

Heat Injury CPG Across Multiple Settings



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SCOPE

- Background
- How Singapore Armed Forces (SAF) was involved in the development of the Heat Injury CPG
- Planning
- Development
- Application

Context to Heat Injuries in Singapore

- 137km North of Equator
- Surrounded by water bodies
- Average temp range 31°C to 23°C
- Average humidity range 79% to 82%



At Risk Population

1. Singapore Armed Forces (SAF)

- Compulsory 2-year military service



At Risk Population

2. Large population of Outdoors Workers

- 6 case of heat stroke in 2009,
- 1 case in first half of 2010



At Risk Population

3. Number of events and participation: Endurance Sportsmen

- Increasing number of large-scale endurance sports events over the last few years



Context in Singapore

- Lack of local open-source guidelines
 - US guidelines based on WBGT not suitable in the local context
- No common definition and recommended treatment
- Low emphasis in medical school

History of CPG development in Singapore

1991

- Review committee set up to review evidence of new medical technology and procedures

1997

- Initiation of MOH's CPG program
- Primary driver is MOH

1998

-First 2 CPGs
-Paediatric Asthma
- H. Pylori

1998 - 2009

- Total of 57 CPGs developed

2010

-MOH collaborating with other agencies to develop & publish CPGs
- e.g. AMS, SAF, HAS

- Total of 72 CPGs to date

The Singapore Armed Forces Medical Corps

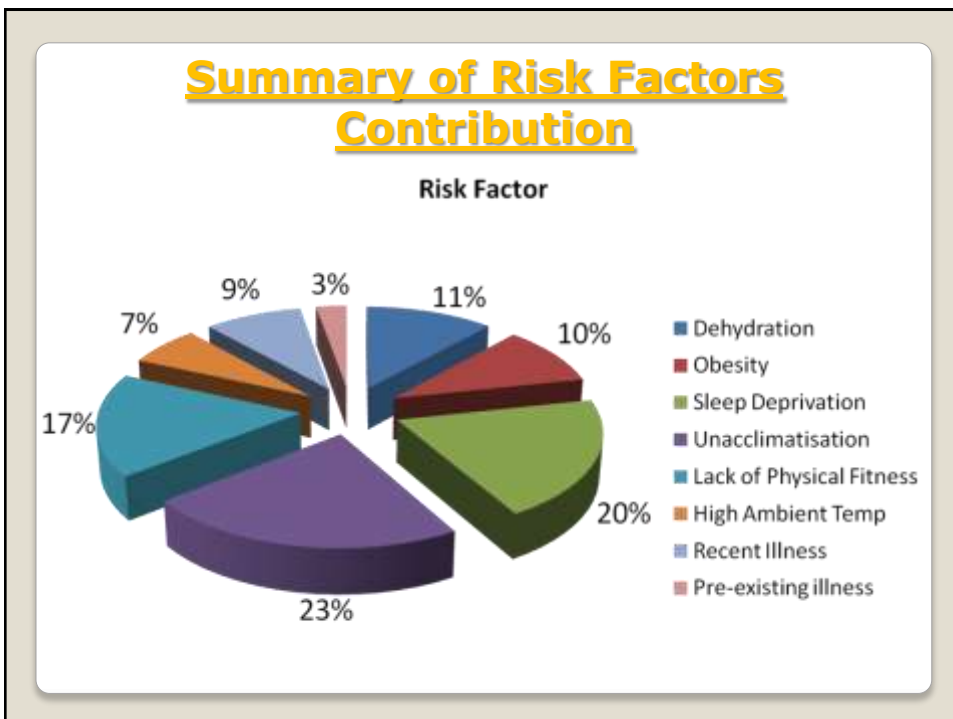
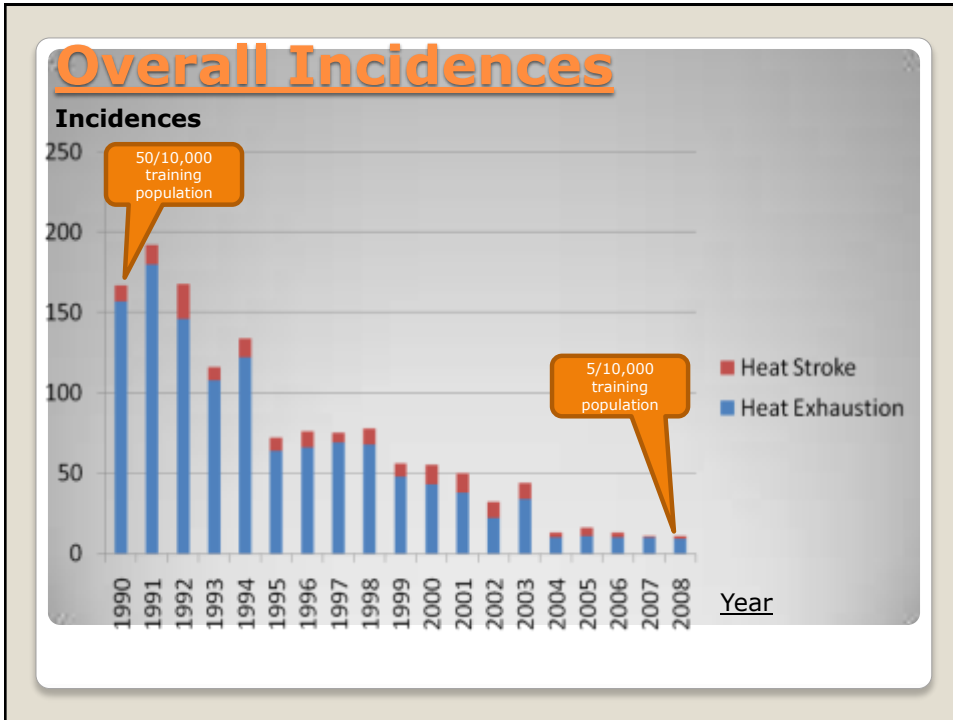


- Tri-service Medical Corps
- Oversees healthcare policy and medical support to SAF

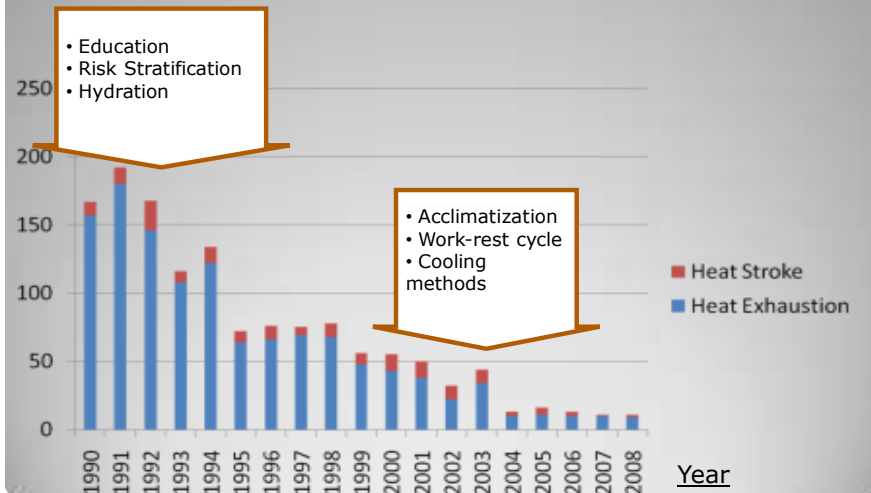


The Singapore Armed Forces (SAF) Experience with Heat Injury

- Internal Review by SAF
 - Retrospective review from 1990 to 2008
- Total number of heat casualties (1990 to 2008): **210**
 - 41 cases of Heat Strokes
 - 169 cases of Heat Exhaustion
- Mean age: 21.8 years old (Range: 18 - 42 years old)



Interventions and outcomes



Intervention Measures Cooling Methods

- Portable Body Cooling Unit
- Delivers evaporative cooling out in the field



S&F Medical Corps members demonstrating, on a dummy, treatment techniques used on soldiers with heat injuries at Red Sox Camp on Friday. The 33 medical series in camps and training schools - including the Basic Military Training Centre on Police Training - have body cooling units to deal with heat injuries. ST PHOTO: MEGAN RAJASEKARAN



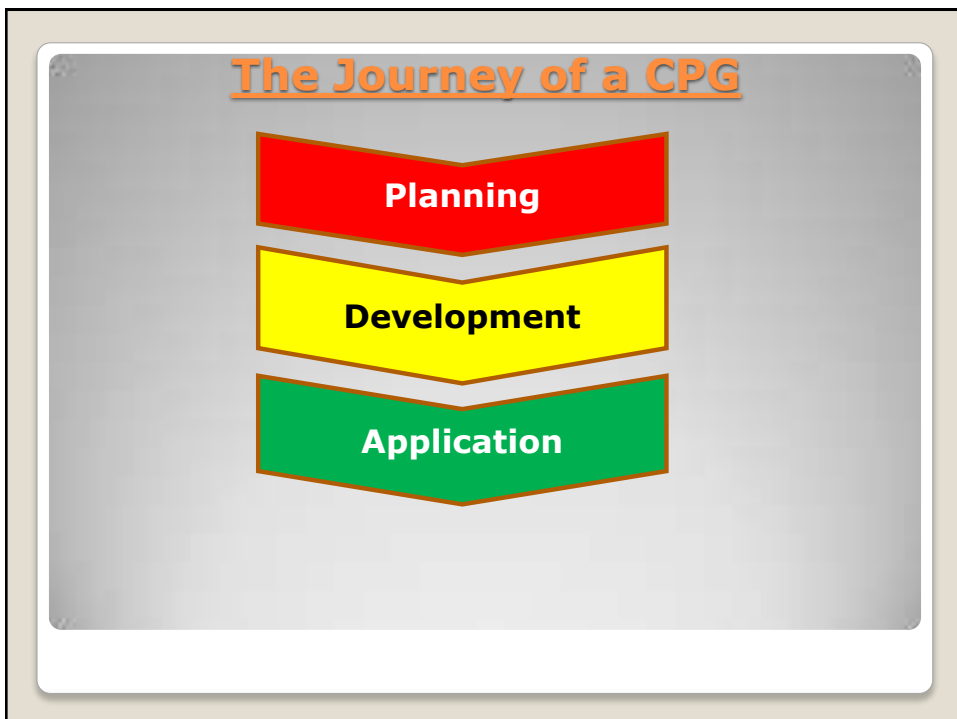
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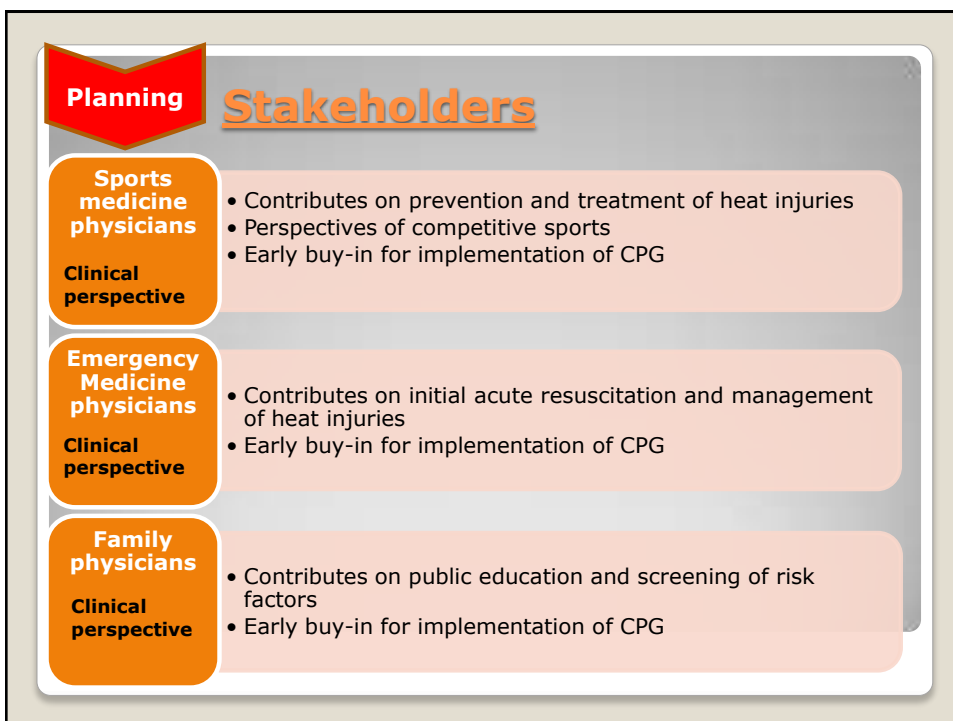
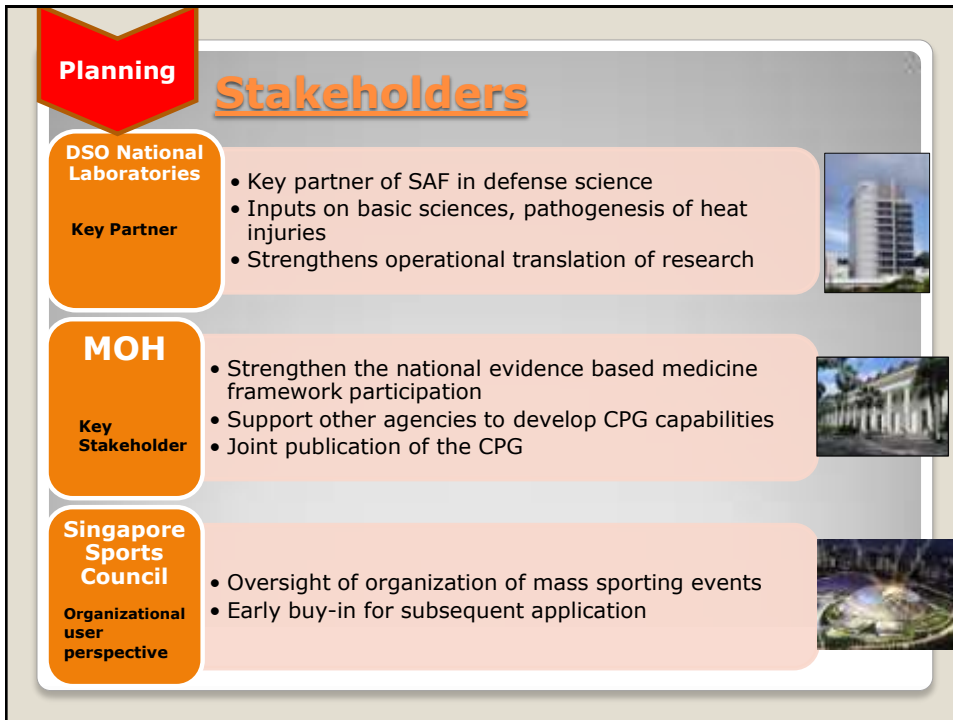
Key Stakeholder



- Ensures integrated clinical standards for care for its servicemen
- Shares its vast experience in managing heat injuries with at risk population
- Develops strategic capability of CPG development
- Challenge:
 - To review evidence surrounding existing practices
 - To provide realistic recommendations for general use

<http://www.moh.gov.sg/cpg>





Development

Adopted SIGN Approach

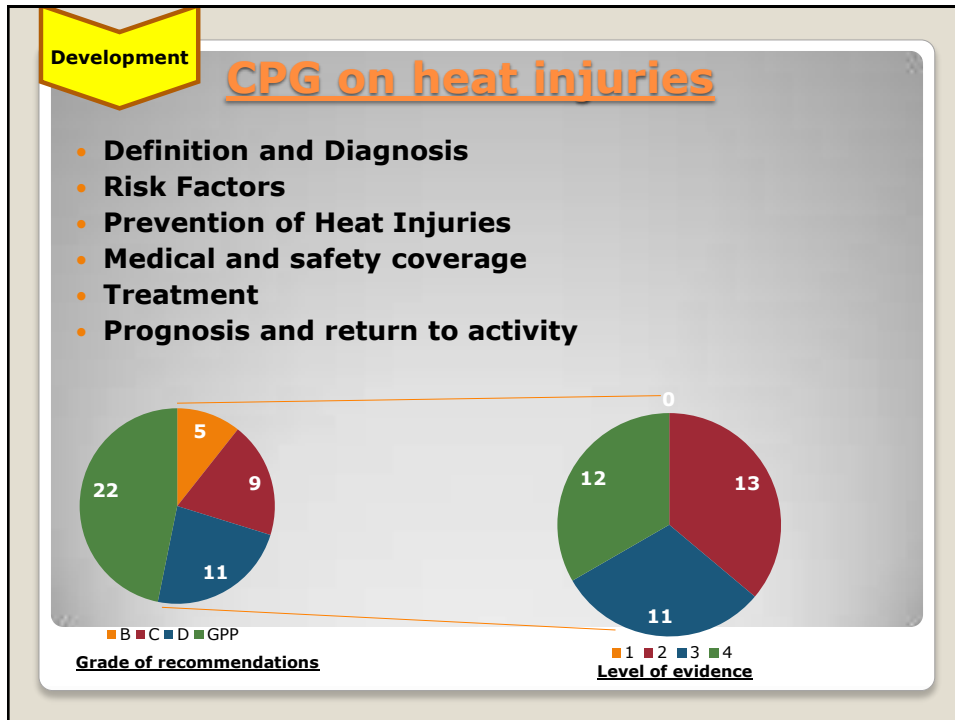
- Training**
 - MOH organised workshops to level up workgroup on evidence-based concepts and processes
- Literature review**
 - Comprehensive literature scanning
 - Distribution to workgroup for review
- Discussion**
 - Relevance to local context
 - Perspectives in terms of CPG process as well as clinical implications

Development

Adopted SIGN Approach

- Evidence-based Approach**
 - Apply level of evidence and grade of recommendation
 - 231 articles/publications as reference

Levels of evidence and grades of recommendation	
Levels of evidence	
Level	Type of Evidence
1 ⁺⁺	High quality meta-analyses, systematic reviews of randomised controlled trials (RCTs), or RCTs with a very low risk of bias.
1 ⁺	Well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias.
1 ⁻	Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias.
2 ⁺⁺	High quality systematic reviews of case control or cohort studies, High quality case control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal.
2 ⁺	Well conducted case control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal.
2 ⁻	Case control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal.
3	Non-analytic studies, e.g. case reports, case series.
4	Expert opinion.
Grades of recommendation	
Grade	Recommendation
A	At least one meta-analysis, systematic review of RCTs, or RCT rated as 1 ⁺⁺ and directly applicable to the target population, or A body of evidence consisting principally of studies rated as 1 ⁺ , directly applicable to the target population, and demonstrating overall consistency of results.
B	A body of evidence including studies rated as 2 ⁺⁺ , directly applicable to the target population, and demonstrating overall consistency of results, or Extrapolated evidence from studies rated as 1 ⁺⁺ or 1 ⁺ .
C	A body of evidence including studies rated as 2 ⁺ , directly applicable to the target population and demonstrating overall consistency of results, or Extrapolated evidence from studies rated as 2 ⁺⁺ .
D	Evidence level 3 or 4, or Extrapolated evidence from studies rated as 2 ⁺ .
GPP (good practice points)	Recommended best practice based on the clinical experience of the guideline development group.



Development

CPG on heat injuries

B Individuals involved in working in a high heat stress environment should undergo a heat acclimatisation regime over 10 to 14 days to improve body temperature regulation during heat exposure (pg 21).
Grade B, Level 2++

B Measure core body temperature with a rectal thermometer if available (pg 27).
Grade B, Level 2++

B Immersion in ice water may be done to manage exertional heat stroke occurring in young people, military personnel, and athletes (pg 28).
Grade B, Level 2++

B The use of iced peritoneal lavage and gastric lavage has yielded inconsistent results and is therefore not recommended (pg 30).
Grade B, Level 2++

B The use of pharmacologic agents has not been shown to accelerate body cooling in the treatment of heat stroke and is therefore not recommended (pg 30).
Grade B, Level 2++

The 'Weekly Cycle (Monthly)' bar chart shows body temperature regulation over time. The y-axis is labeled 'Body Temp (°C)' and the x-axis is labeled 'Target'. The chart shows a series of bars representing weekly cycles, with a target line indicating the desired temperature range.

A photograph of a rectal thermometer.

A photograph of a person sitting in a tank of ice water, illustrating the use of immersion in ice water for heat stroke management.

0.15 to 0.24°C/min

Photographs showing iced peritoneal lavage and gastric lavage, both marked with a large red 'X' to indicate they are not recommended.

Photographs of various pills and capsules, also marked with a large red 'X' to indicate they are not recommended for accelerating body cooling.

Development

CPG on Heat Injuries

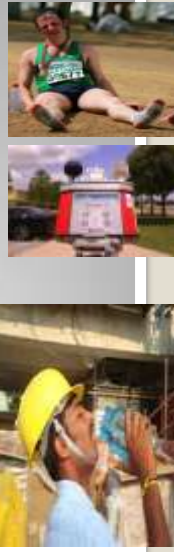
GPP A normal or lower presenting temperature should not exclude the diagnosis of heat stroke. If there is uncertainty differentiating between heat exhaustion and heat stroke, the patient should be promptly managed as for heat stroke (pg 15). **GPP**

GPP The use of wet-bulb globe temperature to assess environmental heat stress should be carefully calibrated, measured and interpreted in the local context (pg 17). **GPP**

C Individuals should drink to replace water loss of about 2% body weight and to quench thirst (pg 22). **Grade C, Level 2+**

D After exercise, continue to rehydrate at regular intervals until clear urine colour is achieved.^{137,143} **Grade D, Level 4**

C For rapid and complete recovery from dehydration, drink 1.5L of fluids for each kilogram of body weight loss after exercise.^{137,143,146} **Grade C, Level 2+**



Development


CPG on Heat Injuries

C Rapid cooling is desirable as decreasing body temperature to below 39°C within 30 minutes of presentation has been shown to improve survival (pg 28). **Grade C, Level 2+**

D Cooling by tap water and the application of ice packs can be used as the initial cooling methods prior to evacuating a heat injury patient to a medical facility.^{30,41,51,106,153,178,179} **Grade D, Level 3**

B Immersion in ice water may be done to manage exertional heat stroke occurring in young people, military personnel, and athletes (pg 28). **Grade B, Level 2++**

B The use of iced peritoneal lavage and gastric lavage has yielded inconsistent results and is therefore not recommended (pg 30). **Grade B, Level 2 ++**



Development

CPG on Heat Injuries


D For heat stroke patients, short acting benzodiazepines are generally effective in controlling seizures.^{18,32,55}
Grade D, Level 4

D In patients with hypotension that is refractive to intravenous therapy, vasopressors may be indicated, but should be used with caution because catecholamines can lead to increased heat production. In such patients, invasive hydrodynamic monitoring (e.g. central venous pressure) is indicated.^{32,209}
Grade D, Level 4

GPP Intravenous fluids and diuretics (e.g. mannitol at 0.25g/kg) help to maintain renal blood flow and may prevent renal destruction in heat stroke.^{32,210,211} Alkalinisation has been recommended for rhabdomyolysis and hemofiltration should be considered for severe cases.^{38,209,211,212}

D Disseminated intra-vascular coagulation is an indication of poor prognosis and should be managed with blood products for bleeding accordingly.^{38,41,213,214}
Grade D, Level 4

D Non Steroidal Anti-Inflammatory Drugs (NSAIDs) and paracetamol should be avoided in the treatment of exertional heat stroke as these may precipitate hepatic damage (pg 32).
Grade D, Level 4



Development

Endorsement by Network of Users

Endorsement

- Army Medical Services
- DSO National Labs
- MOH
- MOM
- Academy of Medicine
- Singapore Sports Council
- College of Family Physicians
- Sport Medicine Association
- Society for Emergency Medicine



November 2010

Application

Publication

- User friendly
- Hardcopy booklet and summary sheet
- On-line in MOH website

Official Launch

- Generate awareness in clinical community
- Pegged to CME
- Article publication in Singapore Medical Journal

Decentralised Adaptation of Various Agencies

- Areas to focus on:
- Layman interpretation
- Ministry of Manpower in their workman guidelines
- Organizers of sports events

Adaptation of CPG

RESTRICTED
**SAF
MEDICAL DIRECTIVES**
HM MEDICAL CORPS

PREVENTIVE MEDICINE PM - 23 REVISED 23 OCT 06

MANAGEMENT OF HEAT DISORDERS IN THE SAF

INTRODUCTION

1. Troops on training and operations are subject to heat loads because of environmental conditions and strenuous exercise which may give rise to heat disorders. Unit Medical Officers should understand the causes of heat disorders and be conversant with their recognition, management and prevention.


AIM

2. The aims of this directive are to provide to

- Types of heat disorders.
- Recognition, management and prevention.
- Reporting of heat disorders.
- Clinical protocol on the use of ECG.
- Maintenance of SCQA.

PHYSIOLOGY OF THERMOREGULATION

3. Human beings are able to keep their body temperature within a narrow range by means of various physiological processes.



SAFETY FRAMEWORK IMPLEMENTATION PLAN

TABLE 1 - IDENTIFY & ESTABLISH	TABLE 2 - CONSIDER THE ISSUES	TABLE 3 - IMPLEMENTATION
2006-2007	2008-2009	2010-2011
<ul style="list-style-type: none"> Identify heat stress hazards Identify heat stress risks Identify heat stress control measures Identify heat stress control measures Identify heat stress control measures 	<ul style="list-style-type: none"> Identify heat stress hazards Identify heat stress risks Identify heat stress control measures Identify heat stress control measures Identify heat stress control measures 	<ul style="list-style-type: none"> Identify heat stress hazards Identify heat stress risks Identify heat stress control measures Identify heat stress control measures Identify heat stress control measures

Challenges

- National-level leadership on performance monitoring and feedback
- Very different context of use, no “one-size fit all”
- Promulgation to lay-users and their adoption

