

GUIDELINES FOR MANAGEMENT OF HEAT ILLNESSES DURING HAJJ

Interim version for Hajj 1440H/2019G

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Note:

These guidelines are interim version prepared for Hajj season 1440H/2019G.

It will be disseminated through MoH healthcare facilities, which operates during Hajj and expected to manage heat illnesses.

Should you have any comment regarding these guidelines, do not hesitate to communicate with us through the centre's email: GCMGM@MoH.gov.sa

Kindly specify the title of the email to be (Heat Illnesses Guidelines)

ICD-10-CM codes

Diagnosis	Main ICD-10-CM CODE	Related ICD-10-CM codes
heatstroke and sunstroke	T67.0	T67.0XXA (initial encounter) T67.0XXD (subsequent encounter) T67.0XXS (sequela)
heat exhaustion, anhydrotic	T67.3	T67.3XXA (initial encounter) T67.3XXD (subsequent encounter) T67.3XXS (sequela)
heat exhaustion due to salt depletion	T67.4	T67.4XXA (initial encounter) T67.4XXD (subsequent encounter) T67.4XXS (sequela)
heat exhaustion, unspecified	T67.5	T67.5XXA (initial encounter) T67.5XXD (subsequent encounter) T67.5XXS (sequela)
Heat cramp	T67.1	T67.1XXA (initial encounter) T67.1XXD (subsequent encounter) T67.1XXS (sequela)
Heat syncope	T67.2	T67.2XXA (initial encounter) T67.2XXD (subsequent encounter) T67.2XXS (sequela)
Heat fatigue, transit	T67.6	T67.6XXA (initial encounter) T67.6XXD (subsequent encounter) T67.6XXS (sequela)
Heat edema	T67.7	T67.7XXA (initial encounter) T67.7XXD (subsequent encounter) T67.7XXS (sequela)

Mesh search keywords	Pilgrimage, Pilgrims, Hajj, Heatstroke , Heat Exhaustion, Mortality, Morbidity, Recommendations, Pathway, Heat, Mass Gathering
Related MoH guidelines	Heat Illnesses Guidelines, Draft https://www.MoH.gov.sa/en/Hajj/PublicationsAwareness/Publications/Documents/Heat-Illnesses-Guidelines.pdf
Guidelines voided by these guidelines	Heat illnesses guidelines, Draft https://www.MoH.gov.sa/en/Hajj/PublicationsAwareness/Publications/Documents/Heat-Illnesses-Guidelines.pdf
Date of the guidelines	July 2019
Date of expected review	February 2020
Type of the guidelines	Clinical Practice Guidelines (curative)
Targeted population	Patients with heat illnesses during Hajj particularly heatstroke
Targeted end users:	Medical and nursing staff managing patients with heat illnesses during Hajj, particularly heatstroke
Related KPI references	
Reference number of the guidelines	22
Number of recommendations	Prehospital management of suspected heatstroke In-hospital management of heatstroke
Number of pathways	3 Heat exhaustion Suspected heatstroke in prehospital settings Suspected heatstroke In-hospital settings
List of medications involved, hyperlinked to Micromedex	Isotonic crystalloid (0.9% Normal saline) https://www.micromedexsolutions.com/micromedex2/librarian/PFActionId/hcs.external.RetrieveDocument/ContentSetCode/DRUGDEX-EVALS/DocId/1192/topicId/dosingInformationSection/subtopicId/adultDosageSection# Benzodiazepines



	<p>https://www.micromedexsolutions.com/micromedex2/librarian/CS/613E83/ND_PR/evidencexpert/ND_P/evidencexpert/DUPLICATIONSHIELDSYNC/A07A73/ND_PG/evidencexpert/ND_B/evidencexpert/ND_AppProduct/evidencexpert/ND_T/evidencexpert/PFActionId/evidencexpert.IntermediateToDocumentLink?docId=347844&contentSetId=100&title=Lorazepam&servicesTitle=Lorazepam&topicId=null#</p> <p>Furosemide</p> <p>https://www.micromedexsolutions.com/micromedex2/librarian/CS/7E6F34/ND_PR/evidencexpert/ND_P/evidencexpert/DUPLICATIONSHIELDSYNC/2BAC7F/ND_PG/evidencexpert/ND_B/evidencexpert/ND_AppProduct/evidencexpert/ND_T/evidencexpert/PFActionId/evidencexpert.DoIntegratedSearch?SearchTerm=Furosemide&UserSearchTerm=Furosemide&SearchFilter=filterNone&navitem=searchGlobal#</p> <p>Mannitol</p> <p>https://www.micromedexsolutions.com/micromedex2/librarian/CS/E93A45/ND_PR/evidencexpert/ND_P/evidencexpert/DUPLICATIONSHIELDSYNC/08F714/ND_PG/evidencexpert/ND_B/evidencexpert/ND_AppProduct/evidencexpert/ND_T/evidencexpert/PFActionId/evidencexpert.DoIntegratedSearch?SearchTerm=Mannitol&UserSearchTerm=Mannitol&SearchFilter=filterNone&navitem=searchGlobal#</p> <p>Intravenous sodium bicarbonate</p> <p>https://www.micromedexsolutions.com/micromedex2/librarian/CS/3BFDED/ND_PR/evidencexpert/ND_P/evidencexpert/DUPLICATIONSHIELDSYNC/85CC4A/ND_PG/evidencexpert/ND_B/evidencexpert/ND_AppProduct/evidencexpert/ND_T/evidencexpert/PFActionId/evidencexpert.DoIntegratedSearch?SearchTerm=%20sodium%20bicarbonate&UserSearchTerm=%20sodium%20bicarbonate&SearchFilter=filterNone&navitem=searchGlobal#</p>
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I. List of abbreviations:

ARDS	Acute Respiratory Distress Syndrome
CDC	Centers For Disease Control And Prevention
CI	Confidence Interval
CINAHL	Current Nursing And Allied Health Literature
CPR	Cardiopulmonary Resuscitation
ECG	Echocardiogram
EMS	Emergency Medical Services
GRADE	Grading of Recommendations, Assessment, Development and Evaluations
ICU	Intensive Care Unit
INVS	Institut National De Veille Sanitaire
IV	Intravenous
Kcal	Kilo Calorie
KPIs	Key performance indicators
LoC	Level Of Consciousness
MoH	Ministry Of Health
°C	Degree Celsius
OR	Odds Ratio
RCTs	Randomized Controlled Trials
WHO	World Health Organization

II. Glossary

Heatstroke	hyperthermia associated with severe central nervous system abnormalities such as stupor, confusion or coma
Heat exhaustion	<i>Signs and symptoms:</i> intense thirst, weakness, discomfort, anxiety, dizziness, fainting, and headache. Core temperature may be normal, subnormal or slightly elevated (less than 40).
Evaporative Cooling	This is based on the physical principle that the conversion of 1.7 ml of water to a gaseous phase consumes 1 kcal of heat
Conductive Cooling	This is a direct transfer of heat down a temperature gradient from the body to cooler objects (e.g., ice) in direct contact with the skin
Acclimatization	An adaptive response to a hot environment in which an individual learns to tolerate exposure to excessive heat. This adaptation may take two to six weeks and includes physiologic adjustment of the cardiovascular, endocrine and renal systems

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1. Introduction:

Exposure to extreme heat in particular is a natural hazard that can affect the human health and is significantly linked to the occurrence of heat illnesses(1,2). These illnesses comprise a wide range of conditions that include mild and life-threatening manifestations such as heat cramps, heat exhaustion and heatstroke(3,4). Many individual and environmental risk factors are reported to play a major role in the frequency and intensity of these illnesses. Age, comorbidities, urbanization, lack of adaptive cooling measures, relative humidity and duration of exposure to heat are some of the known risk factors(5,6).

Extreme ambient temperature results in excess morbidity and mortality directly through causing new illnesses or exacerbating the pre-existing chronic diseases such as cardiovascular and respiratory diseases(1,2). The vulnerable populations also include elderly, children, women and those with low socioeconomic status.(5) Moreover, patients on certain medications such as antihistamines and antidepressants are more affected by ambient heat due to the medication's effect on the physiologic thermoregulation.(7,8) Thus, public health interventions should consider implementing risk mitigation measures and target the susceptible population in particular.

The Holy City of Makkah is a host of two annual Islamic rituals namely Hajj and Umrah. It is located at the western part of the Kingdom of Saudi Arabia and is characterized by a desert climate with extreme heat during daytime (despite the season) and scanty annual rainfalls. Heatstroke and heat exhaustion are leading causes of mortality and morbidity when the pilgrimage to Makkah enters in the hot cycle of the year(9,10). For example, in August 1985, among the 852,000 pilgrims, 2,134 were victim of heatstroke and 15,560 suffered from heat exhaustion (251 and 1826 per 100,000, respectively)(10). The mortality rate from heatstroke

exceeded 50% (1000 fatalities) in few days(10). Although heat exhaustion is a mild to moderate form of heat illness due to water and/or salt depletion, its signs and symptoms require management in EMS (Emergency Medical Services), thus resulting in major strain on the medical health system.

Epidemiological data suggest that the hot cycle associated with health outcome begins in May and would last up to the month of October(9,10). Thus, one can expect to see heat-related mortality and morbidity due to environmental heat exposure this year, as the pilgrimage has entered in the month of August. Therefore, a public health response that includes both preventative and therapeutic measures is paramount to influence outcome.

1.1 Scope and aim of the guidelines

These guidelines aim to provide evidence-based practical guidance for management of patients with heat illnesses during Hajj, particularly life-threatening heatstroke. The guidelines include recommendations that target adults who are at risk of developing heat illnesses during Hajj especially elderly and those with chronic illnesses. These recommendations are not intended to replace clinician's judgement when he or she is presented with a patient's unique clinical presentation. However, most of these recommendations are appropriate for patient with heat illnesses either in and/or outside hospital settings.

These guidelines update the MoH guidelines on the management of heat illnesses, which were drafted during 2016(11). The guidelines also provide clinical pathways for the management of heat illnesses during Hajj based on a review of the evidence, which was not available in the 2016 MoH draft.

The objectives of these guidelines are:

- to mitigate the heat related morbidity and mortality by providing evidence-based clinical practice guidelines regarding the management of heat illnesses during Hajj

1.2 Target audience

The guidelines target local policy-makers, clinicians and healthcare professionals responsible for providing health services during Hajj and managing patients with heat illnesses, particularly heatstroke either in and/or outside hospital settings. The recommendations in the guidelines would be also relevant to clinicians and healthcare professionals in the medical offices of pilgrims` countries who provide health services to their pilgrims. Other potential users include institutions for education of local health care workers.

2. Methods of developing the guidelines

2.1 Guidelines contributors:

MoH established three groups to develop these guidelines:

Group1 (Contributing Authors): MoH guidelines steering group to coordinate the guideline development process.

Group2 (Lead Authors): A guidelines development group composed of content experts including emergency physicians, intensivist and expert in heat illnesses, public health officials, researchers and academics, and representatives of the target audience. MoH selected members of the Guidelines Group based on relevant expertise but also considered appropriate representation of potential stakeholders from Hajj regions.

Group3: An independent external peer review group composed of technical experts to provide peer review of the guidelines will receive these guidelines for review. The updated list of external reviewers will be provided later on. Table 7.2.1 lists the contributors in each group.

2.2 Review of evidence

The MoH Steering Group, with the participation of the Guideline Group, determined the scope of the guidelines and identified nine questions in population, intervention, comparison,

and outcomes (PICO) format to guide the systematic search. PICO questions are shown in (Table 7.2.2). Moreover, the Guideline Group carried out a systematic search of the literature to address the currently available evidence and best practices regarding the management of heatstroke including cooling and hemodynamic support. During the past decade, little data is available addressing heatstroke management during Hajj as most of the relevant clinical research was found to be from 1980s and 1990s. Under those circumstances, the Guideline Group agreed to extend the search in order to include the available heatstroke management guidelines and adapt the applicable recommendations with Hajj context in order to develop these guidelines through compiling the best available evidence.

The background of these clinical practice guidelines includes an update of the 2007 guidelines for the management of heatstroke that Dr. Bouchama have prepared for the World Health Organization, which were based on a meta-analysis for the risks and protective factors of heatstroke(12). Other guidelines were also utilized including Wilderness Medical Society Practice Guidelines for the Prevention and Treatment of Heat Illness: 2019 Update, Consensus Statement- Prehospital Care of Exertional Heat Stroke, 2018 and the 2014 Evidence-Based Approach to Emergency Medicine; Heat Illness In The Emergency Department: Keeping Your Cool(13–15).

The methodology used is summarized in Box 1. These new guidelines incorporate updated literature search.

2.3 Quality of the evidence and strength of recommendations

The Guideline Group examined the quality of evidence and formulated the recommendations using the GRADE (Grading of Recommendations, Assessment, Development and Evaluations) methodology(16).

In the GRADE process, the quality of a body of evidence is defined as the extent to which one can be confident that the reported estimates of effect (desirable or undesirable) available

from the evidence are close to the actual effects of interest. The strength of the recommendations reflects the degree of confidence of the Guideline Group that the desirable effects (e.g. beneficial health outcomes) of the recommendations outweigh the undesirable effects (e.g. adverse effects)(16).

The applicable recommendations and best practices were adopted from the aforementioned guidelines and the original grading was converted to GRADE system. A detailed work on these guidelines will be provided on the first planned update.

The recommendations in these guidelines were graded into two categories based on GRADE system:

A strong recommendation is one for which the Guideline Group was confident that the desirable effects of adhering to the recommendation outweigh the undesirable effects.

A weak or conditional recommendation is one for which the Guideline Group concluded that the desirable effects of adhering to the recommendation probably outweigh the undesirable effects, but the Guideline Group was not confident about these trade-offs.

2.4 Deciding upon recommendations

With the coordination of the steering group, the guideline group met in Riyadh in April- June 2019. Video meetings were also utilized when needed. Systematic reviews and the available guidelines were presented at the meeting. Compilation of evidence, formulation of recommendations, and their relative strength were carried out. Full consensus was reached on all recommendations through email communication and follow up with group members. Had there been disagreement, the planned procedure was for the Guidelines Group to vote and accept the recommendation on a simple majority vote, with reporting of any objections. The Guidelines Group summarized the evidence to guide it through the process of developing

recommendations and to consider the quality of evidence. Table 7.2.3 summarizes the evidence and strength of recommendations.

The current document is an interim version for implementation during Hajj 1440H/2019G. An update with external review is expected to be carried out within 3-6 months after Hajj 1440H/2019G.

2.5 Funding

The development of these guidelines was carried out with no funding or influence from any internal or external organization and all participants were participating free.

2.6 Managing conflict of interest

Assessment of the potential conflicts of interests was carried out by the Head of Committee; upon nomination and selection of the Guidelines contributors. Afterwards, each participant reported verbally potential conflicts of interest at each panel meeting (with actions taken if necessary). Declarations of interests followed the WHO standards for declaration of interests(16).

3. Recommendations for the management of life-threatening heatstroke

3.1 Prehospital settings:

1. Measuring core temperature by rectal probe is recommended and the gold standard to confirm the diagnosis of heatstroke(13–15,17–19)

Strong

2. However, due to the Hajj context and the difficult to maintain patient privacy and hygiene in prehospital settings, the trend measured by any method of surface temperature (axillary, oral) could be an indicator or a precursor for core temperature(15)

Weak

3. Healthcare providers should keep a high degree of suspicion for heatstroke in prehospital settings during Hajj. A lower body temperature (<40C) in a suspected case of heatstroke presented with hyperthermia, severe CNS symptoms and exposure to extreme heat environment should not rule out heatstroke and immediate cooling should not be delayed(13,14,19)
Strong
4. Passive cooling should be started: move to a cooler place, lighten up clothing, initiate external cooling in situ and continue on route during transportation(13,14)
Strong
5. Ice packs should be applied to cover the entire body. If chemical cold packs are used, they should be applied to the cheeks, palms, and soles rather than the skin covering the major vessels, which is the known practice when ice packs are utilized(13,14)
Strong
6. Assess the ABCs and stabilize the patient as needed(13,14,19)
Strong
7. Literature showed that IV fluid of 1-2 liters is recommended in heatstroke cases to provide hemodynamic support(13,20)
Strong
8. Administration of 500 ml normal saline IV is recommended in case of hypotension. Further assessment is required to assess for the need of another 500ml (Expert opinion)
Weak
9. Transfer the patient as soon as possible to a heatstroke unit(13–15,19)
Strong

3.2 In-hospital settings:

1. Measuring core temperature by rectal probe is the most accurate and the gold standard in hospital settings to confirm the diagnosis of heatstroke(13–15,17–19)
Strong
2. The cooling method used should be the one with which the treating staff are most familiar. During Hajj, evaporative and convective cooling is recommended in the management of heatstroke(13–15,19)
Strong
3. The cooling technique within hospital settings during Hajj includes misting the patient with tepid water at 15°C while fanning the patient with air warmed to a temperature of 45°C to keep skin temperature around 30-33°C; thus increasing evaporation and convection cooling and avoiding vasoconstriction(13–15,19)
Strong
4. Stop cooling when rectal temperature is 39°C. There is no evidence of a specific endpoint temperature at which to halt cooling. A rectal temperature of $\leq 39^\circ\text{C}$ appears to be safe in terms of mortality in heatstroke but associated long term morbidity, particularly neurological, has not yet been established(13,19)
Strong
5. If there is pressure on the bed capacities, continue cooling until rectal temperature reaches 39.4°C. Close monitoring of the patient is needed(12,21)
Strong
6. Avoid the use of antipyretics for the treatment of heatstroke patients. No pharmacological treatment has been proved to be beneficial for treating heatstroke(13,19)
Strong
7. Currently, there is not enough evidence to support the use of Dantrolene as an adjunct therapy in HS. Therefore, the use of Dantrolene is ill-advised in clinical settings(13,19,21)

Strong

8. Heatstroke is a medical emergency, where LoC is expected to be reversed with treatment and abolish the need for intubation. There might be a need to consider airway protection and intubation in high-risk groups for aspiration(20)

Weak

9. For Hypotension and hemodynamic support: Literature showed that IV fluid of 1-2 liters is recommended in heatstroke cases to provide hemodynamic support(13)

9.1 Give isotonic crystalloid (normal saline) 1 liter then reassess for the need of more fluid and/or inotropes(Expert opinion)

Weak

9.2 Watch for signs of pulmonary edema(20)

Weak

9.3 Dopamine could be given peripherally if the patient is still hypotensive(Expert opinion)

Weak

9.4 Administering of norepinephrine centrally could also be considered after cooling if the patient is still hypotensive later on(Expert opinion)

Weak

10. For Rhabdomyolysis:

9.1 IV fluid administration with normal saline is the recommended management(22)

Weak

9.2 Mannitol, IV furosemide and IV sodium bicarbonate could be used beside volume expansion to prevent myoglobin induced renal injury, promote renal blood flow and diuresis(22)

Weak

9.3 Monitor urine output(20,22)

Weak

9.4 Monitor serum potassium and calcium and treat even modest hyperkalemia to prevent the occurrence of cardiac arrhythmia(20,22)

Weak

11. In case of associated seizure: Benzodiazepines are the recommended treatment(15,20)

Weak

12. Shivering could be pharmacologically managed with Benzodiazepines(20)

Weak

13. Post-cooling, provide supportive therapy as required for any associated organ/system dysfunction(13–15,19,20)

Strong

4. Research gaps:

During the review of evidence and the development of recommendations, several research gaps were identified. These include:

- Little data is available addressing heatstroke management during Hajj as most of the relevant clinical research was found to be from 1980s and 1990s.
- Analysis of all pilgrims` census data to assess the risk profiles, variation and susceptibility to develop heat illnesses.
- Time-series/ site-series analysis of heat induced morbidity
- Time-series/ site-series analysis of heat induced mortality (all cause and cause specific)

- RCTs addressing the safe cooling end-point temperature in heatstroke cases during Hajj and the outcome of developing long term CNS abnormalities.
- RCTs addressing the effect of specific volume expansion on the presentation, hospitalization and outcome of heatstroke patients during Hajj
- RCTs addressing the effect of specific inotropic medications on the presentation, hospitalization and outcome of heatstroke patients presented with hypotension during Hajj
- RCTs studying the effectiveness and cost-effectiveness of evaporative and convective cooling in managing of heatstroke during Hajj
- RCTs studying the effectiveness of surface temperature measurement as an indicator for core temperature in prehospital settings
- RCTs comparing ice packs and chemical ice packs for cooling in prehospital settings
- Hospital data analysis considering clinical presentation, risk factors, specific presentations such as rhabdomyolysis, patterns of hospitalization, outcome and cost of case management
- Impact of heat during Hajj on emergency transportation and referrals
- Assessment of shivering management in heatstroke cases during Hajj
- Assessment of seizure management in heatstroke cases during Hajj
- Assessment of rhabdomyolysis management in heatstroke cases during Hajj
- KAP studies among pilgrims on prevention measures of heat illnesses during Hajj
- Assessment of prognostic factors of survival among heatstroke cases during Hajj
- Assessment of biochemical presentation of heatstroke cases during Hajj

5. Publication, implementation & evaluation:

5.1 Publication

These guidelines would be submitted for publication after external reviewing and updating 3-6 months after 1440H/2019G Hajj.

5.2 Implementation

These guidelines are designed to be practical clinical guidelines addressing the Hajj context and considering the feasibility during Hajj, available resources and expected increase in heat illness presentations during Hajj. Moreover, the presented guidelines addresses management methods with which the treating staff are most familiar.

Simplified clinical pathways based on these guidelines were also developed to facilitate the improvement of heatstroke management. In addition, training courses based on these guidelines will be provided before Hajj to all healthcare workers expected to deal with heatstroke patients during Hajj including paramedics, nursing staff and physicians in prehospital and in-hospital settings to ensure holistic implementation.

5.3 Evaluation

A clinical audit research dedicated for heat illnesses namely heat exhaustion and heatstroke will be carried on during Hajj to evaluate the implementation of these clinical guidelines.

5.4 Future updating (minor – major)

We are planning to update these guidelines after evaluating the implementation during Hajj through the clinical audit. The availability of relevant scientific evidence will facilitate the update of these guidelines

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7. Annex

7.1 Annex 1: Boxes:

7.1.1 Box 1. Search strategy:

Databases: Medline, CINHAl, Cochrane, and Web pages WHO, European Center for Environment and Health, Institut National de Veille sanitaire (INVS), and CDC

Search terms: Heatstroke, sunstroke, heatstroke, and heat stress disorders

Inclusion criteria:

1. *Therapeutic studies:* Randomized controlled studies, observational studies (cohort or descriptive studies, case-control and case-series) involving more than seven patients. These studies analyzed adult and pediatric populations with classic or exertional heatstroke, subjected to cooling or hemodynamic treatment and reporting cooling time, hemodynamic responses, neurological morbidity or mortality as end-points.
2. *Systematic reviews:* addressing the management of heatstroke and the associated complications, rhabdomyolysis
3. *Clinical Practice Guidelines* for the management of heatstroke in prehospital and in-hospital settings.

Exclusion criteria:

1. Studies reporting only physiological, biochemical and/or immunological end-points (clinical chemistry, hormones, cytokine levels, immune cell responses);
2. Heat stress disorders such as occupational, or induced whole body hyperthermia;
3. Reviews, case reports and case series of less than seven patients;
4. Experimental studies using normal volunteers or animal models.

7.2 Annex 2: Tables:

7.2.1 Acknowledgment

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7.2.2 PICO questions

	Question type	Population, Patient problem	Intervention or Exposure	Comparison or Control	Outcome Measure
1	Diagnosis	In suspected patients of heatstroke during Hajj in Prehospital settings	Other surface methods such as axillary and oral	Rectal thermometer	Accurate for measurement of core temperature
2	Diagnosis	In suspected patients of heatstroke during Hajj in Prehospital settings	Rectal thermometer	Other surface methods such as axillary and oral	Applicable/feasible for measurement of core temperature in such settings
3	Therapy	In heatstroke patients during Hajj in the heatstroke units	39C	Lower or higher temperature like 38C, 37C, >39C	A safe endpoint temperature to halt cooling
4	Therapy	In heatstroke patients during Hajj in the heatstroke units	39C	Lower or higher temperature like 38C, 37C, >39C	Higher mortality rate
5	Therapy	In heatstroke patients during Hajj in the heatstroke units	39C	Lower or higher temperature like 38C, 37C, >39C	Higher long-term CNS morbidity
6	Therapy	In heatstroke patients during Hajj in prehospital settings	1-2 liters	More IV fluid	A safe amount of IV fluid
7	Therapy	In heatstroke patients during Hajj in the heatstroke units	1-2 liters	More IV fluid	A safe amount of IV fluid
8	Therapy	during Hajj In heatstroke patients suffering from shivering in the heatstroke units	Benzodiazepines		To manage shivering
9	Therapy	during Hajj In heatstroke patients suffering from seizure in the heatstroke units	Benzodiazepines		To manage seizure

7.2.3 Evidence of rationale and strength of recommendations

Topic	Recommendations	Original ACCP grading	Final grading by GRADE	Reference
Confirming diagnosis	<p>Measuring core temperature by rectal probe is the most accurate and the gold standard in hospital settings to confirm the diagnosis of heatstroke .</p> <p>Measuring core temperature by rectal probe is recommended and the gold standard to confirm the diagnosis of heatstroke . However, due to the Hajj context and the difficult to maintain patient privacy and hygiene in prehospital settings, the trend measured by any method of surface temperature (axillary, oral) could be an indicator or a precursor for core temperature.</p> <p>A lower body temperature (<40C) in a suspected case of heatstroke presented with hyperthermia, altered level of consciousness and exposure to extreme heat environment should not rule out heatstroke and immediate cooling should not be delayed.</p>	1B	Strong	Wilderness guidelines 2019 Bouchama 2007 Hosokawa 2018 Mazerole 2011 Belval 2018
Management	There are two main objectives in treating heatstroke: immediate cooling and support of organ systems, particularly cardiovascular			
	<p>Pre hospital setting</p> <p>Assess the ABCs and stabilize the patient as needed</p> <p>Methods of cooling pre hospital:</p> <p>Passive cooling should be started: move to a cooler place, lighten up clothing, initiate external cooling in situ and continue on route during transportation</p> <p>Ice packs should be applied to cover the entire body. If chemical cold packs are used, they should be applied to the cheeks, palms, and soles rather than the skin covering the major vessels</p> <p>Transfer the patient as soon as possible to heatstroke unit</p>	1B 1C	Strong Strong	wilderness guidelines, Bouchama 2007, Belval 2018
	<p>In hospital setting</p> <p>The cooling method used should be the one with which the treating staff are most familiar</p> <p>No evidence of one cooling technique superior to another. Non-invasive techniques that are easy to apply, well tolerated and less likely to cause cutaneous vasoconstriction are preferred.</p> <p>Evaporative and convective cooling is considered in classic heatstroke in the hospital setting.</p>	1C	Strong	Bouchama 2007, wilderness guidelines
When to stop cooling	<p>Stop cooling when rectal temperature is 39 C. if there is pressure on the bed capacities, continue cooling until rectal temperature reaches 39.4 C</p> <p>There is also no evidence of a specific endpoint temperature at which to halt cooling. A rectal temperature of ≤ 39 C appears to be safe in terms of mortality in heatstroke but associated long term morbidity, particularly neurological, has not yet been established</p>	1B	Weak Strong	Rosen Bouchama 2007, wilderness guidelines



Other methods of cooling	Avoid the use of antipyretics and dantrolene for the treatment of heatstroke patients. No pharmacological treatment has been proved to be beneficial for treating heatstroke	2B	Strong	Bouchama 1991, wilderness guidelines, bouchama 2007
When to intubate	Heatstroke is a medical emergency, where LoC is expected to be reversed with treatment and abolish the need for intubation. There might be a need to consider airway protection and intubation in high-risk groups for aspiration Carefully consider the need for intubation in heatstroke patients who are unable to protect their airways to prevent aspiration and provide airway support		Weak	Rosen emergency medicine textbook
Resuscitation/ volume expansion and management of hypotension	1-2 liters of Normal Saline is recommended. Most physiological changes will go back to normal with cooling. In prehospital settings: Administration of 500 ml normal saline IV is recommended in case of hypotension. Further assessment is required to assess for the need of another 500ml In-hospital settings: Give isotonic crystalloid (normal saline) 1 liter then reassess for the need of more fluid/ inotropes (expand blood volume and manage hypotension). Assess for signs of pulmonary edema Dopamine could be given peripherally if the patient is still hypotensive. Administering of norepinephrine centrally could also be considered after cooling if the patient is still hypotensive later on.	Expert opinion	Weak	Rosen
		1B	Strong	Wilderness guidelines
		Expert opinion	Weak	Agreed upon with Dr. Bouchama through video call
For rhabdomyolysis	<ul style="list-style-type: none"> IV fluid administration with normal saline is the recommended management. Mannitol, IV furosemide and IV sodium bicarbonate could be used beside volume expansion to prevent myoglobin induced renal injury, promote renal blood flow and diuresis Monitor urine output Monitor serum potassium and calcium and treat even modest hyperkalemia to prevent the occurrence of cardiac arrhythmia 	Expert opinion	Weak	Rosen Emergency medicine evidence 2014 Agreed upon with Dr. Bouchama through video call Scherman 2013 systematic review
For cooling induced shivering	Shivering could be pharmacologically managed by Benzodiazepines		Weak	Rosen
For seizure	In case of associated seizure: Benzodiazepines are the recommended treatment.		Weak	Rosen. Agreed upon by the committee members. Emergency medicine evidence 2014
Prevention				



Prevention	<ul style="list-style-type: none">• Screen for significant preexisting medical conditions especially among elderly: 1B.• Minimize use of medications that would limit the thermoregulatory response especially psychotropic medications: 1C.• Recognize that a larger body habitus is associated with greater risk: 1C.• Ensure ongoing rehydration with a “drink to thirst” approach: 1B.• Consider previous history of heat injury as a reversible risk factor for recurrence: 1C.	1B, 1C	Strong	Wilderness guidelines, bouchama 2007, Bouchama 2007 Alkot 2016, Abdelmoety 2018, Albardi 2016, schmeltz 2015, Ito 2018, Khan 2017,
Other gaps	<ul style="list-style-type: none">• Clinical and epidemiological research including RCTs and systematic reviews should be encouraged during Hajj to provide high level of evidence for disease specific management including heatstroke• Specific disease registry is needed to facilitate research and guide medical management, prevention and health resource allocation • Heat early warning system is required during Hajj and Umrah MG when it coincides with heatwaves and summer season to facilitate evidence based prevention and resource allocation			Bouchama 2007, schmeltz 2015, Ito 2018, Khan 2017

7.2.4 Medications associated risks during heat exposure

Drug Class	Mechanisms	Examples
Anticholinergics	Inhibit sweating	Antihistamine, antipsychotic, antispasmodic, antidepressant, and antiparkinson preparations
Antipsychotics	Inhibit sweating Affect central thermoregulation Slow efferent responses (cutaneous vasodilatation)	Haloperidol, chlorpromazine Clozapine
Sympathomimetics	Increase heat production (motor activity) Peripheral vasoconstriction (decrease cutaneous blood flow)	Over-the-counter nasal decongestants (ephedrine, pseudo-ephedrine, phenylephrine) Appetite-suppressing drugs, amphetamines, and cocaine
Cardiovascular	Decreased blood volume Peripheral vasodilation (potentiate effects of heat-induced dehydration) Bradycardiac (interfere with cardiovascular response during heat stress)	Diuretics Nitrates, calcium channel blockers Beta blockers
Drugs with narrow therapeutic index	Increased toxicity (heat-induced dehydration and changes in blood volume can influence drug's level, kinetics and excretion)	Digoxin Lithium
Drugs that needs specific storage at temperature $\leq 25^{\circ}\text{C}$	Exposure of drugs to high temperature can affect adversely drug licensed to be stored at $\leq 25^{\circ}\text{C}$	Storage temperature of all drugs particularly emergency drugs should be checked and kept at proper temperature during heat wave

7.2.5 Mechanisms, diagnostic and treatment of mild to moderate heat illnesses

Medical Condition	Signs & Symptoms Mechanisms	Management
Heat rash	<p>Small red papules, itchy, in face, neck, upper chest, under breast, groin and scrotum areas.</p> <p>Affect any age but prevalent in young children. Infection with staphylococcus can occur.</p> <p>Attributed to heavy sweating during hot and humid weather</p>	<ul style="list-style-type: none"> • Rash subsides with no specific treatment. • Minimize Sweating by staying in an air-conditioned environment, taking frequent showers and wearing light clothes. • Keep the affected area dry. <p>Topical antihistamine and antiseptic preparations can be used to reduce discomfort and prevent secondary infection.</p>
Heat edema	<p>Edema of the lower limbs, usually ankles, appearing at the start of hot season.</p> <p>Attributed to heat induced peripheral vasodilatation, and retention of water and salt.</p>	<ul style="list-style-type: none"> • Treatment is not required, edema usually subsides following acclimatization. • Diuretics are not advised.
Heat syncope	<p>Brief loss of consciousness or orthostatic dizziness. Common in patients with cardiovascular disease or taking diuretics, before acclimatization takes place.</p> <p>Attributed to dehydration, peripheral vasodilatation and decreased venous return resulting in reduced cardiac output.</p>	<ul style="list-style-type: none"> • Rest in cool place. • Place the patient in supine position and elevate legs and hips to increase venous return <p>Rule out other serious cause of syncope</p>
Heat cramps	<p>Painful muscular spasms, most often in the legs, arms or abdomen; usually occur at the end of sustained exercise.</p> <p>Attributed to dehydration, loss of electrolytes through heavy sweating, and muscle fatigue.</p>	<ul style="list-style-type: none"> • Immediate rest in a cool place. • Muscle stretching and gentle massage. • Oral rehydration with a solution containing electrolytes. • Medical attention should be sought if heat cramps are sustained for more than one hour.
Heat exhaustion	<p>Intense thirst, weakness, discomfort, anxiety, dizziness, fainting, and headache. Core temperature may be normal, subnormal or slightly elevated (less than 40°C).</p> <p>Pulse is thready with postural hypotension and rapid shallow breathing.</p> <p>No mental status alteration</p> <p>Attributed to water and/or salt depletion resulting from exposure to high environmental heat or strenuous physical exercise.</p>	<ul style="list-style-type: none"> • Move to a cool shaded milieu, or if available to air-conditioned place. • Undress the patient, apply cold wet sheet or vaporized cold water, and fanning if available. Airflow from the fan should be directed to the patient. • Place the patient in supine position and elevate legs and hips to increase venous return. • Start oral hydration. However, if nausea, consider intravenous hydration with isotonic crystalloid (normal saline) • Transfer to hospital, if mental status alteration, sustained hypotension, or increase in body temperature.

7.2.6 Prehospital management of life threatening heatstroke (Summary table)

Condition	Intervention	Goal
Prehospital		
Exposure to heat stress (heat wave, summer season and/or strenuous exercise)	Measure core temperature (rectal probe is recommended but other methods such as oral and axillary could be utilized as alternatives. These will provide an indicator for the on-scene assessment and more practical at Hajj and Mass Gathering context compared to rectal probe.	Diagnosis of heatstroke*
	<p>If > 40 °C , move to a cooler place, remove clothing, initiate external cooling†: cold packs on the neck, axillae and groin, continuous fanning (or keep ambulance windows open)</p> <p>Use of chemical Ice packs is the recommended method in pre-hospital settings and transfer (ambulance). Apply chemical ice packs on cheeks, palms and soles</p>	<p>Lower core temperature as low as 39°C</p> <p>Promote cooling by conduction, maintain currents of air</p> <p>Promote cooling by evaporation</p>
Changes in mental status (anxiety, delirium, seizures, coma)	Assess the ABCs and stabilize the patient as needed	Minimize risk of aspiration
	Position unconscious patients on their side and clear airway	
	Administer oxygen 4 L/min	Increase arterial oxygen saturation to > 94%
	Administration of 500 ml normal saline IV is recommended in case of hypotension. Further assessment is required to assess for the need of another 500ml	Volume expansion
	Rapidly transfer to an emergency department	

7.2.7 In-hospital management of life threatening heatstroke (Summary table)

Condition	Intervention	Goal
In-hospital		
Hyperthermia	<p>Confirm diagnosis with thermometer calibrated to measure high temperatures (40 to 47°C)</p> <p>Monitor skin and rectal temperature continuously, if available or every 10 min , if not</p> <p>Continue cooling</p>	<p>Keep skin temperature >30 °C</p> <p>Stop cooling when rectal temperature is <39 °C and 39.4 °C , if there is pressure on the cooling beds ‡</p>
Seizures	Benzodiazepines	Control seizures
Shivering	Benzodiazepines	Manage shivering
Respiratory failure	Heatstroke is a medical emergency, where LoC is expected to be reversed with treatment and abolish the need for intubation. There might be a need to consider airway protection and intubation in high-risk groups for aspiration	Protect airway, augment oxygenation (arterial oxygen saturation to > 90%)
Hypotension§	<p>Most physiological changes will go back to normal with cooling.</p> <ul style="list-style-type: none"> Give isotonic crystalloid (normal saline) 1 liter then reassess for the need of more fluid/ inotropes (expand blood volume and manage hypotension). Assess for signs of pulmonary edema Dopamine could be given peripherally if the patient is still hypotensive. Administering of norepinephrine centrally could also be considered after cooling if the patient is still hypotensive later on. 	Increase mean arterial pressure>60 mm Hg, restore organ perfusion and tissue oxygenation, (consciousness, urinary output, lactate level)
Rhabdomyolysis	Expand volume with normal saline, intravenous furosemide and mannitol	Prevention of myoglobin induced renal injury: Promote renal blood flow and diuresis.
	Intravenous sodium bicarbonate.	Urine alkalinization
	Monitor serum potassium and calcium and treat even modest hyperkalemia.	Prevent cardiac arrhythmia
Post-cooling		
Multiple organ system dysfunction	non-specific supportive therapy	Recovery of organ function

Source, reference [5]

Diagnosis of heatstroke should be suspected in any patient with mental status changes during heat stress even if the temperature is $< 40^{\circ}\text{C}$.

†No evidence of one cooling technique superior to another. Non-invasive techniques that are easy to apply, well tolerated and less likely to cause cutaneous vasoconstriction are preferred.

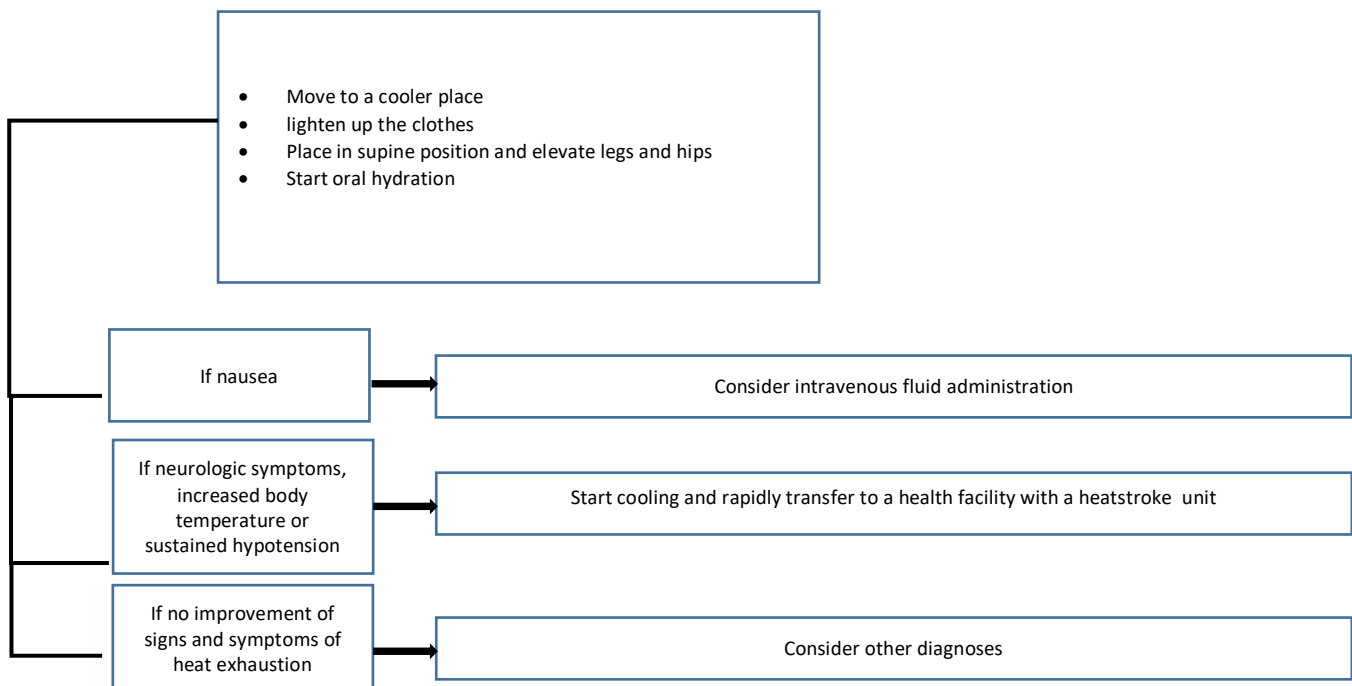
‡There is no evidence to support a specific endpoint temperature at which to halt cooling. However, a rectal temperature of 39°C has been used in large series and proved to be safe. Although a lower temperature to halt cooling would be more advisable taking into consideration the possible neural damage with higher than normal temperature, in these guidelines, the target temperature to halt cooling suggest 39°C . Cool the patient to $< 39.4^{\circ}\text{C}$ if there is a rush of patients and immediate need of cooling bed. Otherwise, it is advisable to continue cooling until rectal temperature of 39°C is reached.

§Hypotension usually responds to volume and cooling. Vasodilatory shock and primary myocardial dysfunction may underline sustained hypotension refractory to volume expansion. Therapy should be individualized and guided by clinical response.

7.3 Clinical Pathways

7.3.1 Clinical Pathway for the Management of Suspected Heat Exhaustion

Clinical pathway for management of suspected heat exhaustion



7.3.2 Clinical Pathway for the Management of Suspected Heatstroke: Prehospital Settings

Clinical pathway for management of **SUSPECTED HEATSTROKE** (Prehospital settings) RASC and T

- Adhere to your BSIs
- Do NOT give medications
- Take full prehospital report (e.g. if IVF was given, documented temperature...)
- Stay in contact with online medical officer during management and on route

RECOGNIZE based on clinical presentation:

- Exposure to extreme environmental heat
 - Mental Status alteration
 - Core Body temperature > 40°C *

Consider other differential diagnosis

REMOVE from heat and lighten up clothes

ASSESS:

- Responsiveness (**AVPU**)
- Vital signs (TEMPERATURE, HR, SO2, GLUCOSE, BP)

STABILIZE (ABCs)

AIRWAY: Position unconscious patients on their side or elevate the head and clear airway (minimize the risk of aspiration)

BREATHING: administer oxygen to keep SaO2 >94
N.B heatstroke is expected to present with altered pattern of breathing

CIRCULATION: Give isotonic crystalloid (normal saline) 500 ml then reassess for the need of another 500 ml if the patient is still hypotensive (expand blood volume and manage hypotension)

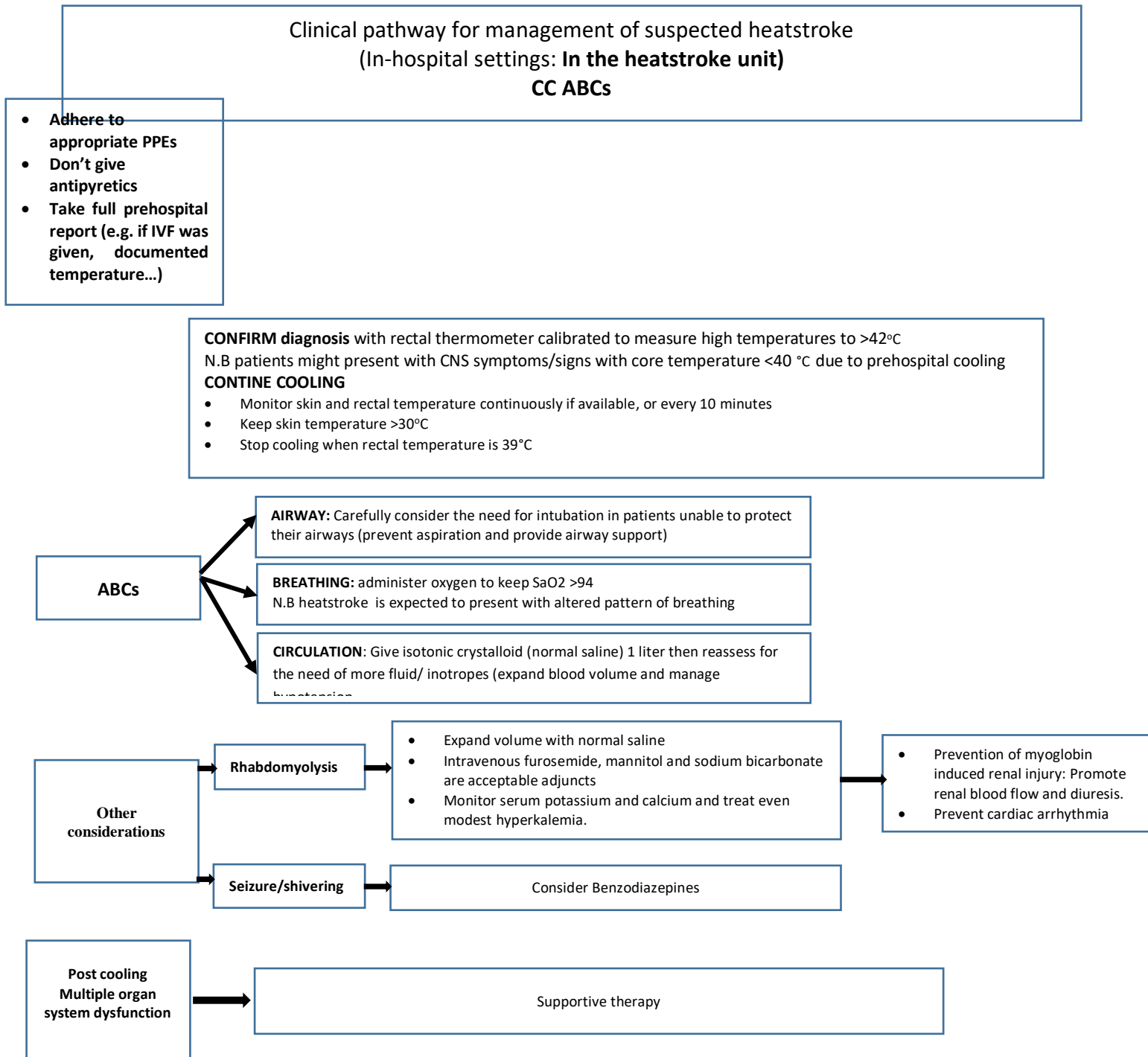
COOLING

- **Should be started immediately on scene and not to be delayed**
- apply ice packs/chemical ice packs, fanning, apply wet sheets to the skin, keep ambulance cold with air-condition
- continue cooling on route to heatstroke unit

TRANSFER

- **TRANSFER** immediately to heatstroke unit

7.3.3 Clinical Pathway for the Management of Suspected Heatstroke: In-hospital Settings



7.4 Annex 3: Major Heat Illnesses Registry Data Sheet

Inclusion:

All major HRI patients suspected or confirmed during Hajj season in the Holy Sites. It is a clinical diagnosis; any hyperthermic patient with history of heat exposure with high suspicion of heat exhaustion/heatstroke will be included.

Hospital: _____

Date: _____

Patient Biodata:

1	Age		
2	Gender	Male	Female
3	Nationality		
4	Country of origin		
5	Country of residence		
6	Hospital ID		



Chronic diseases:

1	Diabetes	8	Liver Failure
2	Ischemic Heart Disease	9	Hepatitis
3	Heart Failure	10	Neurologic disorders:
4	Hypertension	11	Sickle cell disease
5	Kidney Failure	12	Viral illnesses
6	Thyroid Disorder:	13	Psychiatric Illness
7	Skin Disorder:	14	Other: (Specify)

Medication:

1	Anticholinergics	7	Diuretics
2	Antidepressants	8	Laxatives
3	Antihistamines	9	Thyroid agonists
4	Antipsychotics	10	Sympathomimetics
5	Benzodiazepines	11	Neuroleptics
6	Beta blockers	12	Others:
7	Calcium channel blockers		

Transportation by:

1	SRCA	2	MoH	3	Others:
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Presentation times:

		Time	AM / PM
1	Calling Time	:	
2	Scene Arrival Time	:	
3	Hospital Arrival Time	:	

Prehospital assessment:

at the first encounter with the patient

HR	BP	O2 Sat	AVPU	Temp	Blood sugar
	/				
Mental Status			Conscious	Disoriented	Comatose
Sweating status		Profuse sweating	Sweating	Anhidrosis	Unknown/Missed

Prehospital management:

	No	Yes	Explain
IV fluids			How much? _____ ml NS
Cooling initiated at the scene			Fan with sprayed water Ice packing Wet towels
Airway management			Basic / Advanced Airway

In-hospital vital signs:

The first measurement of vitals in the triage:

HR	BP	O2 Sat	AVPU	Temperature	Blood sugar
	/				
Mental Status			Conscious	Disoriented	Comatose

Respiratory Pattern	Normal	Tachypneic	Agonal	Apneic	Cheyne-stokes
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Oximetry utilized to measure O2 Sat:

Earlobe probe measurement	Finger probe measurement	SPo2 in the First VBG/ABG
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Presentation upon ED arrival:

		Yes	No
1	Altered mental status		
2	Seizure		
3	Shivering		
4	Ataxia		
5	Cardiac arrest		
6	Focal CNS abnormality on physical examination		
7	Vomiting or loose stool		
8	Others:		

In-hospital management:

	No	Yes	
IV fluids			_____ ml NS over the 1 st four hrs
Cooling continued in ED			Ice packs Fan with sprayed water
Was the patient covered?			Partial Complete
Intubation			
Antibiotics			
Benzodiazepines			for shivering for seizure
Inotropes via			peripheral central line
Diuretics			Furosemide Mannitol
Sodium bicarbonate			
Hemodialysis			

Active Cooling time:

		Time	AM / PM
1	Cooling time initiated	:	
2	Cooling time stopped	:	
3	develop shivering after the cooling (if yes specify the time)	:	
4	Has vomiting or loose stool after the cooling (if yes specify the time)	:	

Did the patient developed desaturation during the cooling (pulse oximeter: earlobe or finger probe less than 94% or not readable)

If yes, fill the following

Time of desaturation :	Earlobe measurement	Finger probe measurement	SPo2 in the ABG
---------------------------	---------------------	--------------------------	-----------------

Target cooling end-point

39	39.4	Others (Specify):
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Series of vitals and VBG readings:

Time	HR	BP	O2 Sat	AVPU	Temperature	Blood sugar
2 hours after cooling		/				
6 hours after cooling		/				
24 hours after cooling		/				
At disposition		/				

Time	PH	Po2	PCo2	HCo3
2 hours after cooling				
6 hours after cooling				
24 hours after cooling				
At disposition				

Investigations

	At presentation :	:	:	Prior Disposition :	24 hours after cooling :
WBC					
Hb					
Platelets					
Urea					
Creatinine					
Na					
K					
Cl					
Ca					
Mg					
PO4					



pH					
Lactic Acid					
PCO2					
HCO3					
PT					
PTT					
INR					
CK					
Troponin					
ProBNP					
AST					
ALT					
LDH					
Urine Myoglobin					
ECG					
CXR					
CSF findings (if was done)					

Data Collector:

ID:

Post cooling late complications:

Rhabdomyolysis	Brain edema
Coagulopathy	ARDS
Acute kidney injury	Heart failure / pulmonary edema
Liver failure	Electrolytes imbalance

Considered differential diagnoses:

1	Sepsis: _____	9	Thyroid storm
2	Meningitis / Encephalitis	10	Pheocromocytoma
3	Ischemic Stroke	11	Malignant hyperthermia
4	Intracerebral Hemorrhage	12	Neuroleptic malignant syndrome
5	Malaria	13	Serotonin syndrome

6	Seizure	14	Sympathomimetic poisoning
7	Diabetic ketoacidosis	15	Anticholinergic poisoning
8	Withdrawal syndromes: (specify)	16	Others _____

ED disposition:

1	Ward Admission	Number of days	
2	ICU Admission	Number of days	

Outcome:

1	Admitted then Discharged
2	Deceased
3	Transferred
4	Discharged against medical advise

Neurological outcome:

1	Good
2	Fair
3	Impaired