Cold Injury (NFCI) added	3.0 May 17
Section 5 – Reporting and Recording	
Chain of Command reporting Joint Forces Command section added	3.0 May 17
Annex D – Heat Illness Medical Recording Form reviewed and revised	3.0 May 17
Annex E – Cold Injury Medical Recording Form reviewed and revised	3.0 May 17
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Meteorological Office Planning Forecasts revised	2.5 May 16
Table 1 WBGT Index Limits revised	2.5 May 16
Figure 4 Cold Injury First Aid added	2.5 May 16
Chapter 5 Reporting and Recording revised	2.5 May 16

Contents

SECTION 1 – HEAT: GUIDANCE FOR DEFENCE PERSONNEL

The advice given previously in this section has been redacted – given that the PREVENTION OF HEAT ILLNESS now resides in JSP 375 Volume 1 Chapter 41: HEAT ILLNESS PREVENTION

ALL PREVIOUS ITERATIONS OF JSP539 – WHERE PRINTED – SHOULD BE DESTROYED.

Commanders, and those who advise Command, should refer to JSP 375 Volume 1 for advice with respect to the prevention of Heat Illness (and associated risk management).

SECTION 2 – HEAT: GUIDANCE FOR MEDICAL PERSONNEL

The advice given previously in this section has been redacted – see JSP 950 leaflets 2-4-4 and 2-22-4.

ALL PREVIOUS ITERATIONS OF JSP539 – WHERE PRINTED – SHOULD BE DESTROYED.

SECTION 3 – COLD: GUIDANCE FOR DEFENCE PERSONNEL

The advice given previously in this section has been redacted – given that the PREVENTION OF COLD INJURY now resides in JSP 375 Volume 1 Chapter 42: COLD INJURY PREVENTION

ALL PREVIOUS ITERATIONS OF JSP539 – WHERE PRINTED – SHOULD BE DESTROYED.

Commanders, and those who advise Command, should refer to JSP 375 Volume 1 for advice with respect to the prevention of Cold Injury (and associated risk management).

SECTION 4 – COLD: GUIDANCE FOR MEDICAL PERSONNEL

Responsibilities

1. All medical personnel should be trained in the prevention and management of cold injury (appropriate to their level of competency and responsibility). This should be part of initial military medical training for all medical personnel in the DMS, with appropriate refresher training periodically thereafter, targeted by clinical speciality. Civilian DMS personnel should be trained to a level appropriate to their role.

2. In the event of a single case of cold injury, always consider the other members of the group or party. If one individual has been affected by the cold, then there is a high likelihood that others may also be affected. **The Chain of Command should be alerted that other personnel may be at risk.**

3. This section provides medical personnel with an accessible source of information to assist them in the pre-hospital care and management of cold injuries. Cold injuries considered here are Hypothermia, Freezing Cold Injury (FCI) and Non-Freezing Cold Injury (NFCI).

Prevention

4. **Prevention.** The adage that "prevention is better than treatment" is especially true for cold injuries, which may be preventable. Risk of cold injury can also be related to underlying medical problems, and prevention should address both environmental and health-related aspects. One should both ensure adequate perfusion and minimise heat loss to prevent FCI.

5. **Maintaining peripheral perfusion.** Preventive measures to ensure local tissue perfusion include:

   a. Maintaining adequate core temperature and body hydration.

   b. Minimising effects of known diseases or medications and drugs that may decrease perfusion.

   c. Covering all skin and the scalp to avoid vasoconstriction where practicable.

   d. Minimising restriction in blood flow, such as constrictive clothing, footwear, or immobility.

   e. Ensuring adequate nutrition.

   f. Using supplemental oxygen in hypoxic conditions (e.g. >4000 m).

6. **Protection from cold.** Measures should be taken to minimise exposure to cold. These measures include the following:

   a. Avoiding environmental conditions with a risk of cold injury, specifically below –5°C even with low wind speeds.

   b. Protecting skin from moisture, wind, and cold.

c. Avoiding perspiration or wet extremities.

d. Increasing insulation and skin protection by layering clothes appropriately.

e. Ensuring personnel are able to take the appropriate behavioural response to changing environmental conditions (e.g., not being under the influence of drugs or alcohol or suffering extreme hypoxemia).

f. Using chemical hand and foot warmers and electric foot warmers to maintain peripheral warmth (note: warmers should be close to body temperature before being activated and should not be placed directly against the skin nor constrict flow if used within a boot).

g. Performing “cold checks” if an individual experiences extremity numbness or pain or is concerned that FCI may be developing.

h. Recognising frostnip or superficial frostbite before it becomes more serious.

i. Minimising duration of cold exposure.

The time that a digit or extremity can remain numb before developing FCI is unknown; thus, paresthesia should be addressed as soon as possible. An extremity at risk for frostbite (e.g., numb, poor dexterity, pale colour) should be warmed with adjacent body heat from the person or a companion, in the axilla, or on the abdomen.

Individual risk factors

7. There is a wide variation in human tolerance to cold. In some cases of Cold Injury it is possible to identify factors that have caused particular individuals to become casualties. All ranks of medical personnel should be empowered to raise concerns if individuals taking part in the proposed activity have risk factors that commanders may not be aware of, notwithstanding appropriate professional codes of patient confidentiality. Table 1 - Individual Risk Factors details the currently recognised individual risk factors:

Table 4 - Individual Risk Factors

Lifestyle / characteristics	Health	Work constraints
Smoking	Prior NFCI / FCI	Inexperienced
Alcohol in past 48 hours	Hypoxia	Sleep deprivation or fatigue
Inadequate calorie intake	Advancing age	Prolonged cold exposure
Reduced physical fitness	Systemic infection	Oscillating low temperatures and/or repeated exposure
Gender (amongst African-Caribbeans, females may be protected more than males)	Hypovolaemia e.g. dehydration, trauma resulting in blood/third space fluid loss	Forced convective heat loss e.g. wading, swimming, water sports, winter sports, high wind speeds, travel in an open-topped vehicle, motorcycling, skidoos, mountain biking etc
Race (African-Caribbeans may be at greater risk than Caucasians; NFCI only)	Hand Arm Vibration Syndrome	Damp environments and sweating (causing cooling by evaporation or loss of clothing insulating properties)
Race (African-Caribbeans may be at greater risk than Caucasians; NFCI only)	Hypothermia	Inadequate clothing (general, or local)
Race (African-	Stress or anxiety	Constricting clothing (limiting cutaneous blood

Caribbeans may be at greater risk than Caucasians; NFCI only)	(enhancing vasoconstriction and sweating)	flow)
Race (African-Caribbeans may be at greater risk than Caucasians; NFCI only)	Stress or anxiety (enhancing vasoconstriction and sweating)	Immobility
Race (African-Caribbeans may be at greater risk than Caucasians; NFCI only)	Stress or anxiety (enhancing vasoconstriction and sweating)	Upright posture (cutaneous blood flow falls in the feet; NFCI only)

Hypothermia[1]

8. During cold exposure, the initial response of the body is to maintain a normal core temperature (approximately 37°C) by means of active movement and involuntary shivering. Primary hypothermia occurs when heat production in an otherwise healthy person is overcome by the stress of excessive cold, especially when the energy stores of the body are depleted. In hypothermia, conscious level, breathing, and circulation are initially intact but become more impaired as the body cools.

9. Patients should be considered to have hypothermia if they have a core temperature of less than 35°C. Hypothermia can also be staged clinically using the Swiss classification system (stages HT I to HT IV) as detailed in Table 2 - Staging and Management of Accidental Hypothermia. The Swiss staging system is a valuable clinical tool to facilitate triage and emergency treatment. However, definitive assessment of the severity of hypothermia requires accurate core temperature measurement using a low reading thermometer.

Table 5 - Staging and Management of Accidental Hypothermia

Stage	Clinical symptoms*	Typical core temperature†	Treatment
HT I	Conscious, shivering	35 - 32°C	Warm environment and clothing, warm sweet drinks, and active movement (if possible).
HT II	Impaired consciousness, not shivering	<32 to 28°C	Cardiac monitoring, minimal and cautious movements to avoid arrhythmias, horizontal position and immobilization, full body insulation, active external and minimally invasive rewarming techniques (warm environment; chemical heat packs).
HT III	Unconscious, not shivering, vital signs present	<28 to 24°C	HT II management plus airway management as required; ECMO or CPB in cases with cardiac instability that is refractory to medical management.
HT IV	No vital signs	<24°C	HT II and III management plus CPR and up to three doses of epinephrine (at an intravenous or intraosseous dose of 1 mg) and defibrillation, with further dosing guided by clinical response; rewarming with ECMO or CPB (if available) or CPR with active external and alternative internal
Notes			
*Hypothermia may be determined clinically on the basis of vital signs with the use of the Swiss staging system. CPB denotes cardiopulmonary bypass, CPR cardiopulmonary resuscitation, and ECMO extracorporeal membrane oxygenation. †Measurement of body core temperature is helpful but not mandatory. The risk of cardiac arrest increases as the core temperature drops below 32°C and increases substantially if the temperature is less than 28°C			

[1] Cross-referenced with: Peter Paal et al (2016) Accidental hypothermia–an update Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine201624:111. https://sjtrem.biomedcentral.com/articles/10.1186/s13049-016-0303-7 (accessed Nov 20).

10. **Measurement of core temperature.** If possible, measure core temperature using a low reading rectal thermometer. The recorded temperature can vary depending on the body site used and environmental temperature. A measured core temperature of 32-35 °C signifies mild hypothermia with severe hypothermia occurring with a core temperature below 32°. When accurate measurement of the core temperature is not feasible, as in some field settings, decisions regarding management should be based solely on the clinical Swiss staging system[2].

a. **Thermistor probe.** A thermistor probe in contact with the tympanic membrane accurately reflects brain temperature, provided that the ear canal is free of snow and wax and is well insulated against the environment.

b. **Infrared cutaneous, aural and oral thermometers.** Measurements obtained with the use of infrared cutaneous, aural and oral thermometers are often inaccurate in patients with hypothermia.

c. **Rectal probes.** Rectal probes should be inserted to a depth of 15 cm for optimum accuracy, but readings may lag behind core temperature during rewarming.

11. **Pre-hospital treatment priorities.** Treatment is summarised in Annex A - First Responder Initial Treatment of Hypothermia Under Field Conditions and Annex B - Treatment of Hypothermia by Emergency Doctors and Professional Rescuers. Pre-hospital treatments include careful handling of the patient (to reduce risk of precipitating cardiac arrhythmias), provision of basic or advanced life support, passive and active external rewarming and transport to an appropriate facility.

a. Some patients with a core temperature < 28°C engage in paradoxical undressing.

b. Detecting a pulse in a patient with hypothermia may be difficult so signs of life and pulse should be checked carefully for 60 seconds.

c. Persistent breathing or movement by the patient should prompt a strategy of watchful waiting but if no signs of life are detected cardiopulmonary resuscitation (CPR) should be started.

d. Advanced airway management should be performed if indicated to optimise ventilation, oxygenation and cerebral perfusion.

e. Atrial fibrillation is common when the core temperature is less than 32°C. Rewarming will often lead to spontaneous cardioversion to sinus rhythm.

f. The risk of cardiac arrest increases as the core temperature drops below 32°C and increases substantially if the temperature is less than 28°C.

g. Owing to the decrease in cerebral oxygen requirements with cooling, survival without neurologic impairment may be possible even when it is necessary to perform CPR for several hours.

12. **Rewarming.** Full-body insulation and rewarming should be provided for all patients as long as it does not impede CPR or delay transport. For rewarming in the pre-hospital setting

[2] Current scaled thermometers: Oral & rectal (32-42^{0}C) NSN 6515-99-898-2896; Tympanic (ear) (20-40^{0}C) NSN 6515-99-874-6330

well placed (junctional areas of the body not in direct contact with skin) chemical heat packs in association with 'foil' (Blizzard©) blankets should provide adequate heat transfer. Wet clothes should be removed if practical to do so (if not, ensure the patient is packaged using an impermeable layer (Blizzard©, bubble wrap or similar).

13. **Resuscitation fluids.** If intravenous fluids are indicated, they should be warmed (38 to 42°C) to prevent further heat loss. It is worth noting that warm fluids have a small warming effect, but cold fluids have a significant cooling effect.

14. **Transportation.**

a. **Stage HT I.** Conscious, shivering patients can be treated in the field if they are uninjured or transported to a warm environment if rewarming is not possible in the field.

b. **Stage HT II, HT III, or HT IV.** Patients with impaired consciousness should be assessed for cardiac instability.

(1) Patients with stable circulation require active external rewarming (placement in a warm environment; application of chemical heat packs and 'foil' (Blizzard©)) and should be taken to the nearest medical facility.

(2) Patients with pre-hospital cardiac instability (e.g. systolic blood pressure of <90 mm Hg or ventricular arrhythmias), those with a core temperature of less than 28°C, and those in cardiac arrest should be transported to a medical facility ideally capable of providing extracorporeal membrane oxygenation (ECMO) or cardiopulmonary bypass (CPB), unless coexisting conditions (e.g. trauma) mandate transport to a closer facility.

Other considerations

15. **Serum potassium.** A severely elevated serum potassium level is associated with non-survival and is considered a marker of hypoxia before cooling. Termination of CPR is recommended when the potassium level is > 12 mmol/l. When the potassium level is < 12 mmol/l, survival without neurologic impairment may be possible, and CPR should be continued until the patient is rewarmed. Unfortunately, a low serum potassium level does not ensure survival. Other bio markers, such as lactate and pH levels, have been reported to have prognostic significance, although less consistently.

16. **Field or en-route serum potassium testing.** If the serum potassium can be measured in the field or en-route and the level is > 12 mmol per litre, termination of CPR should be considered. If the patient is in cardiac arrest the use of a mechanical chest compression device should be used if available during the transportation phase.

Accidental hypothermia - special situations

17. **Trauma.** Shock caused by hypovolaemia and cerebrospinal injury destabilizes thermoregulation. Hypothermia increases bleeding as clotting factor activity and platelet function are reduced (a critical coagulopathy may occur with a body temp below 34°C).

18. **Avalanche burial without vital signs.**

a. Burial time < 35 minutes, life threatening hypothermia is unlikely, owing to insufficient cooling time, and trauma. Hypoxia should be suspected as the cause.

b. Burial > 35 minutes, the airway is packed with snow and the patient is asystolic, hypoxia preceded hypothermia and CPR is very unlikely to be beneficial.

c. Burial > 35 minutes **and** the airway is not blocked, severe hypothermia should be suspected, and the patient should be treated accordingly.

19. **Drowning without vital signs.** Persons who have been exposed to cold water may have a better outcome than those exposed to warm water.

a. **Immersion.** If the patient's history indicates immersion in cold water (i.e. the body was exposed to cold water but the patient was able to breathe) and it is likely that the body cooled before the onset of hypoxia and cardiac arrest (stage HT IV), survival without neurologic impairment may be possible, and resuscitation should proceed (e.g. patient wearing a flotation device).

b. **Submersion.** If the history indicates submersion (head under) in cold water (i.e. the body was exposed to cold water and the patient was unable to breathe) before cooling, the outcome may be worse.

Frostnip

20. Frostnip is freezing of the superficial skin usually affecting the cheeks, ears or nose. Ice crystals, appearing as frost, form on the surface of the skin. Ice crystals do not form in the tissue nor does tissue loss occur in frostnip. The numbness and pallor that occur resolve quickly after covering the skin with appropriate clothing, warming the skin or gaining shelter that protects from the elements. No long-term damage occurs. The appearance of frostnip may be a precursor for frostbite and appropriate action should be undertaken immediately to prevent further injury.

21. For military purposes frostnip is defined as **a freezing cold injury which resolves completely within 30 minutes of commencing re-warming of the injured part.** Residual symptoms after 30 minutes or more of re-warming confirm a diagnosis of superficial frostbite rather than frostnip. Recurrent frostnip occurring in the same body location should result in review by a medical practitioner.

22. An individual diagnosed with frostnip (providing it is the first episode in that body area that season) may be retained in the field at the discretion of medical personnel and the local commander. Staff should be aware of the cumulative disability which can result from recurrent minor cold injuries.

23. Unit medical personnel should ensure that they review anyone who has suffered frostnip when they return from field conditions, deployment or exercise, and that the injury is correctly recorded in the patient's medical record (see Section 5). Where there is any doubt as to their continuing fitness to operate in cold environments, they should be referred to their Regional Occupational Health Team (ROHT) or the INM Cold Injury Clinic (CIC). Referrals to CIC should be via DMICP. If it is unclear whether a patient should be referred, please discuss with the INM Environmental Medicine and Sciences Civilian Medical Officer on Mil 9380 Ext 68050 Civ 02392 768050.

Frostbite

24. **Pathophysiology of frostbite.** Frostbite may be divided into 4 phases:

a. **Pre-freeze.** The pre-freeze phase consists of tissue cooling with accompanying vasoconstriction and ischaemia but does not involve actual ice crystal formation. Neuronal cooling and ischaemia cause hyperaesthesia or paraesthesia.

b. **Freeze-thaw.** In the freeze-thaw phase, ice crystals form intracellularly causing protein and lipid derangement, cellular electrolyte shifts, cellular dehydration, cell membrane lysis, and cell death. The thawing process may initiate ischaemia-reperfusion injury and the inflammatory response.

c. **Vascular stasis.** In the vascular stasis phase, vessels may fluctuate between constriction and dilatation; blood may leak from vessels or coagulate within them.

d. **Late ischaemic.** The late ischaemic phase results from progressive tissue ischaemia and infarction leading to cell death.

The initial cellular damage caused by ice crystals and the subsequent post-thawing processes are made worse if refreezing follows thawing of injured tissues.

25. **Classification of frostbite.** Frostbite has been divided into 4 “degrees” of injury. These are based on acute physical findings and confirm by advanced imaging after rewarming. These “degrees” can be difficult to assess in the field and before rewarming because the still-frozen tissue is hard, pale, and numb. **Severity of frostbite may vary within a single extremity.**

a. **First-degree frostbite** presents with numbness and erythema. A white or yellow, firm, slightly raised plaque develops in the area of injury. There may be slight skin loss. Mild oedema is common.

b. **Second-degree frostbite** injury results in superficial skin blistering; a clear or milky fluid is present in the blisters which are surrounded by erythema and oedema.

c. **Third-degree frostbite** creates deeper hemorrhagic blisters indicating that the injury has extended into the deep tissues.

d. **Fourth-degree frostbite** injury extends deep to the skin into muscle and bone.

26. **Field treatment.** If a body part is frozen in the field, the frozen tissue should be protected from further damage. Ensure the skin is dry. Remove jewellery from the body part. Do not rub tissue in an attempt to re-warm.

27. **Refreezing injury.** A decision should be made whether or not to thaw the tissue. If environmental conditions are such that thawed tissue could refreeze, it is safer to keep the affected part frozen until a thawed state can be maintained. You must avoid refreezing if field-thawing occurs.

28. **Antibiotics.** 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, e.g., frostbite complicating a gunshot wound, should be started on antibiotics and have anti-tetanus immediately (using an appropriate antibiotic protocol) and transferred to hospital for specialist care. When FCI is severe, the

risks of anaerobic infection are significant, and gas gangrene and tetanus have killed many of those with the worst cold injuries in the past.

29. **Spontaneous or passive thawing.** Most frostbite will thaw spontaneously and should be allowed to do so if rapid rewarming cannot be readily achieved. Strategies for 2 scenarios are presented:

a. **Scenario 1**. The frozen part has the potential of refreezing and will not be actively thawed.

b. **Scenario 2.** The frozen part can be kept thawed and warm with minimal risk of refreezing until evacuation is completed.

30. **Therapeutic options for both Scenarios 1 and 2.**

a. **Treatment of hypothermia.** Hypothermia frequently accompanies frostbite. HTI (hypothermia staging) may be treated concurrently with the frostbite injury. HTII-IV should be treated effectively before treating the frostbite injury.

b. **Hydration.** Appropriate hydration is important in frostbite recovery and fluids should be administered if possible. Oral fluids should be given if the patient is alert. If the patient is nauseated, vomiting or has an altered mental status, warmed IV fluids should be given if available.

c. **Ibuprofen.** If available, ibuprofen (400-800mg TDS) should be started in the field.

31. **Specific recommendations Scenario 1.** Therapeutic options for frostbite in scenario 1 include the following:

a. **Dressings.** Apply if it is practical to do so and will not interfere with mobility. Dressings should be applied to the frozen part and between the toes and fingers.

b. **Ambulation and protection.** If at all possible, a frozen extremity should not be used for walking, climbing or other maneuvers until definitive care is reached. If using the frozen extremity for mobility is considered, a risk-benefit analysis should consider the potential for further trauma and possible poorer outcomes. Although it is reasonable to walk on a foot with frostbitten toes for evacuation purposes, it is inadvisable to walk on an entirely frostbitten foot because of the potential for resulting morbidity. If using a frozen extremity for locomotion or evacuation is unavoidable, the extremity should be padded, splinted, and kept as immobile as possible to minimize additional trauma. Measures should be taken to protect frozen tissue to prevent further trauma.

32. **Specific recommendations Scenario 2.** Therapeutic options for frostbite in scenario 2 include the following:

a. **Rapid field rewarming of frostbite.** Field rewarming by warm water bath immersion can and should be performed if the proper equipment and methods are available and definitive care is more than 2 hours away. Field rewarming should only be undertaken if the frozen part can be kept thawed and warm until the patient arrives at definitive care.

(1) Water should be heated to between 37-39°C. If a thermometer is not available, a safe water temperature can be determined by placing an uninjured

hand in the water for at least 30 seconds to confirm that the water temperature is tolerable and will not cause burn injury.

(2) The affected limb should be suspended in circulating water. Because the water may cool after the rewarming process is started, the water should be continually, but carefully, warmed to the target temperature.

(3) Rewarming is complete when the involved part takes on a red or purple appearance and becomes soft and pliable to the touch. This will take approximately 30 minutes but may take a longer or shorter amount of time depending on the extent and depth of the injury.

(4) The affected tissues should then be allowed to air dry or gently dried with blotting motions to minimize further damage.

b. **Pain control.** During rewarming, pain medications (e.g., NSAIDs or opiate analgesics) should be given to control symptoms as dictated by individual patient response and medication availability.

c. **Spontaneous or passive thawing.** Rapid rewarming is strongly recommended. If field rewarming is not possible, however, spontaneous or slow thawing may be unavoidable and should be allowed. Slow rewarming can be accomplished by moving into a warmer location and warming with adjacent body heat from another person.

d. **Debridement of blisters.** Debridement of blisters should not be routinely performed in the field. If a clear, fluid-filled blister is tense and at high risk for rupture during an evacuation, aspiration of the blister and application of a dry gauze dressing should be performed in the field to minimise infection. Hemorrhagic bullae should not be aspirated or debrided electively in the field.

e. **Dressings.** Substantial oedema post re-warming should be anticipated and circumferential dressings should be wrapped loosely to allow for swelling without placing pressure on the underlying tissue.

f. **Ambulation and protection.** A risk-benefit analysis should again consider the potential for further trauma and, ultimately, higher morbidity if a thawed part is used for ambulation.

g. **Elevation of extremity.** If possible, the thawed extremity should be elevated.

h. **Oxygen.** Oxygen (if available) may be delivered by face mask or nasal cannula if the patient is hypoxic (oxygen saturation SpO_2 <90%) or the patient is at high altitude (>5000 m).

Table 6 - Summary of Field Treatment of Frostbite (>2 hours from definitive care)[1]

1.	Treat hypothermia or serious injuries
2.	Remove jewelry from the body part
3.	Rapidly rewarm in water heated and maintained between 37° and 39°C until area becomes soft and pliable to the touch (approximately 30 minutes). Allow spontaneous or passive thawing if rapid rewarming is not possible
4.	Ibuprofen (400-800mg tds) if available
5.	Pain medication (opiate) as needed
6.	Air dry (i.e., do not rub at any point)
7.	Protect from refreezing and direct trauma
9.	Dry dressings
10.	Elevate the affected body part if possible
11.	Maintain hydration
12.	Avoid ambulation on thawed lower extremity (unless only distal toes are affected)

33. **Photography.** Photographs should be taken as soon as possible after injury, soon after thawing, and frequently thereafter to document the disease process. Any photograph is useful, although high-quality clinical photographs are preferred. Photographs should accompany the patient when attending any specialist review. Photographs should be taken and handled in accordance with JSP 950 Part 1 Lft 2-1-3 Defence Medical Services Clinical Photographic Policy.

Cold Sensitivity

34. Cold sensitivity is a common sequalae even to mild cold injury, both FCI and NFCI. It is often the presenting complaint following a cold injury. Individuals suffering from FCI / NFCI should be protected from further cold exposure for at least 6 weeks, until it is proven they have not been cold sensitised.

Non-Freezing Cold Injury (NFCI)[3]

35. **Background.** NFCI continues to be a significant cause of Disease and Non-Battle Injury (DNBI) casualties in personnel operating in cold and/or wet environments. This has implications for mission success and is thus a major component of operational risk analysis. It also has implications for future employment and deployment. The evidence-base relating to NFCI's pathophysiology, risk factors, prevention, identification and diagnosis is generally weak, being largely drawn from small laboratory studies on animals and humans, case-based evidence from the field, or expert opinion. The criteria used to reach this conclusion (Scottish Intercollegiate Guidelines Network[4,5]) are not wholly appropriate for some of the areas of evidence associated with NFCI. Thus, the weak or absent evidence surrounding the understanding and clinical approach to NFCI does not necessarily mean what is thought true or undertaken is wrong, but rather that the level of evidence supporting clinical activity in other conditions is lacking for NFCI.

36. **Introduction.** While local cooling of tissue to temperatures below minus 0.55°C may result in freezing cold injury (FCI, or frostbite), sustained/fluctuating tissue cooling within a temperature range from just above this point to approximately 20°C may cause NFCI which, in some cases, causes lasting debility (including numbness, paraesthesia, pain, hyperhidrosis, cold allodynia and proprioceptive changes resulting in gait alteration). Protracted and intense vasoconstriction in response to a relatively mild cold stimulus (cold sensitivity) can also result. Thus, in contrast to FCI (where ambient temperature is likely to be below freezing), tissue temperatures associated with NFCI may occur at **any ambient environmental temperature below 20°C** (although risk rises as this ambient temperature falls and/or duration of exposure increases). NFCI affects the lower limbs more frequently than the upper, and the distal limb (digits) more than the proximal. Whilst resulting symptoms may be minor or short-lived, long-term sequelae may result. Whilst these can be asymptomatic, they can also cause symptoms, which can sometimes prove intractable and debilitating.

37. **Pathogenesis.** NFCI pathogenesis is poorly understood. Data are largely derived from case-based accounts, and from animal models of uncertain relevance to human patho-physiology. Human longitudinal histopathological data are completely lacking. However, it appears likely that impaired microvascular flow leads to neurovascular damage, resultant upon ischaemia/hypoxia and/or ischaemia-reperfusion injury. These two elements (neural and vascular injury) may interact, microvascular damage causing neural ischaemic injury, and damage to microvascular innervations leading to further ischaemia. There is also evidence that cold causes direct damage to nerve fibres, independent of ischaemia due to vascular damage.

38. NFCI is best considered as a clinical syndrome of varying severity and time course, with some patients showing full resolution of symptoms within days, and others persisting for years. It is not yet possible to predict, from initial symptoms and signs at presentation, which patients will fall into which prognostic group.

39. **Early symptoms**.

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[3] Much of the text in this section has been adapted from the following MOD commissioned publication: Non-Freezing Cold Injury - The Non-Freezing Cold Injury Review Group. Montgomery et al. January 2013. This source document contains a full list of references. Permission to access this document should be sought from the sponsor to this JSP.
[4] Scottish Intercollegiate Guidelines Network Home page (accessed Nov 20)
[5] Scottish Intercollegiate Guidelines Network Methodology page (accessed Nov 20)

a. Local cold, often accompanied by generalised coldness.

b. Pale extremities +/- cyanosis or mottling.

c. Loss of sensation.

d. Altered sensation, for example burning/tingling/pins and needles.

e. Swelling of hands or feet may occur, but infrequently.

40. **Re-warming symptoms.**

a. Hands and feet take longer than normal to re-warm.

b. Red, hyperaemic hands or feet.

c. Pain, often described as throbbing, stabbing, and painful pins and needles, but as with all neuropathic pain the individual may have difficulty describing the character.

d. Loss of sensation.

e. Altered sensation, in particular individuals often notice that they cannot sense temperature well and that feet or hands feel particularly hot in a shower or bath.

f. Swelling of hands or feet in more severe cases.

41. **Persistent symptoms**.

a. Loss of sensation.

b. Altered sensation.

c. Possibly increased sweating; it is not yet clear whether a true hyperhidrosis may follow NFCI, or whether it is a sense of the foot feeling wet due to neuropathy.

d. Cold sensitivity may develop at any point during the 6 weeks following injury, but does not happen in all cases of NFCI, conversely cold sensitivity may exist without NFCI.

e. Cold sensitivity is an unusual response to a cold environment and may include either or both neurological and vascular symptoms such as hands and feet feeling cold in relatively temperate environments or taking much longer than normal to re-warm following cold exposure.

42. It should be noted that individuals who report full symptomatic recovery may nevertheless have persistent nerve and/or vascular damage and thus be more vulnerable to injury with further cold exposure and may therefore require medical limitations to employment. Individuals who show full recovery of symptoms and have a normal NFCI examination within one week of injury may be cautiously re-exposed to cold environments with a very low threshold for removing them from risk should they develop symptoms. All other individuals should be put on restricted duties, including change of JMES where appropriate, and referred to a ROHT Regional NFCI clinic for assessment.

43. **Predisposing factors.** Cold injury rates are higher in the untrained and the young (16-19 years)[6]. Preventive strategies in support of the Chain of Command (Section 3) should be uppermost. African-Caribbean/Pacific-Islander personnel also have a different physiological response to cold[7] and as such may be at higher risk of cold injury[8]. Those individuals should be aware of this risk and be extra vigilant to maintaining their cold weather skills. In addition, medical personnel should be proactive in highlighting high-risk personnel to the Chain of Command.

44. **The importance of core temperature.** Cutaneous blood flow (CuBF) falls in response to cooling, an effect, which is amplified by a reduction in deep body temperature. However, cooling extremities to approximately 10°C results in cyclical increases in CuBF - a phenomenon known as cold-induced vasodilatation (CIVD) or the 'hunting response', which may help protect tissues from ischaemic/hypoxic injury. A normal (or above-normal) deep body temperature is essential for the CIVD response and a reduced CIVD response may be associated with increased risk of cold-injury.

45. **Future risk after NFCI.** At present, a validated test of known (and appropriate) sensitivity, specificity and positive predictive power for NFCI development does not exist[9]. Those with severe and established (post-hyperaemic phase) NFCI who go on to demonstrate cold sensitivity, neuropathy and hyperhidrosis would appear to have physiological reason to be at greater risk of future NFCI, although the magnitude of this risk increase (and the extent to which it can be mitigated) is unclear.

46. **Diagnosis.** A working diagnosis of NFCI should be made in Primary Healthcare by nominated NFCI clinicians and will be based upon comprehensive history, standardised clinical examination and specialist tests[10]. Complaints of persistent numbness, tingling, burning or pins and needles in his hands or feet, or any other peripheral body part, during cool and particularly wet conditions are consistent with NFCI. Possible alternative diagnoses for NFCI are Raynaud's phenomenon, Hand Arm Vibration Syndrome, and care should be taken not to overlook other differential diagnoses such as sickle cell disease, sinus tarsi syndrome and carpal tunnel syndrome.

a. **History.** This should focus on:

(1) Obtaining a detailed account of the circumstances leading to the NFCI, including environmental conditions (ambient temperature, precipitation, relative wind speed, activity, body insulation and available shelter, food and fluid availability), any predisposing factors and the number of others (if any) injured in

[6] Defence Statistics (Health) report to Cold Injuries Working Group, 5Jan17. Rates are highest for 16-19 age group for all years over the five-year period (2011/12 to 2015/16). Rates are highest for untrained personnel across all years over the five-year period.
[7] Jackson RL, Roberts DE, Cote RA, McNeal P, Fay JT, Sharp MW, Kraus E, Rahman SA, Hamlet MP: Psychological and Physiological Responses of Blacks and Caucasians to Hand Cooling. Report No: T20-89. 1989, Natick: US Army Research Institute of Environmental Medicine.
[8] Burgess JE, Macfarlane F: Retrospective analysis of the ethnic origins of male British army soldiers with peripheral cold weather injury.
[9] The suggestion that NFCI can result in persistent changes in microcirculatory regulation and ongoing peripheral sensory neuropathy in association with hyperhidrosis (which can increase surface cooling) make it plausible that past NFCI might elevate the risk of future NFCI. There is thus a physiological rationale to suggest that past NFCI might elevate future risk. However, proof that past NFCI elevates future risk is lacking. The magnitude of any attributable risk, even if suspected, thus remains unquantified.
[10] Paragraph 12 of the March 2015 Independent Medical Expert Group (IMEG) report to Armed Forces Compensation Scheme states that neither Infra-red Thermography (IRT) or Thermal Threshold Testing (TTT) may be regarded as diagnostic and, at paragraphs 14-17, stresses the importance of a diagnosis of small fibre neuropathy (SFN) in the overall diagnosis of NFCI. Paragraph 20 states that '*NFCI should be diagnosed from the combination of clinical history, clinical examination and special tests*' and, at paragraph 23, in general '*The clinical features of chronic NFCI include persistent abnormal vascular thermal reactivity and a sensory neuropathy affecting solely or predominantly small nerve fibres and giving rise to chronic continuous or intermittent neuropathic pain, frequently accompanied by cold allodynia*'.

same incident. Timings (including durations of exposures and onset of symptoms) should also be recorded.

(2) Clinical features of the affected part at the time of exposure and upon rewarming, and their subsequent progression.

b. **Examination.** For the majority of those injured there are often surprisingly few objective clinical signs. Therefore, the following specific information should be sought:

(1) **Cutaneous features.**

(a) Skin initially appearing pale/white/blotchy with prolonged nail bed capillary refilling time without evidence of swelling.

(b) Skin acquiring a mottled blue appearance with rising temperature in the hours and days after rewarming.

(c) Skin becoming hot and flushed with the possibility of:

i. Oedema and blistering in the hyperaemic phase (days to months)

ii. Hyperhidrosis after the first few weeks.

(2) **Impact on peripheral pulses.** A vascular assessment, including that of pulses and capillary refill time, should be performed.

(3) **Neurological features.** Impaired sensory and motor function over hours to days after exposure. Neurological examination should include an assessment of gait, and of large fibre sensory modalities (light touch, 2-point discrimination, vibration sense and joint position sense) and small fibre modalities (pin prick, heat and cold), with a note of the presence or absence of cold allodynia.

c. **Investigation**[11]**.** A validated test of known (and appropriate) sensitivity and specificity in diagnosing NFCI does not exist. Patients should be investigated in accordance with their symptomatology. For example, a patient with signs consistent with peripheral neuropathy should be referred for appropriate neurological testing.

47. **Clinical care pathway**[12]**.** Routine clinical management of suspected NFCI will be managed in accordance with the clinical care pathway outlined below and DPHC Guidance Note No. 14/17. This will enable appropriate initial management and referral of suspected NFCI patients, ensuring consistent advice and compliance with Joint policy. **All assessments of suspected NFCI cases and their subsequent management should be carried out in accordance with guidance in the relevant DMICP template.** DPHC NFCI Clinic staff will support GPs, reinforce best practice and to support the Chain of Command in their efforts to minimise further harm to personnel at risk. The following tiers of care should be followed:

[11] All specialist tests should be reported in a standardised format, which does not 'confirm' or 'refute' a diagnosis of NFCI, rather relays the results of the tests themselves.
[12] There is an almost complete absence of well-conducted case-control or cohort studies to support any of the information presented in this section. Instead, most of the treatment regimens and advice that exist are based on personal experience or observation.

a. **Tier 1A - NFCI field care.**

(1) **Management.** If NFCI is suspected, you should:

(a) Remove the patient from the risk environment[13]. Shelter the patient and dry affected feet and/or hands replacing wet socks or gloves as needed. Provide supplementary whole-body insulation.

(b) Intake of fluids may help peripheral perfusion where dehydration is a contributory factor to its impairment. 'Sweet fluids', by increasing calorie intake, may help improve perfusion and ability to generate heat though exercise or shivering where this is a factor[14].

(c) In contrast to patients with FCI, those with NFCI should always have their affected parts re-warmed **slowly**, by exposure to warm air alone, and **should not be immersed in water**[8,15]. If necessary, only use paracetamol and/or ibuprofen for pain control. If there is any visible evidence of tissue damage, protocols for FCI should be followed.

(d) Alert the Chain of Command that there has been a cold injury during the activity - others may also be at risk.

(e) Evacuate the patient to safety immediately. Do not allow them to return to the cold environment even if they appear to have recovered.

(f) Arrange a routine appointment with a MO, preferably one with experience in managing NFCI. If the patient has significant skin changes, cannot walk or their pain is not controlled by paracetamol and/or ibuprofen alone an urgent appointment is required.

(2) **Recording.** You should record the episode on the DMICP NFCI template[16]:

b. **Tier 1B - NFCI primary care.**

(1) **Management.**

(a) Manage pain.

(b) Advise the patient to use warm foot/hand spas (30 min / 40°C / twice daily), if appropriate[17].

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[13] In the deployed setting, those with a significant NFCI (or FCI - excluding frostnip) should normally be evacuated to their parent unit once their condition has stabilised. Where a decision is made to retain such patients in the deployed setting then appropriate safeguards should be put in place to avoid further cold exposure. Care should be taken to ensure that personnel being evacuated back to UK are referred to an appropriate medical facility / specialist for continuation of treatment when necessary. This is especially important when the responsible primary care provider remains deployed.

[14] There are no data to show that intake of small volumes of hot fluid affect deep body temperature more than marginally, nor that they lead to vasodilatation through any other mechanism. Thus, whilst comforting to drink warm fluids (with the possible advantage of cradling a warm cup if hands are affected, and increasing the ability to dissolve sugar), maintaining hydration *per se* might seem more important, whilst calories can be ingested in a variety of other forms.

[15] The early period after re-warming can be exquisitely painful in NFCI even without any obvious tissue damage and may require strong oral analgesia. The pressure of bedclothes may cause pain, so a bed cradle may be helpful.

[16] See guidance at Section 5 - Reporting and Recording.

[17] The timing of warm spa use is important. NFCI in the acute setting should **NOT** be rapidly rewarmed and whilst in the hyperaemic phase this may actually cause pain and possibly make the situation worse. It should be reserved for those with on-going neuropathy and those with cold sensitivity.

(c) Advise the patient on appropriate use of clothing and footwear.

(d) Authorise issue of extreme cold weather (ECW) hat and mittens.

(e) Advise smokers on benefits of cessation.

(f) Request bloods: FBC, U&Es, LFTs, random glucose, HbA1c, B12, folate, thyroid screen, auto-antibody screen and (if appropriate) haemoglobinopathy screen.

(g) Advise on appropriate occupational restrictions and consider amending JMES in accordance with JSP 950 Part 1 Leaflet 6-7-7 Joint Manual of Medical Fitness Section 5 Annex N Other Conditions. Issue the NFCI specific PAP10 App 9 (Army only) in accordance with clinical progression.

(h) Prompt the Chain of Command to complete a single Service incident form (patient consent required).

(i) Where there is not recovery within one week refer the patient to the DPHC NFCI Clinics (including INM CIC as tier 2), using a DMICP e-referral. Existing photographic records should be sent separately to the latter. Suspicion of compromised tissue viability should be discussed with the DPHC NFCI Clinic and local surgical services as a matter of urgency.

(j) Thereafter, review as clinically indicated and await DPHC NFCI Clinic appointment.

(k) At any time, consider referring the patient into the Defence Medical Rehabilitation Programme[18].

(2) **Recording.** The episode should be recorded on DMICP.

c. **Tier 2 - DPHC NFCI or INM CI clinic.**

(1) **Management.** If NFCI is suspected:

(a) You should make a working diagnosis of NFCI.

(b) You should make recommendation to award the appropriate JMES, if not already done (to be discussed with ROHT).

(c) Patients should be issued with a NFCI Patient Information Leaflet.

(d) After establishing a baseline of any cold damage/sensitisation, patients should be followed up as appropriate (at 6-12 weeks, 26 weeks and 1-year post-injury) to assess the progress of recovery, provide advice on likely long-term residual sequelae and inform future employability limitations. If the patient is seen more than one year following the index injury, then only one

[18] Especially useful for improvement of functional ability, pain management and for the development of psychosocial coping mechanisms.

attendance may be needed.

(e) Arrange for referral to a Specialist if needed.[19]

(f) Consider referring the patient into the Defence Medical Rehabilitation Programme[20].

(2) **Recording.** The episode should be recorded on DMICP[7].

d. **Tier 3 - specialist referral.** Cases with mild to moderate signs and symptoms of NFCI may be managed locally by suitably experienced medical staff utilising the ROHT or nominated DPHC Regional Lead for advice. More severe cases, or those in which symptoms are persistent, should be referred for tertiary assessment and care as appropriate, including: DMRC Headley Court for pain management; the NHS for specialist neurological assessment; or to the Cold Injury Clinic (CIC), INM. Referrals to these clinics should be arranged by DPHC NFCI or INM CI Clinics only and in accordance with DPHC Guidance Note No. 10/17.

(1) **Clinical assessment** against the criteria below will indicate which patients need onward referral where sequelae are persistent or problematic to treat, or where there remain questions over employment limitations:

(a) Persistent numbness or neuropathic pain, particularly overnight or other symptoms of persistent sensory loss especially temperature sensation. Sensory loss is sometimes indicated by a change of gait or evidence of a functional limitation or restriction.

(b) Evidence of tissue damage, such as skin discolouration changes and trophic changes to nailbeds.

(c) A newly acquired cold sensitivity, i.e. increased sensation of cold on exposure to a cold environment.

The above criteria are not exhaustive and further advice can be provided by INM or DPHC Leads.

(2) **Cold Injury Clinic, INM.** Those patients referred to the CIC will undertake a standardised prognostic test battery, including a neurological examination and assessment, thermal sensory thresholds and cold sensitivity to help inform the patient's future medical employability.

48. **Pain management.**

a. Transient re-warming pain lasting less than an hour or two during re-warming is generally benign. More prolonged pain, particularly overnight, may indicate that the injury is likely to be non-freezing. It is common clinical experience that neuropathic pain responds poorly to non-opioid analgesics. However, there are no reported randomised clinical trials (RCT) of treatment for pain resulting from NFCI.

[19] By a suitably qualified physician
[20] Especially useful for improvement of functional ability, pain management and for the development of psychosocial coping mechanisms.

b. See Annex C - Management of Pain in Non Freezing Cold Injury (NFCI) and Consult the DMRC Neuropathic Pain and Medication –Teaching Guide for Primary Care Clinicians. Clinicians can also email DMRC Pain Clinic for advice at DMRC-Pain Management (MULTIUSER) DMRC-PainManagement@mod.gov.uk

c. Medication used in the management of NFCI pain are commonly associated with adverse effects that may outweigh any analgesic benefit derived. For example, patients should be warned that amitriptyline may cause marked drowsiness (this usually wears off after the first few days) and hypertension (blood pressure should be checked prior to initial use and regularly thereafter). Patients should be made aware of the other side effects and important warnings associated with this (and any other) drug before use in the military setting. Use of any sedative medication will require appropriate restriction on employment.

d. Regular clinical reviews to assess and monitor the effectiveness of the treatment are essential. Each review should include and assessment of:

(1) Adequacy of control measures aimed at protection from cold conditions.

(2) Pain control – including assessment and appropriate pain score.

(3) Impact on lifestyle, daily activities (including sleep disturbance) and employment.

(4) Physical and psychological wellbeing.

(5) Adverse effects.

(6) Continued need for treatment.

49. **Hyperhidrosis.** Hyperhidrosis of the feet and hands is a common secondary issue that can affect the recovery and longer-term management of both significant FCI and NFCI, but especially the latter (see paragraph 41c). Treatment of severe hyperhidrosis can be difficult; whilst topical application of aluminium and similar salts by spray or roll-on can eliminate sweating for short periods, and may thus be useful for critical tasks, this is unsuitable for frequent use. Patients with hyperhidrosis sufficient to interfere with activities of daily living or their job should be discussed with the DPHC NFCI Clinic with a view to referral for specialist dermatological opinion. Sympathectomy (either through a temporary block or permanent surgical methods) is inappropriate for hyperhidrosis and should not be used to manage hyperhidrosis (or symptoms of chronic pain) in NFCI cases, as these individuals tend to have a poor outcome.

50. **Employability.** Once a patient has returned to their parent unit, re-exposure to the cold and / or wet should only be permitted with caution. In general, those who have suffered significant NFCI will need an appropriate JMES for at least the winter after they sustained their injury. They may be employed in sheltered environmental conditions (for example, working indoors in heated buildings only). Patients who are completely asymptomatic, with no suggestion of cold sensitivity and normal neurological examination, can be progressively re-introduced to the cold. If they show signs of sequelae or recurrence, the re-introduction should be terminated at once. Measures to be considered for the on-going occupational management of those who have sustained cold injury include:

a. Avoidance of exposure to cold and/or wet conditions.

b. Restriction to working outdoors only when it is warm and dry[21].

c. Confinement to indoor working (in properly heated buildings) at all other times.

d. Issue with warm hand- and footwear (the latter including Arctic socks and specialist boots if necessary).

e. Ensuring that the patient is encouraged to wear such clothing when they feel a need rather than in accordance with prevailing dress policy.

f. Daily or more frequent re-warming using a foot spa[13,22].

g. Assiduous foot-care routines, and a high standard of personal care in field-craft.

51. For personnel undergoing initial training (both Phase 1 and Phase 2 for the Army) these restrictions may not be possible to implement. Those trainees with anything more than the most trivial NFCI that resolves rapidly post-injury are unlikely to be able to complete training.

52. **JMES.** Patients with persistent NFCI should be graded and appropriate occupational restrictions applied in accordance with JSP 950 Part 1 Leaflet 6-7-7 Joint Manual of Medical Fitness Section 5 Annex N Other Conditions until reviewed by an Occupational Medicine Consultant[23] and only after all necessary referrals have been completed. Patients with significant sequelae limiting their employability and deployability should remain in a restricted JMES until full recovery is established[24]. The JMES of personnel undergoing initial training (both Phase 1 and Phase 2 for the Army) should be discussed with the sS Occupational Physician responsible for providing advice to training establishments.

53. **Re-exposure to cold.**

a. **Trained strength.** NFCI may recover sufficiently quickly that patients can be returned to full duties at around the 3-5 month point. Although it has been common practice in the past to shelter those patients from severe cold exposure for the following winter (for instance, not deploying to Norway for approximately 12 months), those with a normal neurological examination who remain asymptomatic during the onset of the following winter can be re-exposed provided that they, and their Chain of Command, should adopt a cautious approach to re-exposing the individual. Both the Chain of Command and the individual should remain alert to and act upon the recurrence of symptoms.

b. **Un-trained strength.** This group needs to be assessed against the requirements of their remaining training and against their likely future duties on the trained strength. Unless the trainee is entirely asymptomatic, with a normal neurological examination and no persistent skin changes they should be assessed by the consultant in occupational

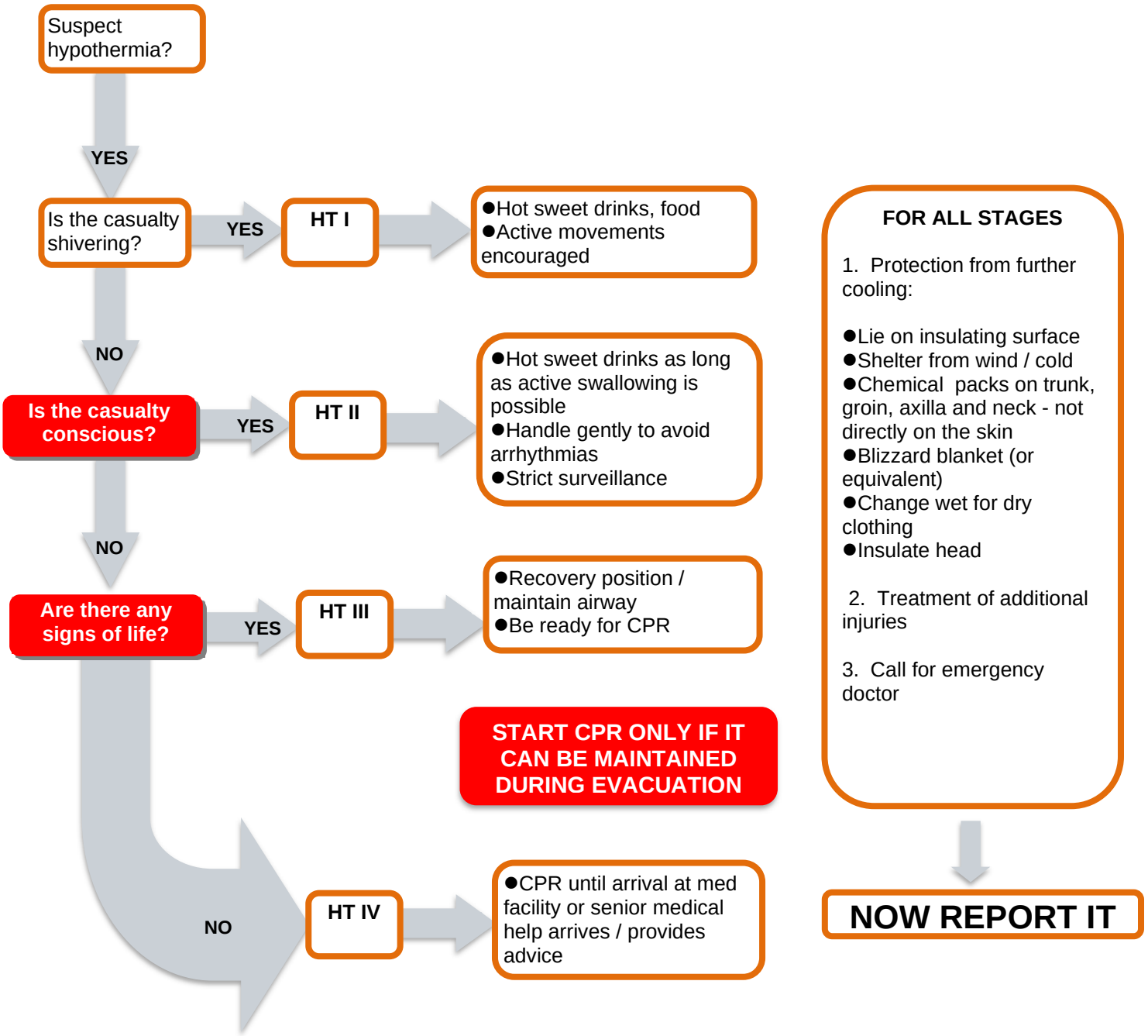
[21] Judgement must be exercised in determining ongoing exposure to cold conditions. For example, even on a cold day many NFCI patients will be able to go for a run providing they leave a warm environment, return immediately to a warm environment and wear appropriate footwear/clothing. Some units experience difficulties employing NFCI patients by recommending that they avoid many fitness and exercise training opportunities because of a misplaced concern about further exposure.
[22] Empirical evidence only.
[23] Dedicated ROMCs are responsible for recommending appropriate JMES awards for SPs with a diagnosis of NFCI.
[24] Medical grading reviews should be carried out in accordance with sS policy.

medicine for recruits, and ROHT NFCI clinic as indicated, but they may not necessarily be returned to normal training.

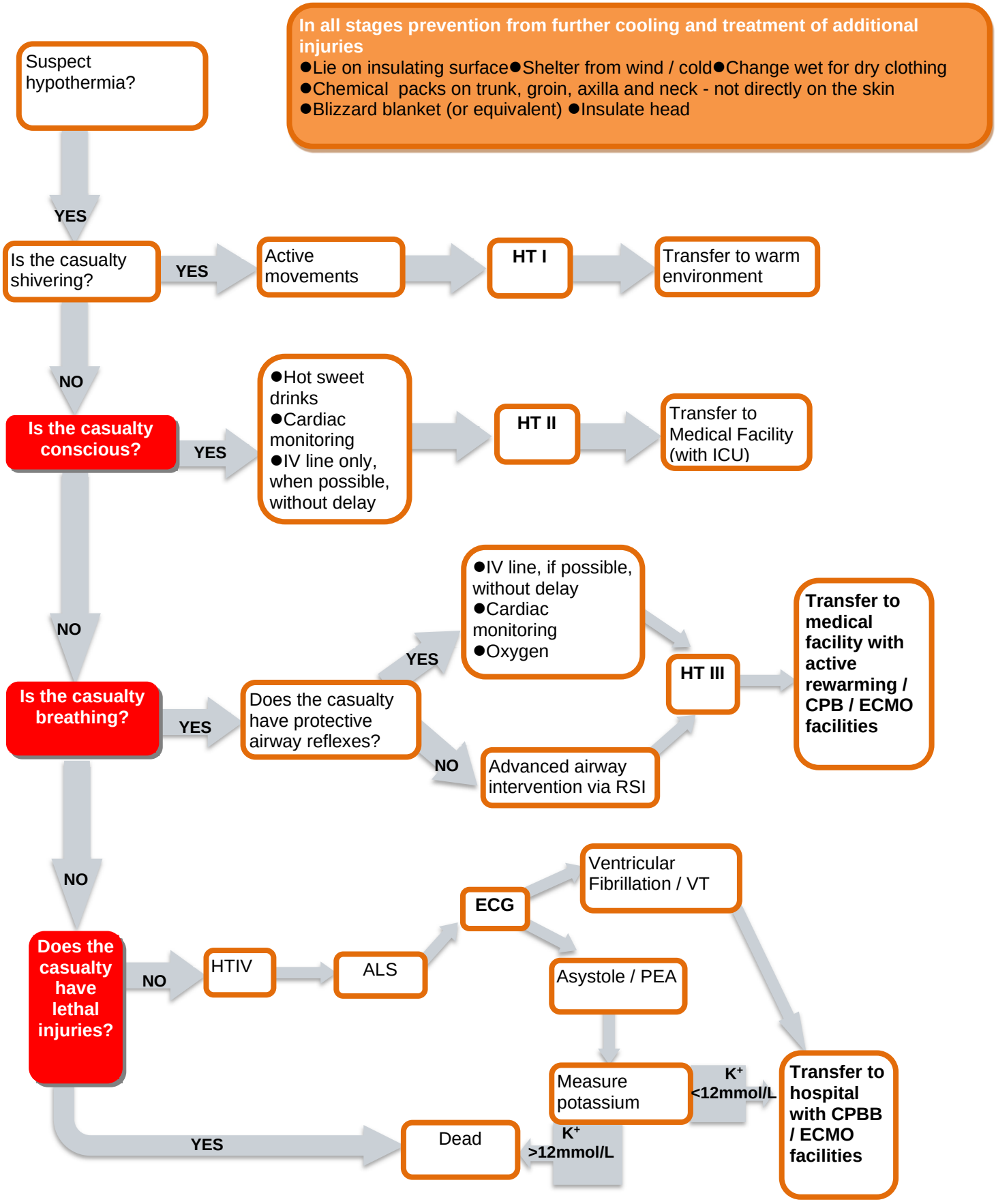
54. **Advice and information for patients.** As a minimum, patients[25] who have suffered suspected NFCI should be provided with a patient information leaflet and an Individuals Guide to Climatic Injury[26].

[25] Including patients who are sent on sick leave, or who may otherwise present to civilian medical services, Civilian medical services should be encouraged to seek advice and support from NFCI Regional Secondary Care Clinics.
[26] Available at: http://defenceintranet.diif.r.mil.uk/libraries/8/Docs2/20140621.8/20140114-DTrgA_Indiv_Climatic_Injury_Pamplet_Web.pdf

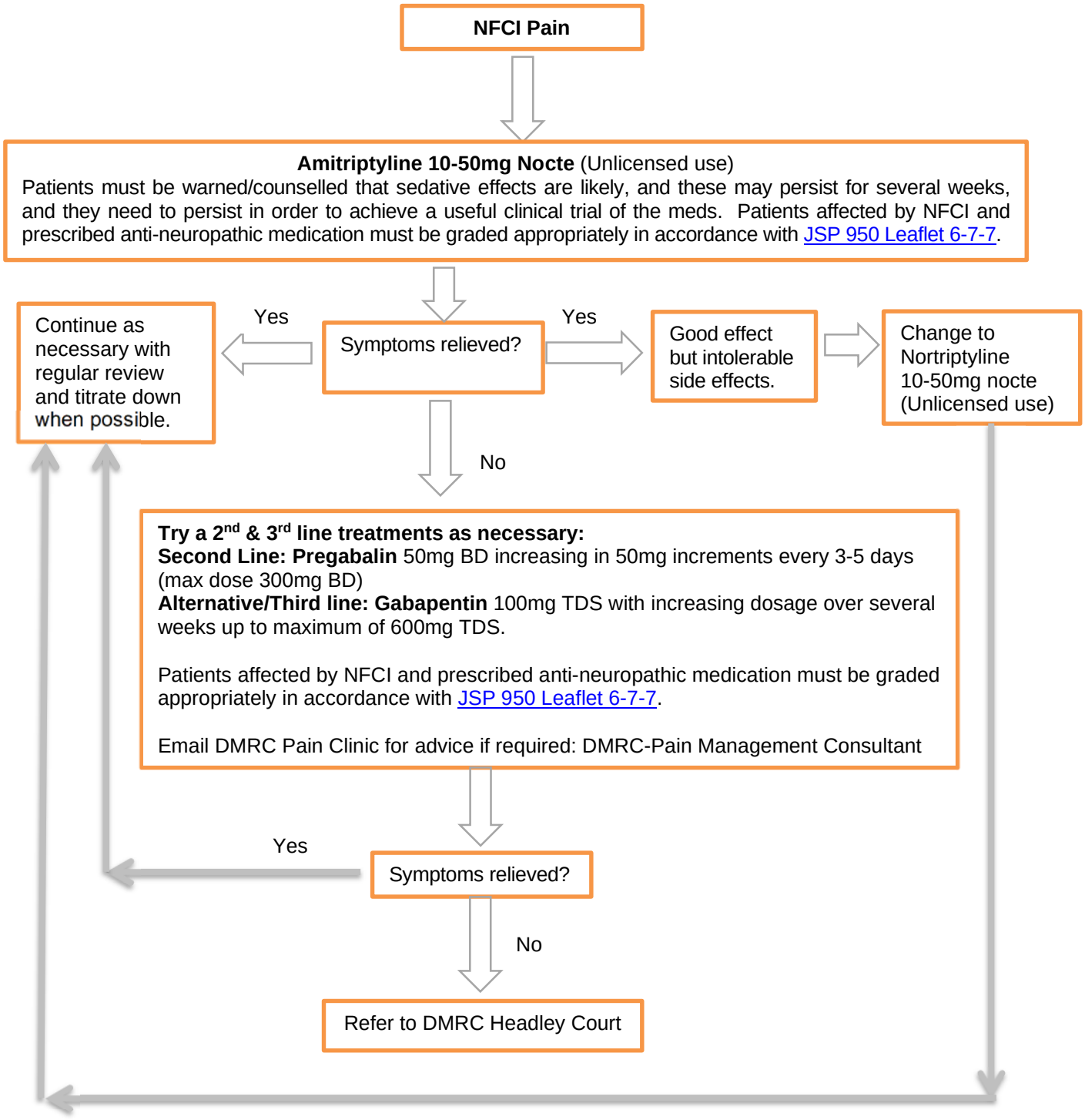
FIRST RESPONDER: INITIAL TREATMENT OF HYPOTHERMIA UNDER FIELD CONDITIONS



EMERGENCY DOCTORS AND PROFESSIONAL RESCUERS: TREATMENT OF HYPOTHERMIA



MANAGEMENT OF PAIN IN NON FREEZING COLD INJURY (NFCI)



SECTION 5 – REPORTING AND RECORDING

1. Reporting and/or recording of heat illness and cold injury is known to be an area of poor compliance in both Command and Medical chains. All cases of climatic illness/injury must be reported and/or recorded by both the:

   a. Chain of Command in accordance with JSP 375 Volume 1 Chapters 41 or 42.

   b. Medical chain in accordance with paragraphs 9-11.

2. Each chain serves a different but complementary purpose, and both are seen as essential to mitigating risk. Improvements in reporting of climatic illness/injury will have practical benefits for personnel. The better the scale and nature of the problem of illness/injury within Defence is understood the better Defence can take steps to minimise the risk of climatic illness/injury occurring. It will also help inform the provision of improved systems of training and treatment so that illness/injury is better recognised and treated when it does occur and is crucial to the monitoring of the effectiveness of this JSP.

3. It is important that all confirmed or suspected heat illness/cold injury cases~~,~~ are reported. Where there are multiple casualties or any fatalities an appropriate investigation must be undertaken. A functional, rapid, local alert mechanism, whereby all local units undertaking similar activities are made aware all incidents of climatic illness/injury as they arise, must be incorporated into the dynamic risk assessment process. Unit medical centres are to be notified by the CoC of all reported cases of heat illness and cold injury to ensure appropriate medical follow-up and recording takes place.

4. Reporting and/or recording of heat illness/cold injury must comply with:

   a. Statute e.g. Health and Safety at Work Act 1974, RIDDOR[1].

   b. Defence Lessons Identified Management System (DLIMS).

   c. Joint and Single Service (sS) reporting.

   d. Medical case recording.

Chain of Command reporting

5. **Reporting threshold.** All cases must be reported; this includes cases where individuals develop temporary or permanent incapacitation i.e. are unable to continue with their duties/training because of climatic illness/injury with or without the involvement of Defence Medical Services or other medical assets.

6. Commanding Officers (COs) must be aware that medical case recording **does not replace their duty to report all cases of heat illness/cold injury meeting the reporting threshold**. Specific reporting or data collation may also be required by the Chain of Command in specific Op Orders or Mounting Instructions.

[1] RIDDOR - Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013. (accessed Nov 20). RIDDOR type incidents are reported and captured within the MOD's own internal reporting cells, who then centrally report such incident to the HSE if they fall within the agreed categories.

7. **Statutory and Service incident reporting.** The CO must ensure that suitable local procedures for their area of responsibility are implemented in accordance with JSP 375 Management of Health and Safety Part 12 Chapter 16 Accident/Incident Reporting and Investigation

Medical Chain recording

9. It is the duty of DMS personnel to ensure that all cases of climatic illness/injury treated under their authority are appropriately recorded. All cases of heat illness/cold injury should be recorded on the appropriate individual electronic heath record heat illness/cold injury template. Where access to the individual electronic heath record is not available, the appropriate forms at Annexes D or E must be completed. These duplicate the templates and data must be transcribed onto the individual electronic heath record at the earliest opportunity by the patient's current primary healthcare provider. Only where this is not possible should the forms must be sent to the medical point of contact detailed at paragraph 11.

10. The individual electronic heath record templates are designed to guide the clinician to the appropriate clinical care pathway and for epidemiological data collection. In addition, providing the patient consents, it is the duty of DMS personnel to record on the individual electronic heath record that they have prompted the Chain of Command to comply with JSP 375 Volume 1 Chapters 41 and/or 42 – as appropriate.

11. **DPHC HQ medical point of contact.** SO1 OH, HQ DPHC Mil 94422 Ext 4745 Civ 01543 434745 **(SG DPHC-OH-SO1)**

HEAT ILLNESS MEDICAL RECORDING FORM ANNEX F

OFFICIAL SENSITIVE PERSONAL
Medical in Confidence
(when completed)

Casualty's details					
Service number		Surname		Forename	
Rank		DOB		Unit	
JMES (at time of incident)		MFD☐ MLD☐ MND☐ A☐ L☐ M☐ E☐		Medical Limitations yes☐ no ☐ (if yes please list)	
Incident details					
Date of incident		Time (local)		Exercise☐ Operations☐ Sport☐ Other☐ (detail)	
Exact Location	Lat/Long or map coordinates		Safety briefing received prior to incident	yes☐ no ☐	
			Activity undertaken		
Clothing worn (detail)			Equipment carried (detail and weight)		
WBGT reading	Date	Time	WBGT Location	At scene☐ Locally☐ Provided by Met Office☐ Provided by forecast☐ Source unknown☐	

Casualty's clinical details						
Initial observations	Date		Temperature (rectal is preferred)			
	Time		Rectal☐ Oral☐ Axilla☐ Tympanic☐			
AVPU	GCS	Pulse rate	Blood Pressure	Resp Rate	SpO_2 %	Blood Glucose
A☐ V☐ P☐ U☐	/15					

Signs and symptoms	Seizure(s)☐ Collapse or loss of consciousness☐ Anxiety and/or agitation☐ Inappropriate or unusual behaviour e.g. behaving as if drunk☐ Nausea and /or vomiting☐ Headache☐ Staggering or loss of coordination☐ Disturbed vision☐ Confusion☐ Dizziness☐ Weakness or fatigue☐ Thirst☐ Impaired judgement☐ Hyperventilation☐ Paraesthesia☐ Myalgia, Cramps☐ Tetany☐ Diarrhoea☐ Other (detail)
Working diagnosis	

Treatment details			Disposal
Clothing removed☐ (excluding underwear) Active Cooling☐ (Spray/sponge with cool water and fan) Fluids Oral☐ IV☐	Oxygen☐ Intubation/Ventilation☐ Urinary catheter☐ Nasogastric tube☐ Central venous catheter☐ Arterial line☐	Venous Blood Sample FBC☐ U&Es☐ LFTs☐ CK☐ Clotting screen☐ Myoglobin☐ Arterial Blood Gas☐	Discharged☐ Admit Role 1☐ Admit Role 2/3☐ Refer to SHC for outpatient follow-up☐ Other☐ (detail)

Predisposing factors

Overweight/obese☐ Previous heat illness☐ Smoker☐ Lack of sleep☐ Concurrent mild illness ☐ Un-acclimatised (this includes all UK and Northern Europe-based personnel)☐ Dehydration☐ Vaccination (previous 48 hrs)☐ Poor nutritional status (missed meals within the past 24 hours)☐ Alcohol (past 48 hrs)☐ air travel (past 24hr)☐ Individual volition☐ Lack of physical fitness☐ Illicit drug use☐ Use of supplements☐ Current sunburn☐ Prescribed and over-the-counter medication e.g. antihistamines and painkillers☐ Inexperienced personnel☐

Medication/drugs	Prescribed	Over the counter	Supplements / herbal	Other
	yes☐ no☐	yes☐ no☐	yes☐ no☐	yes☐ no☐

Person completing form					
Service number		Surname		Forename	
Rank		Position and unit		Signature and date	

Consent

Consent given by casualty for CoC incident reporting yes☐ no☐

The information on this form should be transcribed to DMICP within 28 days by the casualty's current PHC provider. If this is not possible, send the form to (SG DPHC-OH-SO1)

OFFICIAL SENSITIVE PERSONAL
(when completed)

OFFICIAL SENSITIVE PERSONAL
Medical in Confidence (when completed)

Casualty's details					
Service number		Surname		Forename	
Rank		DOB		Unit	
JMES (at time of incident)		MFD☐ MLD☐ MND☐ A☐ L☐ M☐ E☐		Medical Limitations Yes☐ No ☐ (if yes please list)	

Incident details					
Date first reported for medical care (if later than incident)					
Date of incident		Time (local)		Exercise☐ Operations☐ Sport☐ Other☐ (detail)	
Exact Location	Lat/Long or map coordinates		Safety briefing prior to incident	Yes☐ No ☐	
			Activity undertaken		
Clothing worn (detail)			Equipment carried (detail and weight)		
Weather conditions			Wind speed (or estimate)	Wind chill equivalent temperature	

Dry Bulb Air Temperature	Date	Time	Location	At scene☐ Locally☐ Provided by Met Office☐ Provided by forecast☐ Source unknown☐

Casualty's clinical details							
Observations (suspected hypothermia only)		Date	Time	Temperature (rectal is preferred)			
				Rectal☐ Oral☐ Axilla☐ Tympanic☐			
AVPU	GCS	Pulse Rate	Blood Pressure	Resp Rate	SpO_2 %	Blood Glucose	
A☐ V☐ P☐ U☐	/15						

Signs and symptoms	Pale extremities☐ Cyanosis☐ Mottling☐ Altered sensation☐ Swelling of hands or feet☐ Numbness☐ Pain☐ Skin white/ waxy-looking☐ Un-controlled shivering☐ Loss of manual dexterity☐ Mild confusion, disorientation or irritability☐ Loss of insight☐ Slurred speech☐ Apathetic☐ Confused, irrational, ☐ Other (detail)☐

Working diagnosis	Frostnip	Frostbite	NFCI	Hypothermia
	hands☐ feet☐ face☐ other☐	hands☐ feet☐ face☐ other☐	hands☐ feet☐ face☐ other☐	yes☐ no ☐

Treatment details	Disposal
Re-warming☐ Analgesia☐ Antibiotics☐ Anti-tetanus☐ Photography☐ Smoking discouraged☐ Physiotherapist supervised mobilisation☐ Other☐ (detail)	Discharged☐ Admit Role 1☐ Admit Role 2/3☐ Refer to SHC for outpatient follow-up☐ Other☐ (detail)

Predisposing factors
Carbon monoxide poisoning☐ Trauma☐ Altitude Sickness☐ Smoker☐ Alcohol In Past 48 Hours☐ Inadequate Calorie Intake☐ Reduced Physical Fitness☐ Prior NFCI / FCI☐ Hypoxia☐ Advancing age☐ Systemic infection☐ Hypovolaemia☐ Hand Arm Vibration Syndrome ☐ Hypothermia stress or anxiety☐ Inexperienced☐ Sleep deprivation or fatigue☐ Prolonged cold exposure☐ Forced convective heat loss☐ Damp environments and sweating☐ Inadequate clothing☐ Constricting clothing ☐ Immobility☐ Upright posture (NFCI only)☐

Medication/drugs	Prescribed	Over the counter	Supplements / herbal	Other
	yes☐ no☐	yes☐ no☐	yes☐ no☐	yes☐ no☐

Person completing form					
Service number		Surname		Forename	
Rank		Position and unit		Signature and date	

Consent
Consent given by casualty for CoC incident reporting yes☐ no☐
The information on this form should be transcribed to DMICP within 28 days by the casualty's current PHC provider. If this is not possible, send the form to (SG DPHC-OH-SO1)

OFFICIAL SENSITIVE PERSONAL (when completed)