IN THE CORONERS COURT
OF VICTORIA
AT MELBOURNE

Court Reference: COR 2016 6011

FINDING INTO DEATH WITHOUT INQUEST

Form 38 Rule 60(2)
Section 67 of the Coroners Act 2008

Findings of:	**IAIN TRELOAR WEST, DEPUTY STATE CORONER**
Deceased:	Alexander Sheng Wei LI
Date of birth:	10 October 1999
Date of death:	22 February 2016
Cause of death:	**1a HEAT RELATED ILLNESS IN AN INDIVIDUAL WITH ENTEROVIRUS D68 INFECTION**
Place of death:	Plumbago Station, Olary Province, 5434 South Australia

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THE PURPOSE OF A CORONIAL INVESTIGATION

1. Alexander Li's death constituted a '*reportable death*' under the *Coroners Act 2008* (Vic) (**the Act**), as the death occurred in Victoria, and appeared to be unnatural and unexpected.[1]

2. The jurisdiction of the Coroners Court of Victoria is inquisitorial.[2] The Act provides for a system whereby reportable deaths are independently investigated to ascertain, if possible, the identity of the deceased person, the cause of death and the circumstances in which death occurred.[3]

3. It is not the role of the coroner to lay or apportion blame, but to establish the facts.[4] It is not the coroner's role to determine criminal or civil liability arising from the death under investigation, or to determine disciplinary matters.

4. The expression '*cause of death*' refers to the medical cause of death, incorporating where possible, the mode or mechanism of death.

5. For coronial purposes, the circumstances in which death occurred refers to the context or background and surrounding circumstances of the death. Rather than being a consideration of all circumstances which might form part of a narrative culminating in the death, it is confined to those circumstances which are sufficiently proximate to be considered relevant to the death.

6. The broader purpose of coronial investigations is to contribute to a reduction in the number of preventable deaths, both through the observations made in the investigation findings and by the making of recommendations by coroners. This is generally referred to as the '*prevention*' role.

7. Coroners are also empowered:

   (a) to report to the Attorney-General on a death;

   (b) to comment on any matter connected with the death they have investigated, including matters of public health or safety and the administration of justice; and

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[1] Section 4 *Coroners Act 2008*.
[2] Section 89(4) *Coroners Act 2008*.
[3] See Preamble and s 67, *Coroners Act 2008*.
[4] *Keown v Khan* (1999) 1 VR 69.

(c) to make recommendations to any Minister or public statutory authority on any matter connected with the death, including public health or safety or the administration of justice. These powers are the vehicles by which the prevention role may be advanced.

8. All coronial findings must be made based on proof of relevant facts on the balance of probabilities. In determining these matters, I am guided by the principles enunciated in *Briginshaw* v *Briginshaw*.[5] The effect of this and similar authorities is that coroners should not make adverse findings against, or comments about, individuals unless the evidence provides a comfortable level of satisfaction that they caused or contributed to the death.

9. In conducting this investigation, I have made a thorough forensic examination of the evidence including reading and considering the witness statements and other documents in the coronial brief.

MATTERS IN RELATION TO WHICH A FINDING MUST, IF POSSIBLE, BE MADE

Identity of the Deceased, pursuant to section 67(1)(a) of the Act

10. On 22 February 2016, Mr Nicholas Green identified the deceased to be Alexander Sheng Wei Li, born 10 October 1999.

11. Identity is not in dispute and requires no further investigation.

Medical cause of death, pursuant to section 67(1)(b) of the Act

12. On 25 February 2016, Forensic Pathologist Dr Stephen Wills from the Forensic Science Centre in South Australia performed an autopsy on Alexander and provided a written report of his findings. His major pathological findings were;

(a) Marked pulmonary congestion, oedema and acute intra-alveolar haemorrhage.

(b) Bilateral pleural effusions

(c) Epicardial coarse and petechial haemorrhages.

(d) Intramyocardial micro haemorrhages and intravascular platelet-rich thrombi.

(e) Swollen brain with nonspecific APP immunoreactivity

(f) Enterovirus D68 detected on tracheal swab

[5] (1938) 60 CLR 336.

13. The heart demonstrated epicardial haemorrhages and specialist examination confirmed epicardial petechial haemorrhages, myocardial congestion with focal intramyocardial haemorrhages, isolated focus of myocyte necrosis within the left ventricle and platelet rich fibrin thrombi within some intramyocardial vessels. No pre-existing cardiac pathology was identified. The features could potentially be accounted for by underlying disseminated intravascular coagulopathy.

14. Analysis of post mortem sample of vitreous fluid showed slightly raised urea and creatinine, raising the possibility of an element of early renal impairment/failure. There was no evidence of significant dehydration. Toxicological analysis was non-contributory for any alcohol or any other common drugs or poisons.

15. Dr Wills further stated that it was not possible to identify a definitive anatomical cause for the death at post mortem. However, the combination of clinical and pathological features which were identified, strongly raises the possibility that this was a heat related death which would include heatstroke, the most severe manifestation of heat related illness. However, because an ante-mortem body temperature was not recorded, a definitive diagnosis of heatstroke could not be confirmed. The autopsy features which may be seen in heat related deaths up to and including fatal heatstroke are nonspecific. Changes which may be seen during heatstroke and which were identified in Alexander included; brain swelling, features of disseminated intravascular coagulopathy, epicardial haemorrhages and focal myocyte necrosis, pulmonary oedema, congestion and intra alveolar haemorrhage. The National Association of Medical Examiners has recommended that a death be classified as heat related where exposure to a high ambient temperature either caused or contributed to the death.

16. In addition, Alexander suffered from an enterovirus D68 infection. This is a virus that may affect the respiratory tract and result in diseases ranging from mild upper respiratory tract infections, asthma like symptoms through to severe pneumonia and is more common amongst younger people. Alexander's complaints of fatigue and generalised pain could be accounted for at least in part by the infection. Pyrexia resulting from this viral infection may also have contributed, in combination with environmental and exertional factors to the heat related illness which appears most likely to have resulted in his death.

17. Dr Wills concluded that a reasonable cause of death was;

1 (a) HEAT RELATED ILLNESS IN AN INDIVIDUAL WITH ENTEROVIRUS D68 INFECTION

Circumstances in which the death occurred, pursuant to section 67(1)(c) of the Act

18. Alexander Li was a 16-year old boy who resided in Mount Waverley with his parents, Mrs Xiao Jing (Elly) Wei and Mr Yinei Li.

19. Alexander was a year 11 student at Hungtingtower School. Each year, Huntingtower holds a school camp for year 11 students conducted at the Plumbago Station in South Australia. This is a working sheep and cattle station in a remote area which is known to be subject to harsh climate conditions and high heat during summer periods. The school has conducted the camp at this location for almost 40 years and it involves students spending a week at the camp site whilst walking approximately 50-60 kilometres. The objective of the camp is to offer students a unique and challenging experience which includes leadership and team building. Whilst the camp is not compulsory, Principal Sholto Bowen indicated that as the program is part of the Hungtingtower curriculum, '*there is an expectation that students attend camps.*'

20. According to school documents, student preparation for the camp commences the year prior to attending. A 'Student Preparation Booklet' and a 'Nutrition Booklet' were provided to students as well as an itinerary. A training walk for the students was held on 1 February 2016 and an information evening for the parents was held on 3 February. In a joint statement, Mr Li and Mrs Wei explained that they were not informed of the level of risk involved in the excursion, only that the conditions would be tough. It is notable that there is no specific or detailed information in the Student Preparation booklet relating to heat exposure and physical activity during temperatures of high heat.

21. Alexander was described as having a stocky build and was not known to be particularly physically active. Medical records obtained from General Practitioner Dr Michael Zheng indicate that Alexander was diagnosed with asthma in 2009 and was provided with an inhaler in 2015. No severe asthma incidents were noted. There were also no medical matters listed for Alexander in the week leading up to his camp. Alexander's medical records at Huntingtower reference him suffering from allergies to dust and pollen but asthma was not recorded. In addition. the medical report for the school camp as filled out by his parents did not record asthma as a pre-existing condition.

22. On 20 February 2016, 78 students and 29 staff members set off for Plumbago Station via bus where they were to remain until 27 February. Also present were seven support vehicles. That evening, staff and students remained overnight at Hattah Lakes. On 21 February, the staff and students travelled to Plumbago Station, arriving at 4pm. Notable staff members present on this trip included Year 11 Coordinator Mr William Hill, Outdoor Education Instructors Mr Luke Fitz-Gerald and Ms Hayley Forster, Camps Coordinator Mr Nicholas Green, Assistant Trip Leader Mr Peter Chambers and Staff Support Member Mr Matthew Brown.

23. The Plumbago Expedition is managed by a Risk Management Policy as well as consultation with the outdoor education staff to determine whether activities are suitable for extreme weather conditions. The nearest township to Plumbago Station is Mannahill. This area is serviced by volunteer ambulance members based in Yunta, a distance of 42km from Mannahill, and the Royal Flying Doctor Service. Principal Bowen stated that in the approximate 40 year history of the camp at Plumbago, they have only been required to contact the Royal Flying Doctor Service on one occasion when a student had been burned during a cooking accident. There have been no other deaths or major medical incidents in relation to this excursion.

24. According to Mr Green, once at Plumbago, the temperature is not measured. Staff have access to satellite phones but these are not used to check weather forecasts. Mr Green stated that they work off forecasts for the week and monitor students whilst they are travelling. Police investigators were unable to find the exact recorded temperature at Plumbago Station on 21 and 22 February. Detective Brevet Sergeant Paul Clonan downloaded the weather observations for Yunta from the Bureau of Meteorology Website. Therefore the references in my findings below to temperatures relate to those measured at Yunta only. There is a real possibility that the temperature at Plumbago Station may have been higher.

25. The students were split into three groups with Alexander assigned to Group 1 which consisted of 13 students and 3 staff members. Students were responsible for carrying their own packs (14kg for the girls and 17kg for the boys) which included a 7 litre container of water. Following their arrival, the group commenced a 6.5km walk to their first campsite.

26. During the initial walk, Alexander was showing little signs of distress or illness although he appeared reluctant to walk. The recorded temperature was 35.4 degrees Celsius at 4pm. The maximum temperature recorded was 36.1 degrees at 5.30pm. The group camped outside in

the warm conditions with a number of student statements indicating that it was difficult to sleep due to a large number of ants present.

27. On 22 February 2016, Group 1 woke at 5.30am and had some breakfast. Alexander was observed to have some Nutrigrain. The walk that day was anticipated to be 14 km's and staff conducted a briefing regarding the day's activities and discussed maintaining adequate hydration, wearing sunscreen and looking after one another along the way. The group set off at 7.30am in 25.9 degrees Celsius with overcast conditions.

28. At the outset, Alexander was observed to be walking well and remained with the group. According to fellow student Billy Wang, he was talking to everyone and appeared to be in high spirits. After approximately 3km's of walking, the group had their first 'packs off' break, lasting around 15 minutes.

29. The group then re-commenced walking for a further 4km's and had a second 'packs off' break at 10.30am. The recorded temperature during this time was 32.7 degrees Celsius. At this stage, student Alexandra Raphael noted that Alexander appeared to be less enthusiastic than earlier in the morning but was not showing signs of fatigue. The group continued walking along a flat sandy area with salt bushes. By this stage, the clouds had disappeared and they were exposed to the sun.

30. The group attempted to locate some aboriginal paintings and realised that they were somewhat off-course and had a brief break. Alexandra Raphael stated; '*the rocks were radiating the heat so it felt like heat was coming from above and underneath us. Alexander was hugging his water bag for dear life, he looked tired. I was pretty fatigued at this point and had a headache. The team leader said we will stop for lunch in 5 minutes if we can't find the paintings…Alex appeared to be fed up with walking. He was lying down and it seemed as though he was having a bit of difficulty breathing. His breathing was shallow but it looked like he wanted to breathe deeper.*' The group started moving again and Alexander was observed to be moving slowly. This was not unusual as a few other students were showing signs of fatigue at this stage. They walked for 5-10 minutes and stopped for lunch at 12.10pm. The recorded temperature at this time was 35.2 degrees Celsius.

31. Student Tahlia Harper stated that Alexander appeared to be extremely fatigued at this stage and was really struggling. Alexander stated that he was really hot and that he couldn't eat anything. Mr Fitz-Gerald ascertained that he had eaten an apple and provided him with a plain tortilla wrap which he also encouraged him to eat. Alexandra Raphael stated; '*he*

looked quite sweaty and was still clinging onto his water bottle for dear life. He looked drained of energy...and appeared to be sweating more than everyone else. Even when he was in the shade he appeared to be sweating.'

32. At 12.50pm, the group set off again at which point the recorded temperature was 36.1 degrees Celsius. Alexander was placed at the front of the group to set the pace to reduce him lagging behind. The group walked over rocky hills and Alexander appeared to be setting a steady pace. However, as they reached the top of the hill, he sat under a rock formation and Alexandra Raphael observed him to be hyperventilating. His breathing was fast and shallow and he appeared to have a panicked look on his face.

33. Tahlia and Alexandra attempted to calm him down and help him control his breathing. After a while, Alexander's breathing had slowed and he attempted to stand up. Tahlia carried Alexander's water pack whilst Alexandra walked with him down the hill. He was moving slowly and was struggling with breathing. Alexandra stated '*there was a bit of a whistle in his throat, a wheeze, which became more prominent.*'

34. As they reached the bottom of the gully at approximately 1.30pm, the group had another short break before continuing to walk along the flat, again fully exposed to the sun. At 2.30pm a break was called and Alexander appeared tired and confused. Mr Fitz-Gerald provided him with some gastrolyte and checked his pulse which was high. His skin felt hot and clammy and his breathing had slowed. Alexander had already consumed his full water pack but kept drinking more water. Ms Forster placed a wet scarf around Alexander's neck. Alexandra Raphael stated that it appeared as though he was panicking and became unsteady. The recorded temperature for 2.30pm was 39.1 degrees Celsius.

35. Alexander attempted to stand up but fell back down onto the ground. As the staff were attempting to help him, he was resistant and started to become delusional, yelling out incoherent remarks. He again attempted to stand but fell into a bush. He was agitated and his breathing was heavy and rapid. Mr Fitz-Gerald contacted a support vehicle and requested immediate evacuation at 2.47pm. By this stage, Alexander was slumped over, shaking and had become less responsive.

36. Mr Brown arrived in the support vehicle within 10 minutes. Mr Hill, Mr Fitzgerald, Ms Forster and a few students managed to lift Alexander into the back seat of the car where the air-conditioning was set to maximum. The recorded temperature at Mannahill at 3pm was 39.5 degrees Celsius. Alexander was barely conscious at this stage. Mr Hill kept pouring

water over his body to cool him down and he was placed in the recovery position. It appeared that Alexander had something stuck in his throat as his breathing seemed laboured and noisy. Mr Brown attempted to clear Alexander's airway and he vomited up some fluid.

37. The vehicle reached base camp within 10 minutes and the ambulance service was contacted at this time by Mr Chambers and Mr Green. They then drove the vehicle to meet the ambulance en route.

38. Paramedics Kerry Hucks, Sheryl Lewis and Paul Lewis were dispatched at 3.20pm for Plumbago Station. They met Mr Brown's vehicle on the road at 4.43pm, approximately 15km's from Plumbago Station. The paramedics noted Alexander was convulsing with rattling breaths. Blood and mucus was coming from his nose and mouth and he was fitted with an oxygen mask. He was removed from the vehicle and an airway was inserted to clear the blood and mucus. Alexander went into cardiac arrest and cardiopulmonary resuscitation was commenced. This continued for 30 minutes but Alexander's condition did not improve. There were no signs of life at 6.05pm. Alexander was conveyed to the Peterborough Hospital and formally declared deceased at 11.05pm.

Pursuant to section 67(3) of the *Coroners Act 2008* (Vic), I make the following comments in relation to the death:

39. The yearly camping exercise to Plumbago Station is designed to be challenging for students and allows them to build various skills. It is acknowledged that the trip has been undertaken for 40 years during summer periods with no major medical incidents or deaths, however, summer temperatures in Australia can vary significantly and in this instance, temperatures were in the upper range, making conditions particularly challenging and potentially unsafe for students and staff alike. Given the remoteness of the location, the lack of medical facilities readily available and the fact that the temperature is not monitored daily whilst at the camp, there is a very real threat to the health and safety of all individuals involved with potentially catastrophic consequences as in Alexander's case.

40. Whilst Alexander was also suffering from an enterovirus D68 infection which may have accounted in part for his fatigue and generalised pain, there is little doubt those problems were exacerbated by the environmental and exertional factors. A number of students' statements stated that they were struggling in the extreme heat even without underlying illness.

Pursuant to section 72(2) of the *Coroners Act 2008* (Vic), I make the following recommendations connected with the death:

41. That Hungtingtower School consider holding the Plumbago experience during periods of lower/milder heat and not during peak summer conditions.

42. That the 'Student Preparation' booklets be updated to reflect the dangers of heat stroke, heat exhaustion and dehydration and ways in which to manage these conditions. Students and parents should be thoroughly briefed on these dangers prior to the camp and the students reminded of them during the course of the camp.

43. Parents/guardians should also be fully advised of the risks of the expedition prior to signing a consent form.

44. That staff utilize communication equipment to check on current weather forecasts prior to each day's activities and periodically throughout the day, and amend the activities accordingly.

45. That Huntingtower School adopt immediate procedures that provide more accurate guidelines for heat stress management during such activities. In particular, Huntingtower may consider the *Sports Medicine Australia Guidelines on Hot Weather*[6] (see Attachment 'A') which relate to sporting activities in times of high heat and humidity. Bushwalking whilst carrying heavy packs in harsh climactic conditions may be considered strenuous activity, particularly for participants who are inexperienced in such conditions. The guidelines recommend that in temperatures of 31-35 degrees Celsius with relative humidity exceeding 50%, the risk of heat illness is high to very high and duration of the activity should be limited to less than 60 minutes per session. For temperatures 36 degrees and above with humidity of 30% and above, the risk of heat illness is extreme and the activity should be postponed to a cooler condition (or cooler part of the day) or postponed to another day.

FINDINGS AND CONCLUSION

46. Having investigated the death, without holding an inquest, I make the following findings pursuant to section 67(1) of the *Coroners Act 2008* (Vic):

    (a) the identity of the deceased was Alexander Sheng Wei Li, born 10 October 1999

[6] Sports Medicine Australia website. http://sma.org.au/resources-advice/policies-guidelines/hot-weather/

(b) the death occurred on 22 February 2016 at Plumbago Station, Olary Province, 5434 South Australia from heat related illness in an individual with enterovirus D68 infection and;

(c) the death occurred in the circumstances described above.

47. **Pursuant to section 73(1A) of the *Coroners Act 2008* (Vic), I direct that a copy of this finding be published on the Internet.**

I direct that a copy of this finding be provided to the following:

Mr Yinci Li and Mrs Elly Wei

Ms Dimi Ioannou, Maurice Blackburn Lawyers

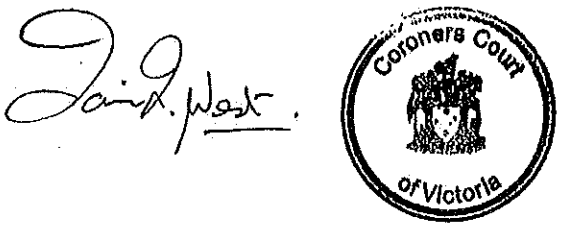
Mr Robert Kitchingmam, Perry Maddocks Trollope Lawyers

Ms Michele Bayly-Jones, South Australian Coroners Court

Senior Constable Paul Collins, Coroners Court of Victoria

Principal Sholto Bowen, Huntingtower School

Signature:



IAIN WEST
DEPUTY STATE CORONER
Date: 23 February 2018

ATTACHMENT "A"

SPORTS MEDICINE AUSTRALIA

HOT WEATHER GUIDELINES

For sporting clubs and associations and the physically active

Why use guidelines?

Every year in hot weather **Sports Medicine Australia (SMA)** receives requests from sporting clubs and associations, individuals and members of the media asking:

- Should our sporting event be modified or cancelled?
- Should our training be modified or cancelled?
- When is it safe to play sport or be physically active in the heat?

To help organisations, coaches, teachers and other individuals when conducting sport in hot weather, SMA has produced this revised set of guidelines. These new guidelines are based on the latest research as well as the expertise of SMA's medical and scientific members.

Most people understand the importance of physical activity for good health but it is just as important that, when levels of activity rise, the risk of harm is minimised. And it is even more important for those who have not recently or regularly taken part in sport or physical activity.

These guidelines are not binding, but SMA reminds all parties that they must act responsibly. We encourage a common sense approach and consideration of the comfort and well-being of all individuals including participants and officials.

Modification or cancellation of events, training or withdrawal from participation may be appropriate even in circumstances falling outside these recommendations.

There are many factors to be considered when clubs and associations are contemplating modifying, postponing or canceling sporting events or training.

Sporting organisations need to be aware of the difficulty of settling "one size fits all" guidelines in this area. For normally healthy active people, the only dangers from heat illness are likely to arise from high intensity exercise such as endurance running. Most community sport does not reach this level for periods long enough to cause serious harm. Many types of sport, such as cricket and tennis, are usually safe at higher temperatures because of the lower intensity of the play.

One area of higher risk for organisers of community-level sport is in the conduct of marathons and fun runs and bike rides. These events are more likely to see participants push themselves beyond their normal boundaries of activity, and organisers need to take extra precautions.

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However, at any time, high intensity exercise in a hot environment, with the associated elevation of body temperature, can lead to heat illness. Heat illness in sport presents as **heat exhaustion** or the more severe **heat stroke**.

Heat exhaustion

- Characterised by a high heart rate, dizziness, headache, loss of endurance/skill/confusion and nausea.
- The skin may still be cool/sweating, but there will be signs of developing vasoconstriction (eg, pale colour).
- The rectal temperature may be up to 40°C and the athlete may collapse on stopping activity. Rectal temperature should only bne measured by a doctor or nurse.

To avoid heat exhaustion, if people feel unwell during exercise they should immediately cease activity and rest. Further benefit comes if the rest is in a shaded area with some passing breeze (from a fan if necessary) and the person takes extra hydration. Misting or spraying with water can also help.

Heat stroke

- Characteristics are similar to heat exhaustion but with a dry skin, confusion and collapse.
- Heat stroke may arise in an athlete who has not been identified as suffering from heat exhaustion and has persisted in further activity.
- Core temperature measured in the rectum is the only reliable diagnosis of a collapsed athlete to determine heat stroke.

This is a potentially fatal condition and must be treated immediately. It should be assumed that any collapsed athlete is at danger of heat stroke. The best first aid measures are "Strip/Soak/Fan":

- **strip off any excess clothing;**
- **soak with water;**
- **fan;**
- **ice placed in groin and armpits is also helpful.**

The aim is to reduce body temperature as quickly as possible. The athlete should immediately be referred for treatment by a medical professional.

Important: heat exhaustion/stroke can still occur even in the presence of good hydration.

Dehydration

Dehydration is fluid loss which occurs during exercise, mainly due to perspiration and respiration. It makes an athlete more susceptible to fatigue and muscle cramps. Inadequate fluid replacement before, during and after exercise will lead to excessive dehydration and may lead to heat exhaustion and heat stroke.

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To avoid dehydration, SMA recommends that:

- athletes drink approximately 500 mls (2 glasses) in the 2 hours prior to exercise;
- during exercise longer than 60 minutes, 2-3 cups (500-700ml) of cool water or sports drink are sufficient for most sports.
- after exercise replenish your fluid deficit to ensure that you are fully re-hydrated, but not over-hydrated.
- refer to SMA's free DRINK UP brochure available as a web download at http://www.smartplay.com.au or from your local National Pharmacies store.

Points to consider:

- Will your players and officials be able to consume enough water during the event?
- Even a small degree of dehydration will cause a decrease in performance.
- Take care not to over-hydrate. Drinking too much fluid can lead to a dangerous condition known as hyponatraemia (low blood sodium). Aim to drink enough to replace lost fluids, but not more than that.

Factors to consider before cancelling or modifying a sporting event or training

(Remember not only to take players into account but also umpires, officials and volunteers.)

The following tables provide estimates of risk related to the weather and also guidelines to managing activity in order to minimise heat stress.

Environmental Factors

1. Temperature

Ambient temperature is the most easily understood guide available, and is most useful on hot, dry days

Ambient temperature	Relative humidity	Risk of Heat Illness	Possible management for sustained physical activity
15 - 20		Low	Heat illness can occur in distance running. Caution over-motivation.
21 - 25	Exceeds 70%	Low - moderate	Increase vigilance. Caution over-motivation.
26 – 30	Exceeds 60%	Moderate	Moderate early pre-season training. Reduce intensity and duration of play/training. Take more breaks.
31 – 35	Exceeds 50%	High – very high	Uncomfortable for most people. Limit intensity, take more breaks. Limit duration to less than 60 minutes per session.
36 and above	Exceeds 30%	Extreme	Very stressful for most people. Postpone to a cooler conditions (or cooler part of the day) or cancellation.

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OR

WBGT
Further guidance might be gained from what is known as the Wet Bulb Globe Temperature (WBGT) index. The WBGT is useful when humidity is high.

WBGT	Risk of thermal injury	Possible modifying action for vigorous sustained activity
< 20	Low	Heat illness can occur in distance running. Caution over-motivation.
21 - 25	Moderate to high	Increase vigilance. Caution over-motivation. Moderate early pre-season training intensity and duration. Take more breaks.
26 - 29	High - Very high	Limit intensity. Limit duration to less than 60 minutes per session.
30 and above	Extreme	Consider postponement to a cooler part of the day or cancellation (allow swimming).

The Bureau of Meteorology (BOM) produces ambient and WBGT readings for many locations in Australia. You can check these readings and a guide for the relative risk for your location at **www.bom.gov.au/info/thermal_stress/index.shtml**

N.B. It is important to watch for unusual "heatwave" conditions or variations from the average temperature for the time of year. This is one situation where there may be a greater danger of heat illness.

Heat stress increases with increases in air temperature but be aware that there are not clear demarcations in risk between temperature ranges. At relative humidity levels above those indicated in the tables, stress increases markedly.

2. Duration and intensity of an event

- The combination of extreme environmental conditions and sustained vigorous exercise is particularly hazardous for the athlete. The greater the intensity of the exercise, the greater the risk of heat related symptoms; eg, distance running is more of a problem than stop-start team events.
- Player and official rotation may also be considered
- Reducing playing time and extending rest periods with opportunities to rehydrate during the event would help safeguard the health of participants.
- Provision of extra water for wetting face, clothes and hair is also important.
- A fan to enhance air movement would be beneficial

3. Conduct of competition and training (hydration and interchange opportunities)

- Associations may consider dividing games into shorter playing periods rather than halves to allow for extra breaks.
- Coaches may consider alternative training times and venues during hot weather.
- Remember, even five minutes rest can cause a significant reduction in core temperatures.
- It is important to consider the welfare of officials, as well as players.

4. Time of Day

- Avoid the hottest part of the day (usually 11 am-3 pm). Scheduling events outside this time should be a consideration throughout any summer competition, training or event, regardless of the temperature.

5. Local Environment

- Radiant heat from surfaces such as black asphalt or concrete can exacerbate hot conditions.
- The type of exercise surface and the amount of sunlight vary significantly with different sporting activities and therefore must be analysed for each individual sport.
- An air-conditioned indoor venue will provide less of a problem. A hot indoor venue or an outside venue without shade cannot be considered an acceptable environment.
- Airflow should be considered, including fans in change rooms or appropriately placed.

Remember, air movement decreases heat stress. However, a following wind can increase problems for runners or cyclists by actually reducing air movement.

Host (personal) factors

1. Clothing

- Type of clothing is vital in minimising health risks associated with exercise in heat.
- Fabrics that minimise heat storage and enhance sweat evaporation should be selected.

- Light weight, light coloured, loose fitting clothes, made of natural fibres or composite fabrics with high wicking (absorption) properties, that provide for adequate ventilation are recommended as the most appropriate clothing in the heat. This clothing should complement the existing practices in Australia that protect the skin against permanent damage from the sun.

- This should apply to the clothing worn by players, umpires, other officials and volunteers.

Protective clothing

If clothing is worn for protective reasons, ensure that it is worn only while training and competing in hot weather. Some examples include leathers in motorcycling and mountain biking, protective equipment for hockey goalkeepers and softball and baseball umpires. Remove non-breathable clothing as soon as possible if the participants or officials are feeling unwell in hot conditions. Start cooling the body immediately via ventilation and/or a cool spray such as a soaker hose or a hand-held spray and a fan.

2. Acclimatisation of the participant

- Acclimatisation of the participant includes umpires, other officials and volunteers as well as players.

- Preparation for exercise under hot conditions should include a period of acclimatisation to those conditions, especially if the athlete is travelling from a cool/temperate climate to compete in hot/humid conditions.

- It has been reported that children will acclimatise slower than adults.

- Regular exercise in hot conditions will facilitate adaptation to help prevent performance deteriorating, or the athlete suffering from heat illness, during later competitions. Sixty minutes acclimatisation activity each day for 7-10 days provides substantial preparation for safe exercise in the heat.

3. Fitness levels/athletic ability of participant

- A number of physical/physiological characteristics of the athlete will influence the capacity to tolerate exercise in the heat, including body size and endurance fitness.

- In endurance events, accomplished but non-elite runners, striving to exceed their performance, may suffer from heat stress. The potential for heat-related

illnesses would be exacerbated if they have not acclimatised to the conditions and have failed to hydrate correctly.

- Overweight and unconditioned athletes, umpires, officials and volunteers will generally also be susceptible to heat stress.
- Refer to SMA's free DRINK UP brochure available from www.sma.org.au/information or your local National Pharmacies store.

4. Age and gender of participant

- **Female participants** may suffer more during exercise in the heat because of their greater percentage of body fat.
- **Young children** are especially at risk in the heat. Prior to puberty, the sweating mechanism, essential for effective cooling, is poorly developed. The ratio between weight and surface area in the child is also such that the body absorbs heat rapidly in hot conditions.
- In practical terms, child athletes must be protected from over-exertion in hot climates, especially with intense or endurance exercise.
- Although children can acclimatise to exercise in the heat, they take longer to do so than adults.
- Coaches should be aware of this and limit training for non-acclimatised children during exposure to hot environments.

NB: Children tend to have a more "common sense" approach to heat illness than adults. They "listen to their bodies" more and will usually slow down or stop playing if they feel distressed in the heat. ***On no account should children be forced to continue sport or exercise if they appear distressed or complain about feeling unwell.***

- Veteran participants may also cope less well with exercise in the heat. Reduced cardiac function is thought to be responsible for this effect.

5. Predisposed medical conditions

- It is important to know if athletes, umpires, officials or volunteers have a medical condition or are taking medication that may predispose them to heat illness.
- Examples of illnesses that will put the participant or official at a high risk of heat illness include asthma, diabetes, pregnancy, heart conditions and epilepsy. Some medications and conditions may need special allowances.
- Participants and officials who present with an illness such as a virus, flu or gastro or who are feeling unwell are at an extreme risk of heat illness if exercising in moderate to hot weather.
- Participants or officials who may be affected by drugs or alcohol may be at an extreme risk of heat illness if exercising in moderate to hot weather.
- SMA has produced Pre-exercise Health Check Guidelines. These should be used if pre-existing medical conditions are suspected or if the participant has

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no recent record of activity. The Guidelines can be downloaded from www.sma.org.au

6. Other factors to consider

- Preventative measures can be undertaken to minimise heat injuries. Examples include the provision of shade, hats, appropriate sunscreen, spray bottles and drinking water.
- It is important to have trained personnel available to manage heat injuries and designated recovery areas for patients.
- In situations where heat problems may be expected, an experienced medical practitioner should be present.

Heat stroke is potentially life threatening. Any indication of this condition should be immediately referred for medical assessment.