CORONER'S COURT
OF NEW SOUTH WALES

Inquest:	Inquest into the death of Keith Titmuss
Hearing dates:	5, 6, 7, 8, 9, 13 & 14 February 2024; 22 March 2024
Date of Findings:	3 May 2024
Place of Findings:	Coroner's Court of New South Wales, Lidcombe
Findings of:	Magistrate Derek Lee, Deputy State Coroner
Catchwords:	CORONIAL LAW – cause and manner of death, exertional heat stroke, exertional heat illness, hyperthermia, seizures, National Rugby League, Heat Policy, Manly Warringah Sea Eagles, Heat Stress Index, Kestrel Heat Stress Tracker, cooling strategies, heat management, use of ice packs, transfer to hospital, player acclimatisation, individualised training program, graduated return to training
File number:	2020/333632
Representation:	Mr A Casselden SC & Mr M Dalla-Pozza, Counsel Assisting, instructed by Ms A Jez & Mr M Tanazefti (Crown Solicitor's Office) Dr P Dwyer SC & Ms E Sullivan for Manly Warringah Sea Eagles, instructed by Pryor Tzannes & Wallis Mr B Bradley for NSW Ambulance, instructed by Norton Rose Fulbright Mr M Lynch for Dr A Delaney & Dr N Gibbs, instructed by Avant Law Mr O Jones for National Rugby League, instructed by Mr D Dressler, National Rugby League Legal Counsel

Findings:	Keith Titmuss died on 23 November 2020 at Royal North Shore Hospital, St Leonards NSW 2065. The cause of Keith's death was exertional heat stroke. Keith developed exertional heat stroke after completing the first outdoor and indoor preseason training sessions following an extended break during the rugby league offseason. The duration of the offseason, Keith's comparative level of fitness to that of his training cohort, Keith's body mass index, the duration and intensity of both the outdoor and indoor training sessions, Keith's state of involuntary dehydration prior to the indoor training session, and the environmental conditions during the indoor training session were all contributing factors to the development of exertional heat stroke.
Recommendations made pursuant to section 82, *Coroners Act 2009*	See Appendix B

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1. Introduction

1.1 On the morning of 23 November 2020, Keith Titmuss, a 20-year-old professional rugby league player for the Manly Warringah Sea Eagles (**Manly**), attended a pre-season training session at the Sydney Academy of Sport (**the Academy**) at Narrabeen. Keith was amongst a group of players preparing for the upcoming National Rugby League (**NRL**) season, one in which Keith himself was seeking to make his First Grade debut.

1.2 The training which Keith and the other players participated in consisted of an outdoor field session followed by a session at an indoor facility operated by Manly that is known colloquially as the "Dojo" (**Dojo)**. After completing a series of drills inside the Dojo, Keith and the other players began to wind down and start stretching. Without warning, Keith became distressed and started behaving erratically, moving his body in an apparently uncontrolled fashion. Manly players and staff came to his assistance, and emergency medical services were contacted.

1.3 Paramedics from New South Wales Ambulance (**NSWA**) attended the Dojo a short time later and found Keith to be exhibiting seizures and to have a very high temperature. Keith was placed in an ambulance and transported to Northern Beaches Hospital (**NBH**). He later went into cardiac arrest and a decision was made to transport Keith to Royal North Shore Hospital (**RNSH**) for further advanced treatment. Tragically, Keith's rapidly deteriorating condition did not improve, and he was pronounced life extinct later that afternoon.

2. Why was an inquest held?

2.1 Under the *Coroners Act 2009* (**the Act**) a Coroner has the responsibility to investigate all reportable deaths. This investigation is conducted primarily so that a Coroner can answer questions that they required to answer pursuant to the Act, namely: the identity of the person who died, when and where they died, and what was the cause and the manner of that person's death.

2.2 Keith's deterioration on 23 November 2020 was sudden and unexpected. The events that followed raised questions about the circumstances of the training session that Keith had participated in, and the factors which may have contributed to his deterioration and untimely death. As the coronial investigation examined these matters, other questions arose regarding relevant procedures and policies relating to player welfare and safety in place at Manly, and within the NRL more broadly. For all of these reasons, an inquest was required to be held.

2.3 In this context it should be recognised at the outset that the operation of the Act, and the coronial process in general, represents an intrusion by the State into what is usually one of the most traumatic events in the lives of family members who have lost a loved one. At such times, it is reasonably expected that families will want to grieve and attempt to cope with their enormous loss in private. That grieving and loss does not diminish significantly over time. Therefore, it should be acknowledged that the coronial process and an inquest by their very nature unfortunately compels a family to re-live distressing memories several years after the trauma experienced as a result of a

death, and to do so in a public forum. This is an entirely uncommon, and usually foreign, experience for families who have lost a loved one.

2.4 It should also be recognised that for deaths which result in an inquest being held, the coronial process is often a lengthy one. The impact that such a process has on family members who have many unanswered questions regarding the circumstances in which a loved one has died cannot be overstated.

3. Keith's life

3.1 Inquests and the coronial process are as much about life as they are about death. A coronial system exists because we, as a community, recognise the fragility of human life and value enormously the preciousness of it. Understanding the impact that the death of a person has had on those closest to that person only comes from knowing something of that person's life. Therefore, it is important to recognise and acknowledge Keith's life in a brief, but hopefully meaningful, way.

3.2 Keith was born on 12 February 2000 to Lafo and Paul Titmuss. Kieth was one of three siblings, with an older brother, Jesse, and a younger sister, Zara.

3.3 Keith's mother describes him as the larrikin of the family. Although in later life Keith would become known for his dedication and hard work, this was not always the case when Keith was a boy. His mother fondly recalls that Keith would do anything to avoid chores around the house or helping his parents by picking up Zara from school.

3.4 Keith developed a love for rugby league from the age of three when he began accompanying Jesse to his football games and training sessions. Keith became the self-designated ballboy and was eager to be a part of his older brother's team. At age five, Keith joined his own team with the Mounties Sport Under 6s. He was the club's leading try scorer in his first year, and won many player of the year awards in the seasons that followed.

3.5 Keith attended primary school at Mount Pritchard East Public School and was a good student and a talented rugby league player. He was later accepted into the rugby league program at Westfields Sports High School (**Westfields**). It was at Westfields that Keith met his future partner, Tatyanna.

3.6 Keith was also a skilled rugby union player and played at a high representative level. After Year 10, Keith transferred to Newington College on a scholarship where he continued to play both rugby league and rugby union. Eventually, Keith decided to focus on rugby league and returned to Westfields to complete secondary school.

3.7 During this period in his life, Keith demonstrated his innate character, as well as the qualities that his parents had instilled in him at a young age. He regularly completed long days – usually starting at 5:00am and not finishing until midnight – of school, sports and studies, and never complained about his busy schedule. Keith was doing what he loved and sharing the love with his many close friends. Lafo recalls being told how Keith would catch a minibus back home with his mates after footy training, and be seated in the back of the bus, legs stretched out, boots off, asking the boys to massage his feet whilst he did his homework on his laptop and controlled the music playlist in the bus with his phone.

3.8 This story speaks to Keith's social nature, and how much he was loved and admired by his many friends. Keith moved amongst many different social circles – school, sports, gaming – and was often in the centre of each one. His mother describes Keith as a social butterfly. His friends called him the Pied Piper of their group. And yet, despite how many friends Keith had, he made time for each of them, as well as others who he barely knew but who would later become his friends. Lafo recalls an occasion at Westfields when Keith stood up for a boy he did not know who was being bullied by other

students. Keith intervened and asked the boy to hang out with him. What resulted was a lasting friendship and a sense of belonging for a young student who might otherwise have lost their way if not for Keith's simple act of kindness.

3.9 Keith was known to be very much a family man, and someone enjoyed being with those closest to him. He was always willing to help and be a part of family gatherings, and enjoyed a strong bond with his siblings. Keith also enjoyed going to the movies, eating out and spending time with Tatyanna.

3.10 As brothers, Keith and Jesse were best friends. They spent many late nights together, sharing a cup of Milo, catching up for the day, speaking about whatever may have been on their mind, and simply enjoying each other's company. Keith also was a devoted big brother to Zara. In equal parts he would be her proudest supporter at her sports games and at the same time offer unsolicited advice with a good dash of humour to tease her. The two enjoyed watching netball games together and chatting about anything and everything.

3.11 Keith's family and friends have variously described his many positive qualities: kind, gentle, respectful, respected, quiet, unassuming, dedicated, hard-working and someone who was truly the salt of the earth. Whilst these descriptions provide those who did not know Keith with an insight into the person he was, they cannot convey how deeply he is still, and always will be, missed by those who love him the most.

4. Keith's playing history

4.1 After playing rugby league as a junior at Mounties Sport, Keith later played in the Under 12s competition at the Marconi Club, before playing for Cabramatta Rugby League Club. During this period, Keith also played rugby union, another sport at which he excelled. He played with Hunters Hill Rugby Club and gained representative honours with the Norths team, before later touring New Zealand as part of the NSW Under 16s squad.

4.2 In 2014, Keith began playing representative rugby league for Parramatta. When Keith was 14 years old, he began playing with Manly, joining the Harold Matthews Squad for young and upcoming players. He played in the Harold Matthews Cup and later the Holden Cup, the NRL Under 20s competition.

4.3 During the 2018 and 2019 NRL seasons, Keith had the opportunity to train with Manly's First Grade side. Unfortunately, Keith sustained injuries during both pre-seasons which appears to have impacted his fitness level. Michael Monaghan, Manly Assistant Coach at the time, observed that Keith's fitness level during each pre-season was well behind that of the other players in the squad.

4.4 In 2020, Keith was awarded a contract to be a development player for Manly. This put him within the top 36 players at the club and meant that he would be training full time with the First Grade team.

4.5 Keith did not play for Manly during the 2020 season. However, the evidence suggests that by the end season Keith had attained a high level of physical fitness and strength. Mr Monaghan was of the view that Keith was in the best physical shape of his life and had increased his strength and athletic prowess during the course of that year.

4.6 Following the conclusion of the 2020 season in September/October, Keith and the other players in the squad had an off-season break before returning to pre-season training in November 2020.

5. Relevant factual background

Pre-training assessments

5.1 On 19 November 2020, Keith underwent a number of pre-training tests and assessments, including a wellness check (a self-administered questionnaire about general wellbeing), a physical marker assessment (a range of exercises to test flexibility and body strength), an electrocardiogram, a functional test, and a medical screen, together with optometry and podiatry assessments.

5.2 Don Singe, Head of High Performance at Manly, reviewed the wellness check and physical marker assessment, noting nothing out of the ordinary and no "*red flags*".

5.3 On the same day, Keith completed a Wingate test, an anaerobic fitness test performed on a stationary bicycle (**Wingate Test**). A lactic blood test was taken at the end of this exercise.

5.4 On 20 November 2020, Keith completed Yo-Yo test, an aerobic fitness test which involved performance of repeated sprints over 20 metres with intermittent and diminishing recovery periods (**Yo-Yo Test**). Keith and a number of other players were observed to struggle during the test.

5.5 On 21 November 2020, Keith completed another indoor cardio bike session.

Outdoor training session on 23 November 2020

5.6 Manly's first pre-season training session to prepare for the 2021 season was held at the Academy at Narrabeen, and commenced at about 9:00am.

5.7 The temperature (measured at Terry Hills) was 21.3°C at 9:00am and 21.6°C at 3:00pm, with a maximum temperature of 24.9°C. The relative humidity was at 92% at 9:00am, decreasing to 74% at 3:00pm.

5.8 The outdoor training session took place on one of the ovals at the Academy and comprised the following:

(a) Warm up activities; and

(b) Skill block exercises, involving a mix of rugby drills and repeat high intensity effort (**RHIE**) exercises. The RHIE exercises included a bag drill, a medicine ball throw and a medicine ball drill, with each RHIE exercise consisting of 40 seconds of effort followed by 20 seconds of recovery when players had access to their water bottles.

5.9 This outdoor session lasted about 90 to 100 minutes and finished at around 10:45am. Following this, the players jogged approximately 800 metres from the oval to the Dojo.

Indoor training session on 23 November 2020

5.10 As at 23 November 2020, the Dojo was not fitted with air-conditioning. However, a number of large floor-standing cooling fans were present inside the Dojo. It is unclear if the fans were turned on.

5.11 The indoor training session initially comprised a "100 passes" drill, involving players catching and passing a football whilst moving between set positions marked on a grid. Following this, the players participated in a cardio circuit involving a variety of drills including:

(a) Up downs/burpees, an exercise requiring players to repeatedly get to their feet from a face down lying position);

(b) Bear crawls, an exercise performed by players on their hands and knees (with knees raised slightly above the ground) requiring players to move their hand and knees forward several places before returning to the starting position); and

(c) Fireman carries, where one player carries another player over their shoulders.

5.12 This cardio circuit lasted between about 6 and 10 minutes, with the total indoor training session taking between around 15 to 20 minutes.

Events following the training session

5.13 Following the completion of the indoor training session, the players began to wind down and stretch. During this period, Keith was observed to be in distress. As it was initially thought that Keith was cramping (a common occurrence following a training session), some of the players spoke to Keith and helped him to stretch. Mr Singe went to get some fluids for Keith.

5.14 After about two or three minutes, Keith's condition subsequently deteriorated and he became distressed and disorientated. Mr Singe, together with several of the players, moved Keith into a seated position on the floor with his back against a wall. Keith was unable to respond to Mr Singe or to any of the other players who had moved him.

5.15 Keith then began to experience what is described as seizure-like activity or fitting. He was seen to be crawling on his back whilst propelling himself with his feet with his arms falling up and down. This behaviour lasted around 7 to 8 minutes, and increased in intensity culminating in Keith emitting a noise described as an "*involuntary howl*". Mr Singe walked with Keith in an attempt to prevent him from hitting any walls.

5.16 James Rahme, Manly's Head Physiotherapist, and Mr Singe put Keith into an area where he could not hit objects or other persons. Due to Keith's involuntary movements, he could not be placed in the recovery position.

5.17 At some stage, Alex Ross, Manly's Head Trainer, was asked to get a doctor. He jogged from the Dojo to the Narrabeen Sports and Exercise Medicine Centre (**the Medicine Centre**), about 200 to 400 metres away. Mr Ross found Dr Anthony (Tony) Delaney, a sports physician, and asked that he accompany him back to the Dojo.

5.18 Mr Rahme was called to attend the Dojo as soon as he could. He did so immediately and saw John Bonasera, Manly's General Manager. Mr Rahme asked Mr Bonasera to call an ambulance. A call to Triple Zero was made at 11:06am.

Initial treatment at the scene

5.19 NSWA Paramedics Matthew Grant and Benjamin Tory arrived at the scene at 11:16am. Keith was observed to be lying supine on the floor, showing signs of tonic-clonic seizure activity, and with a Glasgow Coma Scale score of 3. Keith's vital signs were noted to be:

(a) temperature (measured tympanically) of 41.9°C;

(b) heart rate of 140 beats per minute;

(c) respiratory rate of 38 breaths per minute; and

(d) oxygen saturation of 87% on room air.

5.20 Paramedic Grant formed the view that Keith was fitting and not hyperventilating and asked Dr Delaney to remove a paper bag that had been placed over Keith's mouth. Two doses of midazolam (anti-convulsant medication) were administered to Keith, an intravenous (**IV**) line was inserted, and Keith was provided with oxygen.

5.21 At 11:28am, a second NSW Ambulance crew arrived consisting of Intensive Care Paramedic (**ICP**) Simon O'Brien and Paramedic Michael Noble. Keith was loaded in the back of an ambulance between around 11:40am and 11:44am. A decision was made to transport Keith to NBH.

Treatment at Hospital

5.22 Keith arrived at NBH at about 11:56am. He was treated with cold IV fluids to lower his body temperature. The initial differential diagnoses records included exertional heat stroke, drug-induced hyperthermia, a primary infective process, or intracerebral haemorrhage.

5.23 At 12:07pm, Keith went into cardiac arrest. A decision was made to transfer Keith to RNSH where he arrived at around 12:45pm. Keith was admitted to the cardiac catheter laboratory where extracorporeal membrane oxygenation (**ECMO**) was instituted. However, this did not result in any meaningful change in Keith's condition.

5.24 At 1:23pm, Keith was noted to be in asystole. This, combined with significant metabolic derangement, made Keith's condition unsurvivable. A decision was made to cease active treatment and Keith was tragically pronounced life extinct at 2:16pm.

6. The post-mortem examination

6.22 Keith was subsequently taken to the Department of Forensic Medicine where a post-mortem examination was performed by Dr Jennifer Pokorny, forensic pathologist, on 25 November 2020. This examination identified the following relevant findings:

(a) a mildly enlarged heart, with Dr Pokorny noting that this may at least in part be the result of physiological hypertrophy given Keith's heavy athletic build and history of professional sport;

(b) a focal area of 70% atherosclerotic narrowing in the proximal left anterior descending artery;

(c) no evidence of thrombus present within the heart;

(d) the aorta appeared to be of normal calibre;

(e) a few small foci of lymphocytic inflammation in the heart but below the threshold considered diagnostic of myocarditis;

(f) no evidence of viral infection in the myocardium;

(g) no definite ischaemic injury seen in the bowel; and

(h) no acute traumatic injury, infection or structural abnormality in the brain which may be associated with seizures.

6.23 Dr Pokorny considered that the cause of Keith's death remained unascertained following post-mortem examination. However, Dr Pokorny relevantly noted the following:

(a) Keith's complaints of body cramps after training followed by collapse, tachycardia and profound metabolic derangement are in keeping with heat stroke, which can cause muscle cramps, elevated body temperature and altered mental state, leading to seizures, coma and potentially death;

(b) heat stroke is a difficult diagnosis to make post-mortem as the findings are non-specific and the diagnosis is largely dependent on documentation of the scene findings at the symptoms and signs prior to death; and

(c) the coronary artery disease identified post-mortem, in the context of cardiomegaly, is considered unlikely to be the direct cause of death, though it may have made Keith more vulnerable to the myocardial effects of hypoxia from another cause.

6.24 In the autopsy report dated 21 April 2021, Dr Pokorny concluded that the direct cause of Keith's death could not be ascertained.

7. What issues did the inquest examine?

7.1 Prior to the commencement of the inquest a list of issues was circulated amongst the sufficiently interested parties, identifying the scope of the inquest and the issues to be considered. That list identified the following issues for consideration:

(1) The cause of Keith's collapse at the Sydney Academy of Sport and Recreation at Narrabeen on 23 November 2020;

(2) The physiological processes that led to Keith's death;

(3) Whether Keith had any pre-existing conditions that contributed to his death;

(4) The appropriateness of the training session in which Keith participated in prior to his collapse on 23 November 2020;

(5) The appropriateness of the screening and player welfare measures conducted prior to the training session on 23 November 2020;

(6) The adequacy of the medical response to Keith's collapse, including the following:

(a) The adequacy of the initial response by coaching staff and players at Manly;

(b) The adequacy and effect of the first aid provided by Dr Delaney;

(c) The time taken for the ambulance paramedics to reach the scene;

(d) The adequacy of the treatment provided by the ambulance paramedics;

(e) The decision to take Keith to the NBH; and

(f) The decision to cease treatment.

(7) The adequacy of Manly's procedures/policies and the NRL's procedures/policies to avoid heat related injuries to players during training as at 23 November 2020 and now; and

(8) The adequacy of procedures in place at Manly and the NRL, as at 23 November 2020 and now, to identify and learn from training incidents resulting in serious player injury such that subsequent similar events are either avoided or better responded to, including the following:

(a) What recommendations were made as a result of the Lloyd Perret incident on 6 November 2017?

(b) Were these recommendations implemented and, if not, should they have been?

(c) If implemented, were these recommendations still in place on 23 November 2020?

(d) What role should the NRL play in ensuring such recommendations are implemented and maintained across all NRL clubs?

7.2 These issues are considered in more detail below and some issues have been dealt with together for convenience.

7.3 In order to assist with consideration of some of the above issues, independent opinions were sought from the following experts as part of the coronial investigation:

(a) Associate Professor Mark Adams, cardiologist and Head of the Department of Cardiology, Royal Prince Alfred Hospital;

(b) Professor Mark Cook, neurologist and epileptologist, and Director of the Neurology Unit, St Vincent's Hospital, Melbourne;

(c) Distinguished Professor Aaron Coutts, Head of the School of Sport, Exercise and Rehabilitation, Faculty of Health, and Director of the Human Performance Research Centre, University of Technology, Sydney;

(d) Professor Ian Seppelt, anaesthetist and senior staff specialist intensive care physician, Nepean Hospital.

7.4 In addition, some of the sufficiently interested parties obtained opinions from the following experts:

(a) Associate Professor Anna Holdgate, senior staff specialist in emergency medicine, on behalf of NSWA;

(b) Professor Stephen Nicholls, cardiologist and Program Director of Monash Heart, Intensive Care and Victorian Heart Health Hospital at Monash Health, Director of the Victorian Heart Institute at Monash University and President of the Cardiac Society of Australia and New Zealand, on behalf of Manly; and

(c) Dr Simon Quilty, a general and acute care physician who has commenced a PhD examining the impact of environmental heat on health in hot climates, on behalf of Manly.

7.5 Each of the above experts provided one or more reports which were tendered into evidence, and also gave oral evidence, during the course of the inquest.

8. What was the cause of Keith's collapse on 23 November 2020? What physiological process led to Keith's death?

8.1 As noted above, one possible cause of Keith's death identified following post-mortem examination was heat stroke. The expert opinions gathered prior to, and the expert evidence given during, the inquest confirmed this diagnosis.

8.2 Associate Professor Adams expressed the view that the most likely cause of Keith's death was exertional heat stroke, having regard to the following:

(a) The clinical course of development of muscle cramps and physical distress followed by disorientation and seizures is typical of exertional heat stroke;

(b) The observations taken by attending paramedics of rapid heart rate (140bpm), high temperature (41.9°C) and rapid respiratory rate are all typical for exertional heat stroke;

(c) Keith's blood test results at NBH of severe metabolic acidosis (initial pH of 6.8), high lactic acid (initially 9.8 mmol/L), high potassium (8.4 mmol/L), evidence of early rhabdomyolysis with a high creatinine kinase, evidence of early renal failure; and

(d) Keith's size and physique may have increased his risk of developing heat stroke due to his large muscle mass producing heat and other tissues impairing heat transfer at skin level.

8.3 Professor Cook also opined that the sequence of events on 23 November 2020 – quite vigorous physical activity which Keith may have been less prepared for than at other times, extremely high temperature, neurological abnormalities and then seizures - fit best with a diagnosis of heat stroke. Relevantly, Professor Cook expressed the view that Keith's "*odd behaviour of propelling himself around on the floor, represents a manifestation of confusion and delirium rather than seizure activity, though it is clear that seizure activity followed*".

8.4 Professor Seppelt similarly opined that Keith died of exertional heat stroke, noting that other possible causes of his collapse (primary structural heart disease, drug-induced hyperthermia, primary infective process, intracerebral haemorrhage, primary seizure disorder, and hypoglycaemic coma and diabetes) had all been excluded. Professor Seppelt explained that "*untreated exertional heat shock can lead to multi-organ failure (including cardiac, liver and kidney dysfunction), metabolic acidosis, arrhythmias, cardiac arrest and death*".

8.5 During oral evidence, Professor Seppelt described the aetiology of heat stroke in this way:

> So, it's, in very general terms, hypermetabolism, where the body is generating more heat than the body can disperse and, therefore, rather than maintaining a stable temperature, the temperature goes up and then once you pass a critical point, you start to have effects on pretty much every organ in the system, but what we see particularly is both the high fever, but also effects on the brain. So, part of the diagnosis of exertional heat stroke is some degree of brain dysfunction, whether that's confusion or agitation or delirium or seizures or, ultimately, coma, and, ultimately, death, but the brain is much more sensitive to those high temperatures than some other organ systems.

8.6 Professor Nicholls noted that Keith "*demonstrated a combination of hyperthermia and associated central nervous system dysfunction, which rapidly deteriorated to multiorgan dysfunction, metabolic acidosis and hyperkalaemia with subsequent cardiac arrest*". Professor Nicholls also opined that the most likely cause of Keith's death was heat stroke.

8.7 **Conclusions:** The consensus expert evidence establishes that the cause of Keith's death was exertional heat stroke. The hyperthermia that Keith was experiencing, as demonstrated by his high temperature and rapid heart rate and respiratory rate, manifested itself in muscle cramps and physical distress followed by confusion, delirium, brain dysfunction and seizure activity. This was followed by rapid deterioration to multi-organ failure, severe metabolic acidosis, hyperkalaemia and eventual cardiac arrest.

9. Did Keith have any pre-existing condition(s) which contributed to his death?

9.1 The finding of a focal area of 70% atherosclerotic narrowing in the proximal left anterior descending artery (**Keith's coronary artery disease**) at autopsy possibly represented a significant cardiac condition in a 20-year-old man. The finding raised questions as to whether Keith had any underlying condition which contributed, directly or indirectly, to his death.

9.2 Associate Professor Adams expressed the following views in relation to Keith's coronary artery disease:

(a) whilst significant coronary artery disease affecting the proximal left anterior descending coronary artery is a potential cause of death, it does not appear to be involved in this case.

(b) whilst such a finding appears unusual in a fit and healthy 20-year-old male, it is neither uncommon or unknown;

(c) it was not associated with any thrombosis or sign of myocardial infarction in the myocardium, suggesting that it was not involved in Keith's case; and

(d) the consequences of significant coronary artery disease, such as acute coronary syndrome and demand ischaemia, do not fit with Keith's clinical course and Keith did not display any symptoms (such as chest pain or heart failure) whilst undergoing high levels of physical activity.

9.3 Associate Professor Adams did nevertheless recognise that it is theoretically possible that Keith's coronary artery disease may have contributed to his rapid deterioration, noting:

> During periods of extreme physical exertion the body's muscles produce a large amount of heat. In order to maintain a normal body temperature high levels of blood flow through the body are needed to supply the working muscle and to maintain a high level of blood flow to the skin to allow cooling. If cardiac output cannot be maintained at this high level the core body temperature may rise to dangerous levels leading to exertional heat stroke. It is possible that the coronary artery disease that Mr Titmuss had may have limited his cardiovascular ability to produce enough cardiac output to maintain thermoregulation.

9.4 However, Associate Professor Adams opined that it is unlikely that the coronary artery disease seen at autopsy played any part in Keith's death, and went on to explain:

> [G]iven the amount of strenuous activity [Keith] had undergone on the morning of 23 November 2020, it seems unlikely that his cardiac output would not have been adequate to deal with this.

9.5 It is interesting to note that Manly engaged two experts, Professor Nicholls and Dr Quilty, and invited both to express opinions regarding this issue. Even more interesting, and perhaps surprising, is that it was submitted on behalf of Manly that the opinion expressed by one expert (Dr Quilty) should be preferred over the opinion expressed by the other (Professor Nicholls).

9.6 Professor Nicholls opined that Keith's coronary artery disease is common, and "*reflects the presence of a substantial burden of atherosclerotic disease at this point*". Like Associate Professor Adams, Professor Nicholls recognised that Keith had no symptoms suggestive of myocardial ischaemia despite an extensive history of significant exercise stress.

9.7 As to the question of whether Keith's cardiac condition contributed to death, Professor Nicholls expressed this view:

> Cardiovascular disease, including the presence of severe coronary artery obstruction, can increase the risk of heat stroke, as it can contribute to a limited ability to raise cardiac output in response to heat stress (Marchand and Gin. Canad. J Cardiol. Open. 2022;4:158-63). The presence of cardiovascular disease, including the presence of severe coronary artery obstruction, can also increase the complications of heat stroke.
> […]
> The possibil[le] contribution of the coronary artery narrowing to an inability to appropriately raise cardiac output and subsequent death cannot be excluded.

9.8 So, like Associate Professor Adams, in his report Professor Nicholls described Keith's coronary artery disease as an underlying cardiac condition that may have contributed to Keith's death and which could not be entirely excluded. In contrast, Dr Quilty elevated the significance of any contribution of Keith's coronary artery disease to his death. In his report, Dr Quilty expressed this view:

> It is my opinion that Mr. Titmuss's atherosclerotic cardiac disease contributed to his development of exertional heat stroke and subsequent death.
>
> On the balance of probabilities, it is most likely that the severe proximal Left Anterior Descending artery stenosis impaired coronary blood flow to at least a mild degree when Mr. Titmuss's cardiac output was at its peak (cardiac output was likely at its peak whilst he was in the Dojo Gym). This in turn would have led to at least a slight reduction in oxygenated blood to the heart muscle, which in turn would have most likely had some negative impact on the contractile strength of the myocardium (heart muscle). Any reduction in cardiac contractility would to have some extent impaired the physiological mechanism of shunting blood towards the cutaneous tissue and reduced his physiological capacity for heat dissipation, and subsequently increased his vulnerability to exertional heat stress.

9.9 In a supplementary report, Associate Professor Adams expressly disagreed with the significance that Dr Quilty placed on Keith's coronary artery disease. Associate Professor Adams explained:

> It is however not certain that Mr Titmuss' coronary lesion would have been severe enough to cause myocardial ischaemia. I think it is possible that this lesion may have been significant and as such may have contributed to Mr Titmuss having a higher susceptibility to exertional heat stroke, however on the balance of evidence I think that it is more likely it played little or no part in this. Firstly, the significance of the lesion is uncertain and secondly Mr Titmuss did not display any symptoms or signs of myocardial ischaemia.

9.10 Associate Professor Adams went on to explain that ischaemia is a dynamic physiological effect that is not always reflected by anatomical assessment, and that assessing whether a coronary lesion is likely to cause ischaemia is difficult to assess where functional assessment is impossible. Associate

Professor Adams referred to a 2010 study which found that angiography was inaccurate in assessing the likelihood of ischaemia even when the severity of the lesion is 70% to 90%.

9.11 Associate Professor Adams also noted that there was no evidence of Keith displaying symptoms which suggested that myocardial ischaemia was present, observing that he was able to exercise to a high level without developing chest discomfort or other cardiac symptoms. Further, there were no definite signs of ischaemia when Keith was assessed at hospital. At that time, an electrocardiogram (**ECG**) showed a very rapid heart rate of around 180bpm (likely due to a supraventricular tachycardia). Despite this high level of cardiac workload, the ECG showed no definite signs of ischaemia.

9.12 In his further supplementary report, Professor Seppelt was asked to consider the opinions expressed by Dr Quilty in his report regarding Keith's coronary artery disease. Professor Seppelt offered this view:

> I agree with Dr Quilty that in the context of exertional heat stroke and the associated extremely high cardiac output required this coronary stenosis may have made the situation worse but it was not the primary problem. One of the questions at Northern Beaches Hospital was whether he had had a myocardial infarction leading to cardiac arrest [STEMI or 'ST elevation myocardial infarct'] amenable to urgent coronary angioplasty [re-opening and stenting the artery] but there was no indication on the ECG, and this was confirmed at autopsy where there was no evidence of myocardial infarction [heart muscle death] downstream from the stenosis. I conclude that the coronary stenosis may have restricted myocardial blood flow at a time of maximal demand, but was not the primary cause of [Keith's] death.

9.13 Counsel for Manly explored this aspect of the report with Professor Seppelt in oral evidence during the following exchange:

> Q. But can you explain your view as to why you think that stenosis may have made the problem worse?
>
> A. So, I was following on from Dr Quilty's report, so, purely looking at the physiology of the three main coronary arteries, Keith had a 70% narrowing in one of them, that will, of its nature, decrease the amount of blood that can flow through that narrowing. For most of us we have significant reserves and I'm sure he had significant reserves as well, so that hadn't ever caused him any trouble. Back to basic physiology, yes, with extreme stress, it's going to decrease the total coronary blood flow, but, as I mentioned earlier, <u>there was no significant consequence, I don't think, in this case</u> and, certainly, that did not lead to any infarction which is death of cardiac muscle. [emphasis added]

9.14 In oral evidence, Dr Quilty confirmed that he did not agree with the opinions expressed by Associate Professor Adams and Professor Nicholls in their reports regarding Keith's cardiac condition being less likely to have contributed to his death. There then followed this exchange:

> Q. You don't defer to their expert opinion as leading cardiologists in Australia?
> A. I guess as a general physician with quite a degree of expertise both in cardiology and heat exposure, my opinion differs. There's a 20-year-old man who is very fit and well and died on a relatively mild day from heat stroke. There has to be a predisposition somewhere, and a 70% stenosis in the left coronary artery is considered a severe stenosis, and would need to--

> Q. Pausing there, that assumes the correctness of the section.
> A. You can't get any more correct than a dissection.
>
> Q. On autopsy, Professor Mark Adams questions whether it was perhaps 70%, or it may have been something less.
> A. I thought that his question was more in relation to the flow parameters of that stenosis, and he is correct in his correspondence that you can't judge the flow in an autopsy, and that is a very complex question, and I think it would – I think it's - the fact is that he had a severe stenosis in a critical part of his coronary vasculature, and that could explain the entire cascade of events. In fact, to me it does explain the cascade of events.

9.15 The relevance of Keith's coronary artery disease was further explored with both Associate Professor Adams and Professor Nicholls during their oral evidence in a number of ways.

9.16 *First*, both experts considered the accuracy of the 70% stenosis described in the autopsy report, with Associate Professor Adams expressing this view:

> However, in a lot of people as this plaque grows, the vessel expands to accommodate the plaque. So, even though there is quite a large plaque, there often isn't a great deal of restriction of blood flow.
>
> The question is whether that narrowing within his vessel, would have restricted blood flow in the coronary artery at high levels of workload, and that's something I'm not - I think is very difficult to ascertain. Based on the evidence we've got, it's described as 70%, but I'm not sure whether that 70% is in the cross-section of the artery, whether that 70% is that there is only 30% of the lumen compared to the whole of the cross-sectional area, or whether it's compared to upstream and downstream from that vessel.

9.17 Professor Nicholls expressed a similar view regarding the accuracy of the autopsy findings:

> [W]hen I read the details of Mr Titmuss' case, the presence of disease in his coronaries wasn't a surprise. Perhaps what's less common, is the presence of a severe narrowing, I agree with Associate Professor Adams' caveat about it's an autopsy and how severe it really was.

9.18 *Second*, both experts considered whether Keith's coronary artery disease contributed to his death. Associate Professor Adams gave the following evidence:

> Even if we do angiograms on someone like Keith for whatever reason, if he had been having chest pain, we would then be interested in not just whether it's 50% or 70% compared to the reference vessel, but whether it's limiting flow. And really, the only way to tell that is to do a physiologic study where we put a pressure sensing wire across that legion, this is during life, and we induce maximal flow in that bed, and look to see whether there is any drop off in pressure.
>
> And so, it's a possibility that that could have contributed, but I think is in my opinion, I think it's not highly likely, largely because Keith doesn't seem to have expressed any sort of chest pain on exertion, and certainly was fit and capable of higher levels of workload.

9.19 Professor Nicholls agreed with this opinion expressed by Associate Professor Adams:

> Q. And in terms of whether the 70% stenosis or narrowing had a material contribution to Keith's cause of death, do you agree with Associate Professor Adams that it's unlikely?
> A. I think so. Yeah, agree.
>
> Q. And for the same reasons?
> A. Agree.

9.20 *Third*, both experts were invited to consider the opinion expressed by Dr Quilty on this issue and asked this question:

> I take it then, professors, that you disagree with Dr Quilty who elevates it to more likely than not, a 70% stenosis having a material contribution?

9.21 Associate Professor Adams answered in this way:

> Yeah, no, I think that it's less likely. More likely than not that it didn't contribute.

9.22 And Professor Nicholls answered in this way:

> It's less likely. I think that, you know, when we think of the fact that he has not had any symptoms on exertion that's preceded this, this would seem like somebody who is more than having a stress test at training. So, if we were to put him on a treadmill, he would have passed, quite easily, I would suspect. There is a fairly severe form of systemic distress with severe exertional heat stroke. Put a greater stress [sic], and that potentially have [sic] an impact on the ability to raise that cardiac output with the narrowing. That certainly may possibly [sic] the case.

9.23 **Conclusions:** Keith's underlying coronary artery disease most likely did not contribute to his death. The conclusion is expressed in these terms because the totality of the expert evidence establishes that the possibility of Keith's coronary artery disease having some contribution to his death cannot be entirely excluded. However, the opinions expressed by Associate Professor Adams, Professor Nicholls and Professor Seppelt further establishes that Keith's coronary artery disease was either of no significant consequence, or likely played no role, in relation to the cause of his death.

9.24 The finding of Keith's coronary artery disease itself, if accurate, is not uncommon or unknown in a person of Keith's age. However, there exists some doubt on the available evidence as to the extent of this coronary artery disease. Further, even if the described stenosis is correct, it is uncertain whether it may have either increased Keith's susceptibility to developing exertional heat stroke, or limited his ability to maintain cardiac output to thermoregulate. This is because true measurement of the extent to which stenosis may limit blood flow can only be done in life with appropriate physiological studies.

9.25 In addition, it is unlikely that Keith's cardiac output was impaired in any way given the amount of strenuous activity he undertook during both the outdoor and indoor training sessions on 23 November 2020. Importantly, no evidence of myocardial ischaemia or infarction was seen at autopsy.

9.26 One matter raised by Dr Quilty is that because Keith was "*very fit and well and died on a relatively mild day*" there "*has to be a predisposition somewhere*". To Dr Quilty, this apparent predisposition can be found in Keith's coronary artery disease. However, the opinion expressed by Dr Quilty appears to ignore the fact that Keith's comparative level of fitness was the lowest amongst his training cohort which engaged in the same strenuous activity, that exertional heat stroke can present even in mild temperatures, and that the environment inside the Dojo was conducive to the development of exertional heat illness.

9.27 Accordingly, the weight of the opinions expressed by Associate Professor Adams, Professor Nicholls and Professor Seppelt, taken both individually and together, should be preferred to that of Dr Quilty. Therefore, Keith mostly likely did not have any pre-existing condition which contributed to his death.

9.28 One final observation should be made about this issue. During the course of the inquest, counsel for Manly adduced evidence from a number of current and former Manly players and staff that "*the culture at Manly was a culture of caring about players*". It was a theme which Manly sought to revisit at several points during the inquest.

9.29 On one view, the approach taken by Manly to the issue of whether Keith had a pre-existing condition which contributed to his death is incongruous with the theme described above. This is because it was known to Manly that agitation of this issue was a source of distress for Keith's family. Whilst parties are obviously entitled to robustly protect their interests in any legal proceedings, including non-adversarial proceedings within the coronial jurisdiction, the degree to which the issue was agitated by Manly was surprising and rarely seen. This is particularly so in circumstances where, as noted above, it was submitted on behalf of Manly that the opinion expressed by one expert engaged by Manly should be preferred over the opinion expressed by another expert, also engaged by Manly.

10. The adequacy of procedures at Manly to identify and learn from training incidents

10.1 This issue is concerned with a separate incident involving Manly and one of its players at the time which occurred prior to 22 November 2020, but bore some striking similarities to the incident involving Keith.

The events of 6 November 2017 (the Lloyd Perrett Incident)

10.2 On 6 November 2017, Lloyd Perrett, a Manly player at the time, attended a pre-season training session following an 8 week break. After taking part in wellness, body weight and hydration testing (which showed average wellness scores and mild dehydration), Mr Perrett took part in a training session which comprised a 15 minute general warm up and two 2-kilometre running time trials with a rest break in between.

10.3 During the second lap of a third 2-kilometre running time trial, Mr Perrett started to stumble. During the subsequent lap, Mr Perrett fell over and collapsed. Physiotherapy staff attended Mr Perrett and found him to be unconscious but still breathing. Mr Perrett was placed in the recovery position but displayed signs of agitation. Dr Luke Inman, the Manly Chief Medical Officer (**CMO**) at the time, attended within several minutes and applied a defibrillator to check Mr Perrett's vital signs. Emergency services were contacted. Dr Inman observed that Mr Perrett had an elevated heart rate, low blood pressure, cold and clammy skin, and that his muscles, legs and arms were contracting in a "*pulse-like fashion*". A short time later, Mr Perrett became combative and attempted to stand up before falling back over.

10.4 NSWA paramedics arrived on scene promptly and Mr Perrett was moved to an ambulance on a stretcher. His core temperature was taken and found to be over 40°C. Dr Inman formed the view that Mr Perrett was suffering from hyperthermia/heat stroke. Ice packs were applied to Mr Perrett's groin and neck and he was transported to Mona Vale Hospital emergency department.

10.5 Following treatment, Mr Perrett was discharged from hospital two days later on 8 November 2017. Dr Inman established a recovery program prior to return to play for Mr Perrett which included a period refraining from exercise, a physical examination and testing to ensure no organ damage, initial exercise in a cool environment, and a gradual increase in exercise duration, intensity and heat exposure over two weeks to acclimatize and demonstrate heat tolerance.

10.6 Mr Perrett sustained no permanent impairment following the incident and was later given medical clearance on 23 January 2018 following successful completion of a heat tolerance testing.

Recommendations following the Lloyd Perrett Incident

10.7 Following the Lloyd Perrett Incident, Dr Inman completed an incident report on 6 November 2017 which included the following recommendations:

1. Doctor to provide 30 min Coaching and Performance staff training for emergency response and the collapsed athlete.

2. Emergency Action Plan (as per Brookvale) should also be provided for training facilities and hang in a laminated frame on the wall.

3. Resus gear at training should be increased: eg thermometer for rectal temp. Oxygen in a wall mount, defibrillator (was present), Stethoscope, blood pressure monitoring kit, epipen, asthma meds, c-spine collar. And training provided for its use when needed.

4. Awareness of high risk periods for heat stress in future: athletes with high BMI/ low aerobic capacity, athletes with prior history of heat illness, first 4 days of preseason, temp above 26 celsius and high humidity, prior viral illness or fever, running in a group/ team race. Possibly ease in to training first week and testing max aerobic capacity week 2 should be considered.

5. Next of kin details and medical screening notes accessible to all in a usb keyring format in future.

Presentation regarding exertional heat illness and prevention

10.8 Dr Inman gave evidence that the first of his recommendations was completed within two to three weeks of the incident. Following a changeover of Manly staff, Dr Inman gave a second presentation regarding the same topic on 7 January 2019. A record of the calendar invitation for that presentation records John Bonasera as the organiser and Mr Ross, Mr Singe, Mr Rahme as invited guests. Other Manly staff at the time, namely Mark Booth (Head of Sport Science), Conor Daly (Strength & Conditioning Coach), Cameron Ferguson (Rehabilitation and Strength Coach), and Daniel Schacher (Junior Sports Scientist) were also invited.

10.9 The PowerPoint presentation dated 7 January 2019 is titled *MWSE Injury Prevention* and includes as two of its topics, *Causes of the collapsed footy player* and *Exertional Heat Illness and Prevention*. Under the sub-topic *Prevention and recommendations*, the presentation provides for the following:

Awareness of high risk for heat stress
- Athletes with high BMI/low aerobic capacity
- Athletes with prior history of heat illness
- First 4 days of preseason
- Temp above 26 °C Celsius and high humidity
- Prior viral illness or fever
- Running in a group/team race
- Ease in to training first and second week and testing max aerobic capacity after 2 weeks should be considered

10.10 Further, under the sub-topic *Exertional Heat Illness*, the presentation provides:

Signs and symptoms
- Dizziness, nausea, vomiting and diarrhoea
- Weakness, sweating, dry mouth, thirst
- Cramps, loss of muscle function and ataxia
- Tachycardia (fast heart rate) and hypotension (low BP)

Management
- BLS – DRS ABC

- Measure vital signs – BP, HR, Sats, Temp, BSL, serum Na
- Rapidly lower core body temp (ice bath)
- If no other medical intervention required: "cool first, transport second".

Otherwise get to closest ED ASAP!

10.11 The evidence regarding who attended the 7 January 2019 presentation, and what any attendee recalled of its content, is varied:

(a) Mr Rahme gave evidence that he recalled a presentation given by Dr Inman but was unable to remember the content or any topics covered by Dr Inman;

(b) Mr Bonasera gave evidence that he could not recall attending the 7 January 2019 presentation, describing his role as an "*administrator and facilitator for these types of things*";

(c) Mr Singe gave evidence that he would have attended the 7 January 2019 presentation and recalled the topics contained in the PowerPoint; and

(d) Des Hasler, the Manly Head Coach between 2019 and 2023, gave evidence that, although not on the list of invitees, he could not recall attending the 7 January 2019 presentation by Dr Inman (which occurred shortly after he was appointed Head Coach), or attending any workshop or session conducted by Dr Inman or anyone else at Manly in relation to the risks of exertional heat illness.

Awareness of current and future Manly staff following the Lloyd Perrett Incident

10.12 In relation to his fourth recommendation, Dr Inman gave evidence that each of the matters that he identified are independent risk factors which increase a person's risk for developing heat illness and heat stroke. As to the timeframe referred to in his recommendation, Dr Inman gave this evidence:

> Because that first ten to 14 days are the deadliest, so it takes ten to 14 days to acclimatise to the heat, so most of the cases of heat stroke and death occur really within the first four days, but the acclimatisation, the body really takes about ten days to 14 days to adjust to heat. That's the reason I made those recommendations.

10.13 Dr Inman gave evidence that his recommendations were directed to the Manly performance staff and that he expected that they would be used to develop training programs for players. However, Dr Inman gave evidence that he did not know whether his recommendation was put into effect at Manly during the period that he was the CMO.

10.14 Dr Nathan Gibbs, who succeeded Dr Inman as Manly CMO between 2019 and 2021, gave evidence that when he re-joined Manly in 2019 (having previously worked at Manly between 1996 and 1999), he was not made aware of the Lloyd Perrett Incident, and only learned of a previous incident of exertional heat illness involving a Manly player in 2024 in preparation for this inquest. Dr Gibbs gave further evidence that as part of his preparation he saw the recommendations made by Dr Inman but not Dr Inman's PowerPoint presentation. Further, Dr Gibbs gave evidence that during his time as Manly CMO he did not provide any workshops or training sessions to Manly coaching staff or players regarding the signs and/or symptoms of heat illness, or how it may be prevented.

10.15 Mr Bonasera gave evidence that he could not recall seeing either Dr Inman's incident report or recommendations prior to 23 November 2020, and that he only came across the documents when responding to an order for production issued to Manly by the Coroner's Court in preparation for the inquest. Mr Bonasera gave evidence that he expected the incident report would be stored in "*something like an athlete management system or a sports medicine style database*". However, Mr Bonasera gave evidence that he actually did not know where the records were kept and relied upon a third-party information technology company to conduct a search of Manly's records in response to the order for production issued by the Court.

10.16 When asked whether since the order for production was issued any review has been conducted of the systems at Manly to ensure better record keeping in relation to matters relating to player safety and welfare, Mr Bonasera replied:

> I can't speak to an improvement in record keeping per se, however, we have actively pursued lots of avenues in and around this incident and particularly after establishing the cause of Keith's passing and we've worked very hard to ensure that nothing like that ever comes ever happens again, by improving our systems and processes, both at Narrabeen and Brookvale, which are our two training bases.

10.17 Mr Bonasera could not recall Dr Gibbs ever addressing coaching and support staff regarding the risks of exertional heat stress or illness, and expressed uncertainty about whether Dr Inman had ever done so. However, in oral evidence, Mr Bonasera agreed that between 2017 and 2019, Dr Inman had undertaken work to raise awareness of, and bring to the attention of staff at Manly, the risks of exertional heat stroke or illness. Mr Bonasera also agreed that if appropriate systems were in place at Manly that such information could have been retained in an easily accessible format and used in future seasons.

10.18 When asked why this information may have fallen through the cracks, Mr Bonasera gave the following evidence:

> I can't speak specifically to it. I guess I would say that when Dr Inman finished with the club, we were in season and I do recall at that time, there was a transition period between Dr Inman finishing with us and a new CMO beginning.
> […]
> And so rather than, for example, someone coming straight in after Luke and taking over, the remainder of that season, we worked with a number of doctors on a more casual basis to fulfil the role of CMO. It's very difficult to get a doctor who's in a position to spend the amount of time and travel et cetera with a team and I recall talking to the NRL regularly and working closely with them to get suitably qualified doctors to cover us off for both regular medical clinics and in particular for game coverage.

10.19 On 4 November 2018, Dr Inman sent an email to Mr Bonasera attaching the 2018 version of a policy document from the NRL regarding management of thermal injury/hyperthemia (discussed in more detail below) and requesting that it be passed on to the Manly Head of Performance at the time. Dr

Inman referred to the Lloyd Perrett Incident and indicated that it was the policy of both Manly and the NRL for heat measurements to be taken for all preseason training sessions.

10.20 On 7 April 2019, Dr Inman forwarded a copy of his 4 November 2018 email to Mr Booth, copying in Mr Bonasera, Mr Hasler and Mr Singe, and relevantly wrote:

> Hi Mark,
> I am well aware of the NRL policy and guidelines. Furthermore, John Bonasera forwarded you my email in Nov 2018 regarding heat measurement at training and the clubs stand on the "recommendation" is that it is performed at every training session during the hotter months in preseason (see below). You were made aware of the clubs medical policy for heat measurement at training by John Bonasera and have not complied. You are leaving yourself and the club open to litigation from a player if they happen to suffer from heat stress or worse, die. We have already had one extreme example of this. I would strongly advise that this measurement is continued at training please. It does not take long to set up.

10.21 Mr Booth subsequently forwarded Dr Inman's 4 November 2018 email to Mr Singe indicating that he (Mr Booth) had never seen the email. There then followed an email exchange between Mr Singe and Mr Booth which can be described, on any fair reading, as containing some vulgar language and being derogatory to Dr Inman. Indeed, at 10:22pm on 7 April 2019, Mr Singe wrote in an email:

> That's fine and I can talk to him about what he recommends or what "advise" [sic] I take from him at training but it would only be done when needed and it is still not my responsibility at games.

10.22 When shown the emails during the course of his oral evidence, Mr Singe agreed that aspects of the emails were unprofessional. When asked whether the emails could be construed as demonstrating a "*laissez-faire*" approach or an "*unwillingness to take Dr Inman's concerns about the Kestrel meter seriously*", Mr Singe gave this evidence:

> I would say that - that this is probably a more personal - personal thing than a professional thing, so - this is - looking back at this, this was a - an event that came about from a from a match, from a match that something that happened there during a - an actual NRL match. So - so it was - yeah - two upset people.

10.23 Notwithstanding the above, Mr Singe agreed that the email could be read as Dr Inman having the safety and welfare of players at the forefront of his communications and that Dr Inman was "*always thorough*" with reiterating to relevant staff the need to take proper steps to ensure that measurements are taken during training to avoid exertional heat stroke.

10.24 **Conclusions:** Following the Lloyd Perrett Incident, Dr Inman made a number of well-informed and helpful recommendations aimed at educating relevant staff at Manly about the signs and symptoms of exertional heat illness, and preventing the occurrence of a similar incident. The evidence is unclear as to the extent to which this information was received and retained by relevant Manly staff members.

10.25 What is clear is that following the initial presentations given by Dr Inman about the signs and symptoms of exertional heat illness, and its prevention, no further presentations were given to relevant Manly staff by Dr Gibbs or any other medical professional in the period between at least 12 November 2019 (when Dr Gibbs became Manly's CMO) and 23 November 2020. Relevantly, Dr Gibbs was not told about the Lloyd Perrett Incident, any of Dr Inman's recommendations or Dr Inman's PowerPoint presentation. Indeed, Dr Gibbs first learned about these matters in 2024 when preparing for this inquest.

10.26 It can be accepted that communication and handover issues may arise in any instances of staff turnover within organisations. However, the evidence suggests that whatever record-keeping system existed at Manly between at least 2019 and now (and in this regard, the evidence of Mr Bonasera provided no further clarity) was, and is, not sufficiently robust and reliable to ensure that important information relating to player safety and welfare regarding exertional heat illness is retained and conveyed to those staff to whom it is most relevant. In this regard, Mr Bonasera was unable to identify any improvement made to Manly's record-keeping practices since at least 2019 and appeared to deflect examination of this issue by making a broad statement regarding improvements in other systems and processes.

10.27 Despite acknowledgment of Dr Inman's thoroughness in seeking to ensure that appropriate steps were taken at Manly to prevent a repeat of the Lloyd Perrett Incident, the evidence establishes that on at least one occasion, certain Manly staff members adopted an unprofessional approach to this issue. This perhaps reinforces a conclusion, together with the identified deficiencies in Manly's record keeping, that prevention of another incidence of exertional heat illness involving a player was not always at the forefront of the consideration of relevant staff at Manly prior to 23 November 2020. It is therefore necessary to make the following recommendation.

10.28 **Recommendation:** I recommend to the Chief Executive Officer, Manly Warringah Sea Eagles, that Manly review its record-keeping procedures to ensure that they are sufficiently robust and reliable so that any previous incidents where a player has experienced a serious adverse health event (for example, involving hospitalisation) whilst at training or during a game, and any advice or lessons arising from such an incident, are effectively communicated to all: (a) coaching staff; (b) members of the High Performance Unit; and (c) medical and allied health staff. This communication should occur whenever there is changeover of such staff or at least on an annual basis, whichever is the earlier.

11. The appropriateness of the player screening and welfare measures prior to 23 November 2020

11.1 Joshua Schuster, a current Manly player and one of Keith's close friends, gave evidence that during the 2020 offseason he and Keith were given different training programs by the Manly strength and conditioning coaches. He gave evidence that he and Keith were doing "*gym and just running pretty much*" during the offseason, and described Keith as "*very fit*" and "*training very hard*". He said that Keith was pushing hard in his offseason training to be the best that he could and said that Keith was "*very motivated*" to make his NRL debut.

11.2 Prior to 23 November 2020, Keith (and other members of the training squad) undertook a range of screening and welfare measures including a wellness check, physical marker assessment, an ECG test, medical screening, Wingate Test and Yo-Yo Test. Distinguished Professor Coutts gave evidence that whilst the predictability of exertional heat stress is complicated and very difficult, the range of pre-screening tests are of value in determining whether a person is at increased risk of exertional heat stress.

11.3 Of particular relevance to this issue is the Yo-Yo Test. Distinguished Professor Coutts explained that this is a measure of aerobic and physical performance capacity, and an indicator of aerobic fitness. It is one of the most common aerobic fitness tests completed in rugby league.

11.4 Distinguished Professor Coutts gave evidence that Keith's Yo-Yo Test score of 14.6 and the total distance he travelled of 680 metres was a "*very low score for a professional rugby league player*" who would ordinarily be expected at their peak fitness to travel between 1600 to 1800 metres. Distinguished Professor Coutts noted that, as a forward, Keith would be expected to travel less than the average player because of the nature of his increased body mass. However, even taking this into account, Keith's extrapolated VO2 max (which is a measure of aerobic fitness) would be 42.1 mL of oxygen per kilogram of muscle per minute. Distinguished Professor Coutts explained that Keith's measurement was "*quite low compared to average reported scores for senior elite rugby league players*" whose measurements are typically 55 to 56 mL of oxygen.

11.5 Distinguished Professor Coutts gave evidence that the data from Keith's Yo-Yo Test was a potential red flag as his low aerobic fitness would be deleterious to his ability to deal with heat and intense and prolonged training. Distinguished Professor Coutts explained:

> Low aerobic fitness means you have decreased capacity to deliver oxygen to the working muscle to produce the work and also decreased capacity to move the blood to the skin to cool. So typically when you exercise in the heat, you're producing metabolic heat; you need to cool and thermoregulate, and a low aerobic fitness decreases that capacity. Additionally, if we're all, say, in a team sport, we're doing the same type of training, you would find it relatively harder than your counterparts the less fit you are.

11.6 Distinguished Professor Coutts went on to give evidence that the available data demonstrated that Keith had the lowest aerobic fitness of any of the Manly players tested at the time, and a much lower score for the Yo-Yo Test than reported scores for elite rugby league players in general. This placed him at greater risk of not tolerating the stress of an exercise session, and therefore increase his risk of exertional heat illness.

11.7 Distinguished Professor Coutts also noted that on 14 September 2020 Keith weighed 112.1 kilograms and that on 23 November 2020, Keith weighed 116.8 kilograms, an increase of 4.6 kilograms. Distinguished Professor Coutts explained that such an increase in mass during the off-season is not uncommon for team sport athletes. However, Distinguished Professor Coutts explained that Keith's increase in weight was unlikely due to increased muscle mass (due to the nature of activities and time taken required for such an increase) and more likely represented increased fat mass. Distinguished Professor Coutts gave evidence that as a result, Keith had a lower aerobic fitness on 23 November 2020 compared to the end of the previous season.

11.8 Support for the conclusions reached by Distinguished Professor Coutts can be found in observations made by Mr Monaghan. In contrast to Mr Schuster, on 23 November 2020, Mr Monaghan observed Keith "*straight off the bat was sort of behind significantly compared to everyone else*" and that he was "*struggling in terms of keeping up with the other boys*". When Mr Monaghan made these observations he recalled previous discussions he had with Keith about maintaining his fitness during the offseason which did not translate to the Yo-Yo Test results. Mr Monaghan gave this evidence:

> [T]hat was probably the first thing I noticed because I had actually spoken to him in the - at the end of the - the previous season because he was probably in the best shape he'd been in and sort of I actually called him into my office and spoke to him about trying to look after himself in the offseason because he had made so much improvements during that COVID season that to - to go and have an offseason and let himself get back to where he'd sort of been the previous year, I sort of implored him to - to look after himself in the offseason and make sure he'd come back in really good shape and that was probably what prompted me to - to focus on him a little bit more in that - that YoYo test and that following session was because I'd had that interaction with him and sort of spoke to him about, you know, taking advantage of that, the fitness he had built up during that COVID season that, you know, when I saw how far behind he was it sort of - it sort of - yeah - that was what clicked to me because I'd spoken to him about it.

11.9 **Conclusions:** The player screening and welfare measures conducted prior to 23 November 2020 were appropriate in that they provided valuable information to Manly high performance, sport science and coaching staff about the aerobic fitness of individual players. This information was particularly relevant in relation to the first pre-season training sessions conducted following the off-season.

11.10 The information gathered demonstrates that Keith had the lowest aerobic fitness of any of the players within the same testing cohort. Further, Keith returned from the offseason 4.6 kilograms heavier and it is unlikely that this represented an increase in muscle mass. This meant that Keith had a lower level of aerobic fitness at the start of the pre-season compared to the end of the previous season. Although Keith, like the other players, was provided with an individualised, but unsupervised, training program to maintain fitness levels during the offseason, this did translate into expected Yo-Yo Test results, or expected physical performance on 23 November 2020.

11.11 Whilst the information gathered from the player screening assessments could not be used to predict the likelihood of Keith developing exertional heat stroke or heat illness, it remained significant in another way. The information demonstrated that with comparatively the lowest level of aerobic fitness within the player training cohort, Keith was at greater risk of not tolerating the demands of an exercise session, and therefore at greater risk of exertional heat illness.

12. The appropriateness of the training session on 23 November 2020

12.1 At the outset, Distinguished Professor Coutts identified several general features drawn from relevant literature about the training session on 23 November:

(a) Aerobic fitness is pivotal for athletes to regulate the heat produced during exertion with effective heat distribution, muscle oxygenation, and the acceleration of sweat rates all serving as efficient cooling mechanisms; low aerobic fitness is a risk factor for exertional heat stress;

(b) Larger athletes with lower aerobic fitness are more prone to exertional heat stress as they tend to have lower work efficiency and greater metabolic heat. Lower relative blood volume can hinder effective organ and skin perfusion for heat dissipation;

(c) Reports consistently link increased body mass index (**BMI**) (defined as >30 kg/m^2) to a higher incidence rate of exertional heat stress;

(d) Although the outdoor temperature (between 21.6°C and 24.9°C) and the relative humidity (between 74% to 92%) at the time of the trading session on 23 November 2020 would be considered of low to moderate risk of exertional heat illness, and tolerable by most athletes, hypothermia and exertional heat stress can occur in athletes under temperate conditions, or environmental conditions that have previously been well-tolerated.

(e) Physically fit and motivated athletes are more susceptible to exertional heat stress due to their sustained high metabolic heat production during intense activity like rugby league training, which can be further exacerbated in large athletes, like Keith, who can produce higher levels of metabolic heat and have reduced ability to thermoregulate.

Interpretation of collected data

12.2 Distinguished Professor Coutts noted that the reported data for the training session on 23 November 2020 indicated that Keith moved a total of 6,794 metres. Distinguished Professor Coutts considered that this represented a "*large volume session*" for Keith to complete given that it was:

(a) the first session following an offseason of suspected lower and unsupervised training;

(b) the third highest value reported in the previous three months of data (which included in-season training sessions when the players were better prepared); and

(c) higher than the game load for a player of Keith's position, who would be expected to travel approximately 3.5 to 5.5 kilometres during a game.

12.3 Distinguished Professor Coutts also considered the following data collected regarding the training session on 23 November 2020:

(a) Distinguished Professor Coutts described the total duration of the session of 139 minutes to represent a "*longer session*" given that "*two hours on your feet for any training session is considered a decent duration*".

(b) Distinguished Professor Coutts gave evidence that the measurement of Keith's movement of 48.7 metres per minute was not particularly significant as it simply represented a calculation of the metres travelled by Keith divided by the duration of the session, and that on its own the figure may give the impression of a low intensity session. However, the result does not take into account common training activities in team sports which can involve standing still or not much movement, but still be intense. Such activities in the context of rugby league include tackling a bag or skill drills. Therefore, the GPS data only provides one measure of the work being performed by players, but is not a complete measure of the true work being done.

(c) Distinguished Professor Coutts noted that the measurement of Keith's high-speed running (**HSR**) of 469 metres was of limited utility. However, Distinguished Professor Coutts explained that comparative data indicates that a hit-up forward might do around 250 metres of HSR in a match, indicating that Keith's measurement was therefore higher than during a game.

(d) Distinguished Professor Coutts noted that the measurement of player load (performed by an accelerometer in the GPS device worn by players) can account for some of the load that is not measured by distance. A higher number equates to a greater load for a player. Distinguished Professor Coutts noted that Keith's player load of 780.96 represented the highest number of any of the sessions completed by Keith in the period between 24 August 2020 and 23 November 2020.

(e) Distinguished Professor Coutts described Manly's NRL Daily Field Report for 23 November 2020 to be data collected from various load measurements from wearable devices for each player in the squad, aggregated into summaries of each drill completed. Distinguished Professor Coutts gave evidence that the data was classic of rugby league training sessions and showed that the average of most of the drills reported was between 80 to 100 metres per minute, which is typical of the speed and distance travelled in a rugby league game.

However, Distinguished Professor Coutts gave evidence that Keith's individual data was "*a little lower than most*" of the other players, which was probably expected for someone of relatively lower fitness doing a team-based activity. Therefore, even though Keith was performing similar type activities, he travelled less distance.

Measurement of internal responses

12.4 Distinguished Professor Coutts gave evidence that determining how Keith was responding would be impossible from merely interrogating the available data. Some measure of internal response would be required to determine how Keith was coping with the training session. Whilst that measurement is obviously not available, the subjective measurement of internal responses from other players in the training group is instructive:

(a) Mr Schuster described 23 November 2020 as the toughest preseason training session he had completed and attributed this to it being his first exposure to elite training at the NRL level as well as the "*running conditioning side of it*" involving a series of sprint work, box runs and grid runs.

(b) Mr Schuster was also asked about the nature of training in general and gave this evidence:

> Q. At that point in time, how would you describe the environment or the culture at the club as to whether or not you could put your hand up and say "I need a break, I've hit the wall"? Was that something you could do, or you'd be frowned upon?
> A. No. Not with Des as our coach.
>
> Q. When you say not with Des, you're referring to Des Hasler, the--
> A. Yeah.
>
> Q. --head coach of the Manly Warringah Sea Eagles?
> A. Correct.
>
> Q. Do I take it, with Des, you just had to push through the pain barrier?
> A. Yep.
>
> Q. And that if you took time out, it might come back against you?
> A. Correct

(c) Sione Fainu, a former Manly player, described the outdoor training session as "*pretty tough*" and rated it a 7 out of 10 in terms of intensity. Initially, Mr Fainu said that the indoor training session in the Dojo "*wasn't too hard*" but later described it as a "*hard session*". Mr Fainu said that he was struggling during the session, that Keith would have been "struggling from the start", and that "everyone was struggling". Overall, Mr Fainu rated the indoor session as a 9 out of 10 in terms of intensity.

Mr Fainu also gave evidence that he and the other players felt comfortable that they could put their hand up and sit out a training session if it "*got too much*". However, Mr Fainu also gave evidence that he had never observed any player do so. Mr Fainu then gave the following evidence:

> Q. Would it be fair to say that the environment or the culture was to push through whatever the cost?
> A. Yes.

(d) Ben Trbojevic, a current Manly player, gave evidence that the during the outdoor training session all the players were "*under fatigue*" but that they were encouraging and pushing each other. When asked if his reference to being under fatigue was another way of saying that the players were struggling, Mr Trbojevic explained:

> No, not really, cause I think the, the sessions are designed to get fatigued. You've met - like, that's - you've got to meet the physical demands of the game and every session's hard in its own way and,

> like, when we go out and play footy, for example, like you're under a lot of fatigue, so that's, that's what we train for, you know what I mean?

Mr Trbojevic gave evidence that subsequent outdoor training sessions increased in intensity from the session on 23 November 2020, and that he personally had "*done harder sessions than the one*" on that date.

12.5 Aspects of the evidence given by both Mr Schuster and Mr Fainu highlighted the different perspectives that players and coaches may sometimes hold in the context of competitive elite team sports. Dr Gibbs helpfully described the nature of this apparent tension in his evidence:

> I think it's really the problem is the system you have young players like Keith coming in who want to get a contract in rugby league and secure their future and they want to train hard and push into fatigue and they're not going to put their hand up and say, "I'm tired", and have a coach think, "This guy is not much good." You also have the coaches and the training staff who want to train the team harder to get a better on field performance than they had last year and to push players to fatigue and understand fatigue and push through it. Because that's what you do to be a good football team. So, they're the things that drive the training program and drive a player trying to get a good career. And if you combine that with hot weather, then that creates a disaster that could happen like Keith. And so the I really think if you if you had to if you had a rule where you had to restrict training and it was an NRL rule, not an individual club rule that they could manipulate, that would really help control everyone's eagerness to train hard which everyone wants to do.

12.6 Dr Gibbs also gave evidence that in his experience as a sports medicine physician since 1991 he had witnessed the same thing in AFL as well as rugby union.

12.7 Perhaps unsurprisingly, Mr Hasler offered a slightly different view to that of Dr Gibbs when he gave this evidence:

> [I]t's really important from the outset, particularly the younger players that are coming in, that there is a real need not to overstride. The space in which they come into, particularly at NRL level and top 30 as they start that area, it's one of openness and honesty and trust and that they can communicate openly to counteract that emotion of, "I must succeed", or, "I must impress the coach."

12.8 Mr Hasler went on to explain:

> I think it's also important to understand, that before the training sessions start, we instruct the players and showing them the plan on what's to happen, that if they're feeling ill or feeling like they're not coping well with it, if they feel that they have a strain or an injury, that they raise their hand or they let us know that they are not coping or they are struggling with the session and not to feel threatened. It's essential to understand and realise that the last thing we want them to do is to injure them or not to have them on the field and that's essentially really important as part of our culture plan.

12.9 Mr Monaghan also gave evidence similar to that of Mr Hasler:

> Well, that's again that's - that's again one of the the cliches of those – the footy teams and all that. It's about pushing yourself further and – and there's no doubt that that is part of the challenge of

> preseason is - is, like I said, improving and pushing yourself and I've no doubt players have - have done - that have - there's been some consequences of – of trying to push themselves further and like I said for the most part it's driven by the players, there's a lot of, you know, that camaraderie in that like, play, about pushing each other and working for each other and that's, like I said yeah whether that results in - in harm, I don't - I haven't seen it very often but there's - because there's also that part of the harder you push them it can often be a detriment to training, so, you know, that's the role of our HPU guys is to - to set those limits and - and making sure that we're all aware of trying to improve and push them as far as we can but doing it within, you know, within that idea of still taking care of each other and – and being responsible for each other and having that duty of care.

Conditions inside the Dojo

12.10 One matter of focus during the inquest was the conditions, or perceived conditions, inside the Dojo. Again, there were varied witness accounts regarding this matter:

(a) Mr Schuster gave evidence that he thought the temperature inside the Dojo was 33°C or 34°C. He described the conditions as humid, "*very hot*" and the hottest that he had ever been inside the Dojo. He said that the doors inside the Dojo were not open and that he could not recall whether the fans were turned on. He said that although he was feeling "pretty good" in terms of his level of fitness, he was feeling a "*little bit*" gassed, with a "*little bit*" of muscle fatigue as well as lactic acid buildup.

(b) Mr Schuster said that he did not observe Keith to be struggling inside the Dojo and that he "*looked ordinary, the same as every other session*". Mr Schuster explained that Keith was not one to complain and that he kept to himself and would always push through, not wanting to be seen as a quitter.

(c) Moses Suli, a former Manly player, gave evidence that the conditions inside the Dojo were "*usually hot*" and that it was a "*tight space*". Mr Suli also gave evidence that the two side doors in the Dojo were usually open. Further, Mr Suli gave evidence that there was no air conditioning in the Dojo but that there were two floor fans which were sometimes turned on by players or staff when it was hot.

(d) Mr Trbojevic did not agree with conditions inside the Dojo being "*hot and stuffy*" or "*hot and humid*". He said that he himself was warm from training but had no precise recollection of the conditions inside the Dojo. Mr Trbojevic said that he could not recall whether the floor fans were turned on, or whether the doors were open, but said that they were usually left open. Mr Trbojevic again described all the players being "*under fatigue*" and that by looking at any of the players it would appear that they had completed a "*hard session*". However, Mr Trbojevic said that it never reached the point where he felt that he needed to sit out. He said that it "*wasn't a culture or thing from the coaching staff*" where it would be frowned upon if a player sat out a training session.

(e) Mr Ross gave evidence that he could not recall what the temperature was inside the Dojo but said that he "*wasn't uncomfortable*". However, Mr Ross later acknowledged that the Dojo on occasion could get "*hot and stuffy*", particularly when there were "*20 or so*" players training

inside but that the side doors were always open when players were training. He could not recall whether the fans were turned on.

(f) Mr Singe gave evidence that he had no sense of how hot it was inside the Dojo, and would only remember if there was "*something that made [him] feel uncomfortable*".

(g) Mr Monaghan gave evidence that both doors in the Dojo were open, "*there was some breeze coming through*" and that he could not recall it being "*hot or anything like that*" or whether the fans were turned on.

12.11 As noted above, different evidence was given by various witnesses about whether the floor fans inside the Dojo were turned on at the relevant time. Distinguished Professor Coutts explained that even if the fans had been turned on, they would have provided limited effective cooling in the hot and humid conditions inside the Dojo. This is because evaporative cooling through sweat is less effective, and alternative cooling methods such as ice packs or air-conditioning (which was not available on 23 November 2020) are more suitable.

Effect of the Dojo training session

12.12 Distinguished Professor Coutts gave evidence that the outdoor training session of over two hours would have increased player load. According to Distinguished Professor Coutts, an 800 metre jog to the Dojo followed by the addition of up to 10 minutes of intense activities under body weight (such as fireman carries) and other high-intensity body movements (burpees and bear crawls) made the training session, as the first of the season, "*notably demanding*".

12.13 During his evidence, Mr Hasler was asked about the duration and intensity of the training session on 23 November 2020 up to the point where the players entered the Dojo:

> Q. Would you accept that in circumstances where Keith has done about 139 minutes on the outdoor training pitch in direct sunlight where he is four kilograms heavier than he was at the start of the offseason, he's got a BMI of 35.3, he's the least aerobically fit player in the squad, based on the yoyo test results and he then goes into the Dojo, that they may have been an unnecessary risk for Keith?
>
> A. If he had to do it consistently and nonstop for 139 minutes and then yes, it would've been unreasonable, but it was fragmented with breaks and varying changes of speed and rest and recovery.

12.14 Distinguished Professor Coutts opined that the additional intense training activities completed in the Dojo were critical in Keith developing exertional heat stroke for the following reasons:

(a) Although the playing group was provided with frequent drink breaks during the outdoor training session, involuntary and unavoidable dehydration occurs during prolonged and intense exercise. With involuntary dehydration, the sweat rate exceeds gastric emptying rate resulting in a net fluid loss. Therefore, Keith likely entered the Dojo in a dehydrated state (0.9 to 3 litres), which likely contributed to the onset of exertional heat stress; and

(b) The lack of proper temperature control, poor cross-ventilation, limited effective cooling (even with the doors open and floor fans on), 15 to 20 players exercising in close proximity and at a high intensity within the Dojo likely created a hot and humid "*microclimate*".

12.15 Overall, Distinguished Professor Coutts described the environment in the Dojo in this way:

> [T]hey would have entered the Dojo in a dehydrated state, and then the sitch [sic] would have compromised cooling capacity and they would have had increased metabolic heat because of the training, and then they would have done intense training in an environment that appears to be hot and humid, and that would have been challenging from a thermoregulation point of view, because it couldn't have cooled. If it was humid in particular, you would sweat, but the sweat would drip off. It will not evaporate, and therefore the cooling effect may have been limited in that environment, and that's classic for those type of activities you do in those environments.

12.16 Ultimately, Distinguished Professor Coutts expressed this opinion regarding the entirety of the training conducted on 23 November 2020:

> In summary, Keith's physical exertion was the main driver of his critical core temperature rise. This was as a result of the prolonged and intense training session. Keith had poor aerobic fitness which increased the relative intensity of the session and produced large amounts of metabolic heat (due to his size) with compromised cooling capacity. The intense activities completed in the hot and humid "Dojo" environment likely further elevated his core temperature whilst dehydrated. It is my opinion, that collectively, these conditions resulted in Keith developing [exertional heat stroke].

12.17 **Conclusions:** The objective data gathered in relation to Keith regarding the training session on 23 November 2020 demonstrates that various metrics (distance moved, high speed running, player load) exceeded measurements gathered for Keith over at least the previous three months. In addition, other load measurements found in Manly's NRL Daily Field Report for 23 November 2020 demonstrates that Keith's measurements were generally lower than those of the training cohort. Taken together, this evidence supports the conclusion that Keith's aerobic fitness was the lowest amongst the training cohort. This in turn increased the relative intensity of the overall training session for Keith.

12.18 Although there are differences within the training cohort regarding their subjective assessment of the intensity of the 23 November 2020 training session, the evidence tends to suggest that it was amongst the more demanding sessions that the players had experienced. It can be accepted that the training session, and others like it, are intended to induce fatigue to better equip players for conditions they may face in a competitive game situation.

12.19 However, the evidence given by Mr Schuster and Mr Fainu conveys that players felt that they were expected to push themselves past the point of fatigue. It is, perhaps, unsurprising that a player's perception of what is expected of them may differ from that of a coach, particularly in the context of competition for places for spots at the highest level in rugby league. It is, perhaps, also equally unsurprising that despite players being told by coaches that they could avail themselves of an opportunity to withdraw from training if they were unable to meet its demands, there is no evidence that such an opportunity was frequently seized by any players. All of this supports a conclusion that, subjectively, the 23 November 2020 training session was "*notably demanding*", as described by Distinguished Professor Coutts.

12.20 It is most likely that by the time he entered the Dojo, Keith (and other players) was experiencing involuntary dehydration which contributed to the onset of exertional heat stroke. Although the witness accounts are again divided the evidence from most of the players, as opposed to those inside the Dojo who were observing the players, is that the conditions were hot and humid. Indeed, Paramedic Grant, an independent witness, described the conditions as "*very hot, very humid*".

12.21 It can be accepted that the doors inside the Dojo were at least partially, if not fully, opened. However, given that the doors were only located on one side of the matted area, it does not appear that there was adequate cross-ventilation as described by Distinguished Professor Coutts. Whilst there is no doubt that floor fans were present inside the Dojo on 23 November 2020, the evidence is equivocal as to whether the fans were actually turned on. Even if the fans were on, Distinguished Professor Coutts' evidence establishes that it would not have resulted in effective cooling of the players.

12.22 Having regard to Keith's lower level of aerobic fitness compared to the rest of the training cohort, the total duration of the training session, the intensity of the session and the resultant demands it placed on the players, and the culmination of the session in a hot and humid environment with players experiencing involuntary dehydration, the training session on 23 November 2020 was, more likely than not, inappropriate.

13. The adequacy of the initial response by players and coaching staff at Manly

13.1 Associate Professor Adams opined that, from a cardiac point of view, the response by those present in the Dojo before the arrival of NSWA paramedics was appropriate. Associate Professor Adams noted that Keith was not at that time showing any signs that he was suffering from any cardiac condition.

13.2 Similarly, Professor Cook considered the response to be appropriate, noting that "*there is no other first aid that they can administer for an epileptic seizure like that, other than to try and make the individual safe from injury*".

13.3 Professor Seppelt also considered that after it became apparent that Keith was not merely experiencing cramping, but had started to deteriorate and become distressed and disoriented, appropriate steps were taken. These included protecting Keith whilst he was having a seizure and putting him in a safe position, as well as seeking assistance from Dr Delaney who was located in close proximity to the Dojo, the team physiotherapist, and NSWA.

13.4 **Conclusions:** The initial response by Manly players and staff inside the Dojo on 23 November 2020 was adequate. Keith was appropriately placed in a safe position and measures were taken to prevent further injury to him. Without medical training, and absent a diagnosis provided by a medical professional, there is no evidence to suggest that anything more could have been done by those immediately present.

14. The adequacy and effect of the first aid provided by Dr Delaney

14.1 Dr Delaney qualified as a sports physician in 1996. He worked as an independent practitioner at the Medicine Centre, located at the Academy, since 2012. Although the Academy is used by various elite sports teams, Dr Delaney gave evidence that, except where urgent medical attention may be required, he had "*little to do*" with the athletes from such teams as they had their own medical staff or club doctors.

14.2 Dr Delaney gave evidence that 23 November 2020 was the first occasion (at that time) that he had been asked to respond to an emergency situation at the Academy involving an elite athlete, and that he had never been to the Dojo previously. Dr Delaney also gave evidence that whilst he had previously seen patients with exertional heat illness and heat stress, he had never previously seen a patient suffering from exertional heat stroke. Further, Dr Delaney gave evidence that although as at 23 November 2020 he had seen "*in the literature somewhere vague references to seizures*" he had never previously seen a patient with exertional heat illness or heat stress displaying any symptoms of seizure or convulsion.

14.3 Dr Delaney gave evidence that he applied the paper bag to Keith's face for "*[a]round about a minute, and that was a very light application*". Dr Delaney explained his reason for doing so:

> I thought the predominant issue was that of the seizure or the tonic-clonic spasm, but I thought there may have been some additional tetany or spasm arising from low carbon dioxide, or hypocapnia.

14.4 Dr Delaney went on to give evidence that symptoms of hypocapnia included abnormal heart rate, muscle cramps, seizures, dizziness and fainting. Dr Delaney also gave evidence that he did not have his emergency bag with him at the clinic on 23 November 2020 and therefore did not bring it to the Dojo. Accordingly, Dr Delaney gave evidence that he did not have any medical equipment to undertake any investigations (such as taking Keith's temperature) and in essence was limited to observing Keith's symptoms and attempting to interpret them.

14.5 Professor Cook opined that Dr Delaney consideration "*that hyperventilation might be contributing to the clinical manifestations observed*" in the Dojo was not unreasonable.

14.6 Professor Seppelt noted that Dr Delaney, after considering various diagnostic possibilities (including a grand mal seizure and ruptured intracranial aneurysm), concluded that there was an element of primary hyperventilation. As a result, Dr Delaney held a paper bag over Keith's mouth on the presumption that there was hypocarbia and respiratory alkalosis secondary to the hyperventilation. In fact, Professor Seppelt explained that Keith's hyperventilation was actually secondary to a severe metabolic acidosis.

14.7 As to the use of the paper bag by Dr Delaney, Professor Seppelt expressed this view:

> The 'brown paper bag' is historical (and often seen on TV with actors having panic attacks), and has no place in modern emergency medicine. While in [Keith's] case it was probably harmless, it may have distracted from other priorities and at least theoretically rebreathing carbon dioxide could

make the underlying metabolic acidosis worse. It was appropriately removed by the paramedics when they arrived.

[…]

Attempts at rebreathing from a paper bag were misguided but probably of no consequence.

14.8 **Conclusions:** The evidence establishes that on 23 November 2020 Dr Delaney was urgently and unexpectedly called to attend a clinical situation about which he had no previous direct experience. Without appropriate medical equipment, Dr Delaney was unable to perform any assessment of Keith which might have assisted in diagnosing the cause of Keith's presentation.

14.9 The expert evidence establishes that Dr Delaney's consideration that hyperventilation may have been the cause of Keith's presentation was not unreasonable in the circumstances. Notwithstanding, Dr Delaney's use of a paper bag was misguided. There is no persuasive evidence to suggest that its use adversely contributed to Keith's condition or his treatment. Indeed, upon the arrival of NSWA paramedics the bag was promptly and appropriately removed.

15. Was there any delay in calling an ambulance?

15.1 Mr Bonasera gave evidence that up to around 11:00am on 23 November 2020 he had been working in the coaching offices at the Academy. At around 11:00am, Mr Bonasera walked over to the Dojo (for reasons unrelated to the events occurring inside the Dojo at the time). After walking down a corridor that leads to the actual area containing mats and equipment for the players to train, Mr Bonasera observed what he described as a "commotion" at the back for the room and several staff and players gathered around someone (who he did not know to be Keith, at the time). Mr Bonasera gave the following evidence regarding what he did next:

> And then within a, I guess, within a space of a minute, it became obvious that there was something wrong and James Rahme happened to be there at the same time. We had a brief discussion, maybe ten seconds, something of that nature. We both agreed that we needed to call an ambulance. James made his way towards Keith and I contacted the ambulance.

15.2 Following the outdoor training session on 23 November 2020, Mr Rahme returned to the physiotherapy room where he received a call from Mr Ferguson, a member of the Manly strength and conditioning staff. According to Mr Rahme, Mr Ferguson indicated that that there was "*something serious going on*" and that Mr Rahme should make his way to the Dojo. Mr Rahme drove to the Dojo, exited his car, and walked down the corridor into the main training area where he saw Mr Bonasera. Mr Rahme also saw Keith in the distance moving around in "*a commando crawl backwards*" which "*seemed involuntary*". Mr Rahme gave evidence that he said to Mr Bonasera, "*Call the ambulance now*". Mr Rahme explained his reason for doing so:

> From a distance, because it looked like [Keith] was seizing and knowing that he has never had a medical history of that and I have got on the record, my brother-in-law suffers from epilepsy, and I know that it's, it's something that you have just got to contact. Yeah. It's an ambulance, paramedic thing.

15.3 Mr Ross gave evidence that following the outdoor training session he collected the equipment from the field and made his away to the Dojo. After entering the Dojo, Mr Ross stated that he saw that Keith "*appeared to be in trouble*" as he was "*on the wrestle mats moving around on his back in circles*". Mr Ross heard that Keith was making "*a strange grunting noise*" and it appeared to him that "*Keith was having some sort of fit or seizure*". Mr Ross saw Zac McClary near Keith, trying to make sure that Keith did not injure himself. After "*a couple of minutes*", someone (who Mr Ross cannot now remember) asked Mr Ross to get a doctor. As he made his way out of the Dojo, intending to go to the Medicine Centre, Mr Ross gave evidence that he saw Mr Bonasera on the phone and, although he could not hear what Mr Bonasera was saying, assumed that he was calling an ambulance.

15.4 NSWA records establish that the Triple Zero call made by Mr Bonasera was received at 11:06am. This is consistent with Mr Bonasera's evidence of attending the Dojo at around11:00am. NSWA allocated the job to Paramedics Grant and Tory at 11:09am who arrived at the Academy at 11:16am. By 11:17am they had reached Keith.

15.5 **Conclusion:** The evidence given by Mr Bonasera, Mr Rahme and Mr Ross is entirely consistent. Together, it establishes that Mr Rahme recognised within a short period of time that Keith was displaying seizure-like behavior that warranted the attendance of paramedics. Mr Rahme promptly and appropriately asked Mr Bonasera to call Triple Zero and request the attendance of an ambulance. Mr Bonasera did so without delay. The NSWA records support the timeliness within which the ambulance was requested.

16. The adequacy of the treatment provided by NSWA paramedics

16.1 Paramedics Grant and Tory arrived on scene at 11:16am and reached Keith at 11:17am. Paramedic Grant observed Keith to be suffering tonic-clonic seizures. Paramedic Grant heard Dr Delaney say that Keith was hyperventilating and saw that Dr Delany was holding a paper bag over Keith's nose and mouth. Paramedic Grant formed the view that Keith's "*main problem was that he was fitting, and not hyperventilating*", and therefore asked Dr Delaney to remove the paper bag.

16.2 Paramedic Grant drew up 5mg of midazolam and administered it to Keith intramuscularly. Paramedic Grant asked Paramedic Tory to take a baseline set of observations for Keith whilst at the same time call for an ICP for backup. A short time later, Paramedic Tory reported that Keith's tympanic temperature was 41.9°C. Paramedic Grant observed that Keith was febrile and stated that he "*could literally feel the heat radiating off him*".

16.3 After establishing an IV line, Paramedic Grant observed that Keith was still fitting and drew up a second 5mg dose of midazolam. This was also administered intramuscularly, whilst a heart monitor was attached to Keith.

16.4 In oral evidence, Paramedic Grant was asked whether he had any opportunity, whilst he was treating Keith, to consider what might have been causing his fitting. Paramedic Grant gave evidence that his "*main feeling was that it was from his temperature or that the fitting was causing his temperature to get even higher*". Paramedic Grant recognised that fitting itself can cause hyperthermia but did not consider that the hyperthermia might have been the result of exertional heat stroke.

16.5 ICP O'Brien and Paramedic Noble arrived on scene at around 11:28am. ICP O'Brien observed that Keith was hot and diaphoretic, lying on the ground but not actively convulsing. After receiving a handover from the paramedic team on scene, ICP O'Brien formulated a plan to establish an IV line (to quickly administer midazolam intravenously in the event of repeat seizure activity, and to administer fluids to manage dehydration and hyperthermia), remove Keith from the Dojo which was a source of heat into an ambulance, to commence active cooling (with wet compress bandages and application of ice packs) and to transport him to hospital.

NSW Ambulance Protocols

16.6 NSWA Protocol E3 Hyperthermia (**Protocol E3**) relevantly provides the following:

> Heat stroke is defined as hyperthermia in the setting of CNS dysfunction. The core temperature with heat stroke is >40 °C and typically ranges from 40 to 44 °C although heat stroke can occur at lower temperatures. It should be suspected in the setting of high heat stress, through either exertion or environmental factors.

16.7 Protocol E3 describes the clinical features of heat stroke to be the same as for heat exhaustion (namely, fatigue, nausea, malaise, collapse, headache, vomiting and dizziness) with the addition of anhidrosis, altered loss of consciousness, hot dry skin and a temperature greater than 40 °C.

16.8 A flow chart within Protocol E3 describes treatment for heat stroke to remove the patient from the heat source, and then:

- Remove clothing
- Cool patient (apply ice pack to neck, arm pits and groin
- Continually reassess for hypothermia
- Treat associated conditions:
  - Dehydration – M8
  - Medical hypoperfusion/hypovolaemia – M25
  - Seizures – M9
  - Nausea & Vomiting – M6
  - Hypoglycaemia – M21

16.9 This is followed by transfer of the patient to a hospital emergency department.

16.10 NSWA Protocol M9 Seizures (**Protocol M9**) relevantly provides the following:

> A seizure may be defined as a sudden attack of altered behaviour, consciousness, sensation or autonomic function produced by a transient disruption of brain function. The result of this altered brain function is most commonly a tonic (stiffening) or tonic-clonic (stiffening-jerking) seizures. When the seizure has motor accompaniments, it is also known as a convulsion.
> […]
> It is important to attempt to control the seizure without delay because the longer the seizure continues, the more difficult it becomes to control.

16.11 Protocol M9 also contains a flow chart for treatment of seizures which describes protecting the patient from injury, considering other causes and treating the patient according to specific protocols, administering midazolam and treating any associated conditions (such as hypoglycaemia, hyperglycaemia and hyperthermia), and then transporting the patient to a hospital emergency department.

Availability of ice on 23 November 2020

16.12 It is clear from the above that Protocol E3 directs NSWA paramedics to apply ice to the neck, groin and axilla of a patient presenting with heat stroke in order to cool the patient. The issues which arise in Keith's case are therefore whether ice was available to any of the attending paramedics on 23 November 2020, whether any consideration was given to its use in order to cool Keith, and whether it was actually used for this purpose.

16.13 Mr Ross gave evidence that it was his practice on each training day at the Academy, including on 23 November 2020, to gather collect ice from a large ice machine located at the venue. Some of the ice was used to cool drinks used by players during training sessions whilst other ice was packed into approximately 15 to 20 bags weighing around 3.5 kilograms and placed into an esky. The esky itself is placed in small van which Mr Ross used to drive around the Academy.

16.14 Mr Ross gave evidence that he also has an ice scoop which can be used to decant the ice in the 3.5 kilogram bags into smaller bags so that they can be applied to a person. Mr Ross gave evidence that it would take him 10 seconds to decant such a bag of ice.

16.15 During his evidence, Mr Ross was asked how soon he could have obtained such bags of ice if he had been requested to do so on 23 November 2020. Mr Ross explained:

> Straightaway. Yeah. The van was parked right outside. I always park as close to the door as possible because they're taking equipment, the water bottles or something like that with them, or the GPS bibs. So, I had to collect them to finish the packup process. So, the van was parked very close to the I can't tell you exactly where but it was parked very close to the door and the ice was in there.

16.16 In addition, Professor Holdgate noted that NSWA ambulances carry four to six *Sentry Medical Instant Ice Packs*, which are single use, non-refrigerated packs. These packs contain chemicals which, when activated by twisting and squeezing, initiate an endothermic reaction to create a cold pack.

Consideration given to the use of ice packs

16.17 Paramedic Grant stated that he was aware that chemical ice packs were available in the ambulance, and that he did not turn his mind to requesting ice from any person present in the Dojo, which was available. When asked why he did not turn his mind to this, Paramedic Grant gave the following evidence:

> Because when we're operating in that environment, we always go back to our primary survey. So, A is for airway, B is for breathing, C is for circulation, D is for dysfunction, disability, E is for environment. Temperature comes under environment. It's at the bottom of the list. When I arrived, Keith was fitting. A fitting patient hasn't got control of his airway, effectively, and he's also not breathing effectively. The seizing is going to be causing his temperature to go up. My main priority is to get that seizure activity under control. That. Was [sic] my sole focus at that time. Putting ice packs on a seizing patient isn't going to do anything, especially when they're tonic-clonic seizing, because we're supposed to put them behind the neck, under the axilla which is under the armpits, and in the groin, and when he's got full, like, body movements going on, those ice packs aren't going to stay in situ and they're not going to cool effectively. So, my priority the whole time I was with Keith was to get that seizure activity under control, so he did have an airway and he was breathing effectively. Then I could focus on other things.

16.18 Paramedic Grant gave evidence that his main priority was to control Keith's seizure activity, remove Keith from the Dojo which was a source of heat, place Keith into the ambulance which was air-conditioned and where cool fluids could be administered. Paramedic Grant also gave evidence that Keith could not be moved until his seizure was under control and it was safe to do so, and that it is not common practice to seek the assistance of bystanders in holding down a seizing patient as it may cause injury to the bystanders as well as hinder paramedics in performing their job.

16.19 ICP O'Brien gave similar evidence that for patient experiencing seizures, there would be "*uncontrolled violent movements*" which would create practical difficulties in keeping ice packs in place on those parts of the body. This in turn would limit the effectiveness of the ice packs and make "*cooling extremely difficult*". ICP O'Brien also emphasised that the priority would be to keep the patient safe and seeking the assistance of bystanders to hold ice packs in place would expose both patient and the bystanders to risk of injury.

16.20 ICP O'Brien gave evidence that as at 23 November 2020 he was familiar with the provisions of Protocol E3. However, he described Keith's presentation, compared to a patient who may have been suffering exertional heat stroke at a distance running event like the "City2Surf", as "*much further down the spectrum of heat stroke and probably multi organ failure, renal failure* [sic]". ICP O'Brien gave evidence that Keith was progressing to a state of extremis and agreed (with counsel for NSWA) that Protocol E3 did not necessarily apply to a patient like Keith who was extremely unwell. Instead, ICP O'Brien gave evidence that he was required to use his clinical judgment in managing Keith's presentation and that this involved removing Keith from any heat source, ensuring that his airway was managed, and his seizure activity was controlled, and transporting him to hospital as soon as possible so that medical assistance could be provided.

16.21 Martin Nichols, the NSWA Associate Director of Paramedicine and Clinical Practice, emphasized the importance of managing the airway of a seizing patient, particularly one who is unconscious. Mr Nichols explained that a patient experiencing tonic-clonic seizures may present with trismus which makes normal airway management measure more difficult, and that increased metabolic demand can lead to heat production and in turn cause metabolic derangements such as acidosis.

16.22 Mr Nichols gave evidence that in his experience of 20 years as a frontline clinician (including 12 years in an aeromedical environment dealing with critically unwell patients), he could only recall "*a few cases*" involving hyperthermic patients as a result of physical exertion also presenting with seizure activity. Mr Nichols gave evidence that regardless of the cause of patient's seizure NSWA would expect a paramedic to complete a primary survey, ensure the patient's airway was managed, apply oxygen if required, prepare an agent such as midazolam to control the seizure activity, and ensure that the patient is in a safe environment.

16.23 Mr Nichols explained that any benefit in applying a cooling agent (such as an ice pack or cold compress) is dependent on the likelihood that it will stay in position, how long it will be in position, and a patient's underlying haemodynamic status to move blood through larger vessels to assist with cooling. Mr Nichols explained that Keith presented as a seizing patient, with a decreased level of consciousness, fast heart rate and low blood pressure. The priorities of the attending paramedics were to therefore manage Keith's airway and seizure and to move him inside an ambulance. Mr Nichols considered that Paramedics Grant and Tory needed to remain with Keith and that, in maintaining their priorities, there would not have been any opportunity to retrieve chemical ice packs from the ambulance.

16.24 If the paramedics had been informed that ice was available nearby, Mr Nichols considered that it would have been "*reasonable to use that and place that somewhere*" depending on whether the ice was "*presented in a nice, sealed plastic bag of a reasonable size*". However, Mr Nichols noted that there may have been concerns about rolling Keith laterally to protect his airway, and to placing his arm in an ideal position so that an IV cannula could be inserted. Ultimately, Mr Nichols offered this view:

> So, I suppose what I'd say to you is if ice was in front of me in a size and shape and form that I thought I could reasonably put on the patient and - I would - it would be reasonable to do so. I think, though, that from what I can see of this case, at the time, the paramedics is a lot of cognitive load they were considering. They were prioritising the high value priorities. I don't know how reasonable it would

> be to expect them to engage into a discussion about availability, preparation, size of ice at that point in time when they're trying to manage the seizure.

16.25 Mr Nichols did not consider that the attending paramedics should have asked whether any ice was available given that they had an existing management plan for Keith and that the priority was to firstly manage Keith's seizure and any sequelae, and then consider his temperature. In addition, Mr Nichols questioned the benefit of applying ice packs for a short period of time and that non-invasive methods of cooling would be "*dependent on other physiological factors in [Keith's] presentation*", and expressed the opinion that it would not have made any difference to the eventual outcome.

Simultaneous treatment of heat stroke and seizures

16.26 In evidence, Mr Nichols was asked whether it would be possible for a paramedic to follow the above management steps whilst concurrently also treating hyperthermia that the patient may be suffering from. Mr Nichols gave the following evidence:

> So, the only - the only reasons why you wouldn't treat the hyperthermia in parallel or concurrently would be due to limitations of resources and establishing priorities. So, the - I do believe in this case the focus on - what I assume was on focus on some airway care and oxygen administration, completing a full examination, administering Midazolam, considerations for vascular access and moving the patient were the appropriate priorities that I would apply, but it would be ideal if we could manage - if we could attempt some aspects such to manage the patient's temperature at 5 the same time, but I would - I would put that that is a - there's a holistic nature of managing someone's temperature. There's four ways people can lose heat. You could radiate heat into the environment. It can be conducted into the objects you're touching. Wind and water can help with convection and there's an evaporative process that we'd all be aware of when we sweat and the exercise. So, a lot of the guidance that clinicians will use apply all of those factors concurrently. So, what I would say is that the consideration for removing clothing is obviously helping with that as well. You know, not having too many people around and touching the patient as well, to improve that airflow as well. Considerations of the environment in getting from the hot environment to the cold environment. So, I suppose I would say that the - in this case, the paramedics were concurrently managing the patient's temperature. It would have been optimal to have also used ice packs, but I would put that they were managing the patient's temperature.

16.27 Mr Nichols was asked in evidence whether there would be any value in amending Protocol E3 to describe seizure activity as a potential symptom of heat stroke. Mr Nichols considered this to be unnecessary given that Protocol E3 refers to heat stroke occurring in the setting of central nervous system (**CNS**) dysfunction, and that one of the key things paramedics will look for when attending a patient is any altered level of consciousness such as from a seizure. In Keith's case, Mr Nichols considered that the attending paramedics "were able to join the dots from seizure to CNS dysfunction".

16.28 Professor Holdgate was also asked whether it is possible to treat seizure activity and hyperthermia simultaneously, and gave this evidence:

> It really depends on the resources and how many pairs of hands and how much brain width you've got to think of all the things that you need to be doing, and that's the biggest challenge for paramedics in this situation or medical staff in a hospital setting, is you're juggling many different

> priorities. Had there been enough pairs of hands and enough working brains that could put it all together, there is no reason you couldn't do both at the same time, but with four paramedics on the scene in the circumstances they were, I'm not surprised it didn't come to the top of their list.

16.29 Professor Holdgate went on to offer this explanation:

> I think it is difficult for anyone who has not worked in the pre-hospital environment to understand the challenges and complexities of actually getting something done in the real world, and so although the time minute by minute may look like a lot of time has passed with not much happening, in fact the physical challenges of a managing a large young man surrounded by his teammates, fitting, extremely hyperthermic and extremely agitated with a low blood pressure, low oxygen saturations, I think fully occupied the first two and then the subsequent two paramedics in doing everything they did to the point of transfer. I'm not saying the care was perfect because care is never perfect, but I think it was completely appropriate given the challenges they were facing.

16.30 Professor Holdgate explained that whilst application of ice packs to the axilla and groin is a "*practical and relatively easy thing to do*" it was "*probably not terribly effective*" and impossible to apply for someone like Keith who was actively fitting. Even if this could be done, Professor Holdgate noted that it would have required one person dedicated to the role at each contact point, sufficient space to allow other resuscitative treatment to continue, and the likelihood that the ice packs would reduce access to areas which might be required to administer medication or apply other treatment measures. Ultimately, Professor Holdgate expressed this view regarding the application of ice packs:

> [S]o of the various methods of cooling, that method is probably one of the least effective methods of cooling. So it doesn't - won't cause any harm if it can be done, but it may not cause much benefit.

Use of ice packs during transfer to hospital

16.31 Although chemical ice packs were available in the ambulance which Keith had been placed in, Paramedic Grant could not recall whether they were applied to Keith. Paramedic Grant gave evidence that whilst en route to hospital he was tasked with looking after Keith's airway and that he was "*hyper-focused on making sure that his airway remains patent*". In addition, Paramedic Grant explained that attempts were made to insert an oral airway but that Keith had a gag reflex and started seizing again and vomiting. There was therefore vomitus in the airway which required suctioning. Ultimately, Paramedic Grant gave evidence that it is possible that there was no mention of ice packs being applied because they could not have been applied effectively.

16.32 In his second statement dated 11 February 2024, ICP O'Brien said that he did not have a clear recollection of whether any ice packs were applied to Keith whilst he was in the ambulance. In oral evidence, ICP O'Brien said that he had a "*vague impression*" that ice packs may have been applied but later agreed that, in the absence of any documented NSWA record to this effect, that it was more likely than not that no ice packs were applied.

16.33 In his second statement, ICP O'Brien also said the following:

> If ice packs were not applied, I accept this should have been done, if possible given [Keith's] fitting state and airway issues.

16.34 When asked in oral evidence whether, in retrospect, he would have done anything differently in providing treatment to Keith, ICP O'Brien clarified his statement in this way:

> Well, I know there's - can see there's a focus on ice packs and I know it's most likely that they weren't applied. From my point of view, or, I should say, I had - I had a plan for his treatment, a specific plan, and - which involved an order of priorities which was to establish an intravenous line or a cannula, to then administer intravenous fluids, then remove [Keith] from the atmosphere - from the environment to the back of the ambulance where we would then apply ice packs and urgently transport [Keith] to hospital. I'm very open to the idea of doing things differently and investigating this and analysing it, but I can say that I'm quite satisfied with my plan of action and course of action.

Expert evidence regarding the use of ice packs

16.35 In evidence, Professor Seppelt agreed that it was reasonable for paramedics to both remove Keith from the environment that he was in, namely the Dojo as it was a source of heat, and to control his seizure activity which would have been exacerbating his heat. Professor Seppelt agreed with counsel for NSWA that both of these measures would have started the cooling process.

16.36 Professor Seppelt also agreed that it was reasonable and proactive for the NSW paramedics to control Keith's seizures with midazolam and to administer fluids to treat hyperthermia and prevent rhabdomyolysis and renal failure. Finally, Professor Seppelt agreed that it was reasonable for the paramedics to cool Keith whilst transporting to hospital, and that there were significant challenges in attempting to apply ice packs when a patient is seizing and vomiting in an ambulance.

16.37 In his supplementary report, Professor Seppelt referred to Protocol E3 and opined that if ice was available to the attending paramedics, "*the priority was cool first then transport*". However, Professor Seppelt noted that this needed to be balanced against "*priorities of time and geography*", meaning that if more than a five-minute delay was expected in finding ice *"then it was reasonable to 'load and go'"*.

16.38 Professor Holdgate was asked about the concept of "*cool first then transport*" during her oral evidence and offered the following views:

> I think you have to take that in context. I - that may apply in some circumstances, and I - specifically in this instance we're not just talking about hyperthermia, there were many other things going on at the same time. So if [Keith] was simply hot and nothing else was going on, so he was conscious and breathing and wasn't having a fit, yes, it would've been appropriate to commence cooling treatment prior to transfer, but that wasn't the case here. He wasn't just hot, he had many other things going on which were – required immediate resuscitation.

16.39 Professor Holdgate went on to explain that Keith was fitting which was generating "*an enormous amount of body temperature*", his oxygen saturation was initially low at 87%, once his fitting had stopped Keith was attempting to pull off his oxygen mask because he was confused which made airway management challenging, his blood pressure was slow which required gaining IV access, and he required the application of cardiac monitoring. Ultimately, Professor Holdgate expressed the view that a clinician would never let a seizure continue, or ignore a seizure, in order to treat

hyperthermia by calling the patient. Professor Holdgate emphasised that treating the seizure would take "*immediate priority*".

16.40 Professor Holdgate also noted that a review of relevant literature relating to the effectiveness of strategies to reduce exercise-induced hyperthermia demonstrated that the most effective method of rapidly lowering body temperature is ice water immersion followed by dousing and fanning, then partial immersion in cold water and, finally, application of ice packs to the groin and axilla.

16.41 In both her report and in oral evidence, Professor Holdgate expressed the view that even if ice packs had been applied for at most 20 minutes, Keith's temperature "*may have been lowered by 0.5 °C at best*" (using a calculation of maximum temperature reduction of 0.02 °C per minute over 25 minutes between around 11:30am and 11:55am). Professor Holdgate considered that this would have made a "*small*" but not a "*significant*" contribution.

16.42 Overall, Professor Holdgate noted that by the time of Keith's arrival at NBH his temperature had fallen to 39.9°C, a reduction of 2°C from when it was taken as being 41.9°C. Professor Holdgate considered this to be a "*substantial reduction*" over a period of about 45 minutes and supported her view that the other interventions performed by the paramedics (seizure control, administering IV fluids, removing Keith from the hot environment in the Dojo and into an ambulance) were more effective in reducing his temperature.

16.43 As for the chemical ice packs available in the ambulance, Professor Holdgate noted that the product information states that the packs are intended "*to alleviate pain and reduce swelling from minor injuries…suitable for sports injury, sprain and minor pain ailments*". Professor Holdgate could find no references or evidence for the use of such packs in the management of hyperthermia.

16.44 **Conclusions:** In accordance with relevant NSWA protocols, the attending paramedics appropriately prioritised treating Keith's seizures and managing his airway. Although the paramedics recognised that Keith had a very high temperature and was experiencing hyperthermia, none of the paramedics turned their mind to enquiring about the availability of ice to cool Keith. This was not unreasonable in the circumstances as the paramedics were already dealing with a substantial cognitive load in managing Keith who was extremely unwell and rapidly deteriorating.

16.45 Ice was readily available in Mr Ross' van which was parked near the Dojo, and could have been provided promptly had it been requested. However, it is most likely that its use would have been ineffective in cooling Keith. The evidence establishes that the effectiveness of applying ice packs to cool a patient is dependent on the ice packs remaining in place on the body where large blood vessels are close to the surface of the skin, the duration of placement, and a patient's underlying haemodynamic status. In Keith's case, his seizures made keeping ice packs in place for long enough to be effective extremely difficult, and likely even impossible. In addition, Keith's low blood pressure also reduced the effectiveness of ice pack application.

16.46 Even if ice had been used it may have adversely affected other aspects of Keith's management. Enlisting bystanders to hold ice packs in place may have exposed them, and Keith, to the risk of injury whilst his seizures remained uncontrolled. Further, there may have been a requirement to move Keith quickly in the event of sudden deterioration, and use of ice packs may have hindered or delayed access to perform necessary interventions or administer medication.

16.47 It is possible that Keith's hyperthermia and seizures could have been treated simultaneously. However, this would have been dependent on resources available at the time in circumstances where the attending paramedics were already fully occupied with Keith's management and arranging for his rapid transfer to hospital. Even if ice packs could have been applied it is most likely that this would not have resulted in any significant reduction in Keith's temperature.

16.48 It is most likely the case that no ice packs were applied to Keith whilst he was in the ambulance being transported to hospital. Again, Keith's presentation at the time made the application of ice packs very difficult. Keith's airway required careful management, he had a gag reflex and began seizing again and vomiting, which required suctioning. Further, the chemical ice packs were not intended to be used to treat hyperthermia and likely would have been less effective than using actual ice packs.

16.49 Despite ice packs not being used, the attending paramedics followed a management plan which involved cooling Keith. That is, he was removed from the hot and humid environment in the Dojo, his seizures were managed to prevent heat-generating metabolic activity, he was placed in an air-conditioned ambulance, and he was transferred to hospital where other cooling strategies, such as administration of IV cooling fluids, could be implemented. These interventions resulted in a reduction in Keith's temperature that well exceeded the reduction that likely would have been achieved with the application of ice packs. Overall, the treatment provided to Keith by NSWA paramedics was adequate and appropriate.

17. The decision to take Keith to Northern Beaches Hospital

17.1 The attending paramedics on 23 November 2020 together with the most senior clinician on scene, Paramedic Specialist and Duty Operations Manager Antony Clarke, discussed Keith's management and, as a team, made the joint decision to transport Keith to NBH. This was estimated to be approximately 5 minutes away from the Academy if Keith was transported in a road ambulance under lights and sirens.

17.2 Professor Seppelt gave evidence that this was the correct decision as NBH was not very far away and has a fully equipped, modern emergency department. If Keith had instead been transported to a tertiary level hospital, such as RNSH, where ECMO services are available, this would have involved driving straight past NBH and adding approximately 30 minutes of travel time which would have delayed definitive treatment. In addition, Professor Seppelt noted that prior to leaving the Academy, a diagnosis for Keith had not been established and he had not yet gone into cardiac arrest so there would have been no consideration of ECMO at that time.

17.3 **Conclusion:** It was appropriate for attending paramedics to take Keith from the Academy to NBH. At the time of transfer, Keith required management in a hospital environment and NBH was located in very close proximity to the Academy. There was no indication at the time of transfer that Keith required more advanced therapies available at a tertiary level hospital that was located further away. Transporting Keith to such a hospital, and bypassing NBH, would have delayed definitive treatment for him.

18. The decision to cease treatment

18.1 Following his arrival at NBH at 12:05pm, Keith went into cardiac arrest at 12:07pm. A mechanical resuscitation device (LUCAS device) was attached at 12:08pm and Keith underwent 2 minute cycles of cardiopulmonary resuscitation with 3 boluses of adrenaline. At 12:10pm, Keith was intubated and a nasogastric tube was inserted.

18.2 Consistent with referral pathways, the treating team at NBH contacted RNSH to consider providing ECMO therapy which could not be provided at NBH. RNSH accepted Keith's care and Professor Seppelt described this as an "*extension of attempts at resuscitation*" and a "*valiant and I think last-ditch attempt for a dying 20-year old*".

18.3 Ultimately, Professor Seppelt described the decision to cease treatment in this way:

> They tried their hardest. They did the best they possibly could do and when it was clearly not working, they terminated resuscitative efforts. That wasn't withdrawing of life support as we usually consider that, but it was saying this has not worked, there is nothing more that we can do.

18.4 **Conclusions:** Keith's transfer to RNSH represented a final attempt to institute life-saving therapy in circumstances where Keith was in extremis. Despite every effort, further resuscitation attempts were unsuccessful and treatment was ceased. The decision to do so was appropriate in the circumstances.

19. The adequacy of Manly and NRL policies and procedures to prevent heat-related injuries to players during training

Relevant NRL policy framework

19.1 The *NRL Operations Manual* (**Manual**) is Schedule 6 to the NRL *Rules* and is updated and issued to all stakeholders annually, including NRL Clubs and their personnel. Each player must adhere to, and comply with, the NR*L Rules*. The Manual is intended to help regulate the conduct of Clubs, Club officials, match officials and players in order to organize, manage and administer the NRL competition.

19.2 Section 33 of the Manual contains the *Medical Officer's Handbook* (**Handbook**). According to Dr Sharron Flahive, NRL Chief Medical Officer, the Handbook is "*prepared by the NRL's medical advisory panel in accordance with best industry practice*". All Club Officials, medical staff, coaching and training staff are bound by the terms contained in the Medical Officer's Handbook .

19.3 The Handbook contains *Advisory 2 – Heat Policy & Management of Thermal Injury/Hyperthermia* (**Heat Policy**). The 2019 version of the Heat Policy, which was in force as at 23 November 2020, relevantly provides:

> HEAT POLICY - Extreme Conditions of Temperature and Humidity [original emphasis]
>
> 33.41.1. The NRL have adopted a new scientifically formulated Heat Policy in the interests of Player safety and welfare.
>
> 33.41.2. It must be adhered to for all Matches (including; competition and trials) and is a recommendation for Club Medical and Training staff for Club training in both the preseason and during the season.
>
> 33.41.3. All Club Medical Officers and allied personnel must be aware of, and fully comply with, Rules 3.14 to 3.17 of this Manual which makes provision for extraordinary weather conditions. In particular, Rules 3.16 and 3.17 deal with hot weather.
>
> 33.41.4. All NRL CMOs must also make sure they are up to date with appropriate recognition and management of Heat Illness.

19.4 The determination of what heat policy strategies are to be deployed is dependent on the measurement of the Heat Stress Index (**HSI**). In this regard, the Heat Policy also provides:

> Heat Stress Index Measurement
>
> 33.41.5. The Heat Stress Index (HSI) must be measured before all NRL Matches when there is any concern regarding excessive temperature and/or humidity.
>
> 33.41.6. The home team Club Medical Officer (CMO) at each ground must:
>
> a. Use the Kestrel 5400 Heat Stress Tracker (with Vane mount and tripod) to measure the Heat Stress Index (HSI) 40 minutes before each match, in the centre of the ground/in full sun (see explanatory note 6.). (Other measurements may be recorded to track weather condition changes but the measurement at 40 minutes' pre-match should be used as the official measurement; unless conditions are deteriorating, then follow up measurements may be used.)

b. The measurements (Air Temperature, Globe temperature, Humidity and Air Speed) must be performed in the middle of the playing surface.

c. These measurements must then be inputted into the supplied Excel program (Heat Policy formula) to determine the Heat Stress Index (HSI) and recorded for future reference. This reading should also be reported to the NRL Ground Manager and opposition CMO immediately (at least 30 minutes prior to scheduled kick off time).

d. The Ground Manager and both team's CMOs will then use the HSI to determine the appropriate Heat Strategy to be implemented for that Match.

e. The HSI results must be forwarded to the NRL CMO for any match in which any Heat Provisions are implemented (by COB on the next business day).

19.5 The Heat Policy goes on to then set out what has been described as a colour-coded "traffic light system" to identify the appropriate Heat Policy Strategy to be implemented depending on the HSI measurement:

Heat Stress Index (HSI)

33.41.7. The HSI is to be calculated by the Home Club Medical Officer (CMO) using the supplied "Heat Policy formula" Excel program. The following Heat Stress Index ranges must be used to determine the appropriate Heat Policy Strategy to be implemented for that Match.

HSI < 100 = No Heat Strategy Interventions/Cooling Breaks required
HSI 150 to 200 = Implement Basic Cooling Strategies
HSI 200 to 250 = Caution: Implement Full Heat Policy Strategies
HSI >250 = Delay/Postpone Match

Please note:

a. For Matches the Highest HSI calculated using the Heat Policy formula (i.e. backs, forwards etc.) should be used to determine the HSI for that Match.

b. For Training, it is recommended that the session be cancelled / postponed if the HSI is in the Black (>250) and if the HSI is Yellow or Red (150 to 250), then the Club's Medical Staff (incl CMO) and Sports Science staff should be consulted as to the appropriateness or possible modification of that training session along with the provision of appropriate cooling strategies.

19.6 The Heat Policy goes on to describe Basic Cooling Strategies (where the HSI is between 150 to 200) such as:

(a) placing iced towels over a player's lap and head;

(b) placing rolled towels with ice placed around a player's neck whilst on the bench and at half-time;

(c) use of sideline fans (including misting fans); and

(d) use of fans and air-conditioning in the dressing room.

19.7 In addition, for the Full Heat Policy (where the HSI is between 200 to 250) directs implementation of the Basic Cooling Strategies as well as:

(a) extra ice, towels and fans being made available;

(b) an extended half-time break;

(c) a one minute time out called by referees approximately 20 minutes into each half during which players may utilise iced towels; and

(d) provisions to allow trainers carrying water to enter and leave the field as quickly as possible.

19.8 It should be noted that the 2023 version of the Heat Policy is currently in force. However, there are no material differences between the relevant provisions of the Heat Policy described above and the corresponding provisions in the 2023 version. Therefore, for convenience it is proposed to refer to only one document.

19.9 The inquest identified a number of apparent issues associated with aspects of the Heat Policy, namely:

(a) although its application is mandated for all matches, it is only recommended to be applied for training, without any indication of the reasoning for this difference;

(b) it does not distinguish between outdoor and indoor training settings;

(c) it mandates measurement of the HSI in subjective terms (namely, "*when there is any concern regarding excessive temperature and/or humidity*") without defining, or providing further guidance as to, when such measurements ought to be taken; and

(d) most of the cooling strategies that are to be implemented in response to HSI measurement thresholds are match-specific and not universally applicable to training settings.

19.10 These issues are dealt with in more detail below. As the Heat Policy was adopted by Manly during the period between about 2018 and 2023, it is first useful to set out the relevant policy framework at Manly, and additional steps taken by the NRL and Manly since 2023, many of which are informed by the provisions of the Heat Policy.

Relevant policy framework at Manly

19.11 On 4 and 5 November 2018, Mr Bonasera, at Dr Inman's request, circulated the Heat Policy to Manly coaching, sport science, and strength and conditioning staff. Mr Bonasera gave this evidence about application of the Heat Policy at Manly from that point in time:

> Q. Was it your understanding from at least this moment in time, that the NRL heat policy was to apply to training scenarios at Manly?
> A. In what respect?

Q. In all its respects. That is, the NRL heat policy was to be adopted and implemented by Manly in training.
A. If you mean that we would comply with what the NRL heat policy suggested, yes.

Q. In a training scenario?
A. Yes, which was, if there was any suggestion that the weather was over a particular--

Q. Any concern, I think is the language.
A. Yep, then you would use the Kestrel.

Q. What was the threshold at Manly for the concern whereby the Kestrel device was utilised?
A. I couldn't speak to that. I'm not sure. I would leave that to the performance and medical staff.

Further steps taken by the NRL and Manly

19.12 In preparation for the inquest, both the NRL and Manly were provided with the expert reports authored by Associate Professor Adams, Professor Cook, Professor Seppelt and Distinguished Professor Coutts. As described above, these reports clearly referred to the causal connection between exertional heat stroke and Keith's death.

19.13 After considering these reports Dr Flahive "*formed the view it was important that various matters in relation to occurrence and management of heat stroke be emphasised to Clubs and Club [Medical Officers], particularly given that pre-season training was then commencing [in around November 2023]*". Accordingly, on 4 December 2023, the NRL issued a note by email (**Note**) to all Clubs in relation to the issue of heat stroke and, in particular, exertional heat stroke.

19.14 In summary, the Note:

(a) reminded Club CMOs of their obligation to keep up-to-date with appropriate recognition and Management of heat illness, including exertional heat stroke;

(b) instructed CMOs to ensure that relevant staff and players are aware of the risk factors for exertional heat stroke, including low aerobic fitness and high body mass index, as well as recommended treatments, whilst emphasising that exertional heat stroke can occur even in ambient weather conditions;

(c) conveyed an expectation that Clubs adhere to the Heat Policy for preseason and off-season training, with environmental conditions to be monitored and recorded on location prior to and during all training sessions;

(d) reminded Clubs of their obligation to conduct emergency scenario training;

(e) reminded Club CMOs of their obligation to have an Emergency Action Plan for medical emergencies at matches and training, including how to identify and treat exertional heat illnesses;

(f) recommended that Clubs adopt a two-week period of controlled training load for reconditioning and heat acclamation for players who returned to full training after a prolonged break in addition, players completing training should be screened and classified according to the known factors for exertional heat stroke and adjustments made to training accordingly; and

(g) instructed that, where environmental conditions warrant, a cold water or ice tub and iced towels should be available to immerse/soak players with a suspected heat illness.

19.15 In October 2023, Manly published its own Heat Illness Guidelines (**Manly Guidelines**) which was distributed to its football staff and players. The Manly Guidelines were prepared by Dr Paul Bloomfield, Manly's CMO, and are available to players and staff via an application. The Manly Guidelines adopt the colour-coded "traffic light system" used in the Heat Policy and also relevantly provides:

> The Heat Stress Index (HSI) must be measured **before** all training sessions using the **Kestrel 5400 Heat Stress Tracker (with Vane mount and tripod)** when there is **<u>any</u>** concern regarding excessive temperature and/or humidity. The Kestrel device should be set up and allowed to sit in position (centre of field/in full sun) for **at least 3-5 minutes** before taking the measurements so that the Globe temperature has time to reach its true level. [original emphasis]
>
> Lack of any wind is also an issue worth considering. Low temperatures can still be an issue as high humidity can exist.
>
> As per the Heat Policy, for Training, it is recommended that the session be cancelled / postponed if the HSI is in the Black (>250) and if the HSI is Yellow or Red (150 to 250), then the Club's Medical Staff (incl CMO) and Sports Science staff should be consulted as to the appropriateness or possible modification of that training session along with the provision of appropriate cooling strategies.

19.16 On 15 November 2023, Dr Bloomfield conducted a preseason staff briefing which included an overview of the Manly Guidelines. A further pre-season player briefing on the same topic was provided by Dr Bloomfield on 12 December 2023.

19.17 Dr Bloomfield also prepared a one-page information sheet titled *Sea Eagles Player Education – Exertional Heat Stroke (EHS)* (**Manly Information Sheet**) which was distributed to all staff and players. The Manly Information Sheets provides a description of exertional heat stroke, sets out its possible signs and symptoms, and outlines the risks of exertional heat stroke and how such risks may be prevented. Distinguished Professor Coutts described the Manly Information Sheet as having "*important information for players they should understand*" and Dr Flahive gave evidence that it (or a similar document) could form part of standardized training provided to NRL players annually.

Review conducted by the NRL

19.18 In addition, sometime around December 2023, the NRL commenced an "*in-depth review*" review of the Heat Policy with the assistance of:

(a) Professor Ollie Jay, University of Sydney, an expert in the area of heat illnesses, particularly in the context of sport, and whose team is a world leader in heat policy development and implementation, focusing on strategies that minimise the risk of heat-related illnesses developing; and

(b) Dr Douglas Casa, CEO of the Korey Stringer Institute based in the United States, which is a research, education, advocacy and consultation body aimed at, amongst other things, reducing risks surrounding heat stroke.

19.19 On 14 February 2024, the evidence in the inquest concluded, and the matter was adjourned to 22 March 2024 for oral submissions. Shortly before that day, Counsel Assisting provided to the Court and distributed to the sufficiently interested parties a list of proposed recommendations (**CA Recommendations**), most of which relate to issues associated with the Heat Policy. A copy of the CA Recommendations can be found at **Appendix B** to these findings.

19.20 During the course of submissions, counsel for the NRL indicated that both during the evidence in the inquest and following the conclusion of the evidence, extensive discussions had taken place between Dr Flahive and Professor Jay. Further, by way of update, counsel for the NRL indicated that the NRL had formally engaged Professor Jay to consider, amongst other things, most of the CA Recommendations.

19.21 On 19 April 2024, Dr Flahive provided a further statement which indicated the following:

(a) the NRL engaged Professor Jay on 12 March 2024 to review the Heat Policy and most, but not all, of the matters raised in the CA Recommendations;

(b) Professor Jay is expected to complete his review of the Heat Policy by 10 May 2024;

(c) once complete, it is expected that Dr Casa will consider the Heat Policy between May and July 2024, and provide advice and recommendations regarding the Heat Policy; and

(d) the outcome of the review by Professor Jay and Dr Casa (**Jay/Casa Review**) will be considered by the NRL and any changes to the Handbook and Heat Policy will be submitted to the Australian Rugby League Commission (**ARLC**) for approval, with the aim to "*ensure that any changes are well in place in advance of the commencement of pre-season for the next NRL premiership season*".

19.22 In addition, Dr Flahive explained that the ARLC has in the meantime implemented various non-exhaustive, interim changes to the Heat Policy which make clear the following:

(a) Clubs must comply with the Heat Policy during training, including the use of the Kestrel device and the measure of the HSI.

(b) Clubs must comply with the Heat Policy during training, including the use of the Kestrel device and the measure of the HSI.

(c) A Club's Emergency Action Plan must address the risks arising in relation to heat illnesses.

(d) All Club CMOs must ensure all relevant staff are aware of the key risk factors, symptoms and treatment methods for heat illness.

(e) The need for a 14 day period of heat acclimation for players who have had a prolonged break.

(f) The need for screening and classification of players in relation to known factors for exertional heat stroke and adjustments made as appropriate.

19.23 **Conclusions:** Since at least October 2023, when the NRL and Manly first became aware of the correlation between exertional heat stroke and Keith's death (as a result of evidence gathered as part of the coronial investigation), both organisations have taken timely and proactive steps to improve player welfare and safety in relation to exertional heat illness.

19.24 Manly has published its own material to educate and guide players and staff about the risks and symptoms of exertional heat illness, and disseminated this material in an accessible and understandable form. Manly has also taken the initiative to adapt aspects of the Heat Policy, which is primarily directed at game settings, to its own training environment.

19.25 The NRL has similarly initiated a review of aspects of the Heat Policy and arranged for interim changes to provide improved guidance regarding the Heat Policy pending completion of the review.

19.26 One of recommendations proposed in the CA Recommendations is that Manly give consideration to using the circumstances of Keith's death to, in essence, provide ongoing education and awareness to its players and staff regarding the incidence of heat stroke, factors which may increase the risk of it occurring, its signs and symptoms, and appropriate steps to take regarding its management. As noted above, publication and dissemination of the Manly Information Sheet has already addressed the first three of these matters. It is intended that other recommendations to the NRL will direct attention to aspects of the Heat Policy that relate to the fourth of these matters, namely the implementation of cooling strategies and whether a medical officer should be present at training sessions to direct management in the event of a case of exertional heat illness. Accordingly, it is neither necessary or desirable for the proposed recommendation to be made.

Kestrel Tracker

19.27 As set out above, operation of the Heat Policy is dependent on the HSI calculated from measurements taken from the use of a Kestrel 5400 Heat Stress Tracker (**Kestrel Tracker**). In this regard, questions arose as to the frequency and manner of its use, particularly by Manly.

19.28 Mr Singe gave the following evidence:

> The Kestrel was used. It's a tool used by the Sports Science Department and it's put out on the field. It was always our understanding from the NRL that it was put out on the field in adverse or hot conditions or where we believed that the temperature was actually changing from what we had already got from the from the from the measurement that we were expecting.

19.29 However, later in his evidence Mr Singe appeared to identify a threshold for use of the Kestrel when he said:

> Yes. 26 is usually the that's the temperature that that when we originally had the Kestrels with the NRL that was their recommendation, that was the temperature that the Kestrel would come out.

19.30 Later in his evidence, Mr Singe said that "*when the days were hot*" the Kestrel Tracker was used. However, Mr Singe later acknowledged that his earlier reference to the Kestrel Tracker being used when it was at least 26 °C was an assumption on his part and that he could not be certain this was in fact the case. Ultimately, Mr Singe said that he was uncertain whether the Kestrel Tracker was used for every outdoor training session.

19.31 Mr Singe also gave evidence that he could not recall the Kestrel Tracker being used on 23 November 2020 and explained that he "*didn't receive any information or indication that there was going to be an [sic] adverse heat or weather condition on that day*". Mr Singe also said that he had never seen the Kestrel Tracker used in the Dojo.

19.32 Mr Hasler gave evidence if any there were any concerns with any measurements taken with the Kestrel Tracker, those concerns would be raised with him as Head Coach. However, Mr Hasler said that he did not recall seeing anyone take Kestrel measurements during any training session, including the session on 23 November 2020, and inside the Dojo.

19.33 Mr Bonasera gave evidence that it was his understanding that the Kestrel Tracker would be used on training days where there was some concern in relation to heat. Mr Bonasera gave evidence that he had seen the Kestrel Tracker used "*on a number of occasions*" in training scenarios in the period between April 2019 and December 2020 but was unable to identify specially how many times he had seen it used. Mr Bonasera said that he had never seen the Kestrel Tracker used indoors, including at Manly's current indoor training facility which is air-conditioned, and at the Dojo which is also now air-conditioned.

19.34 Mr Ross gave evidence that he saw the Manly sports scientists using the Kestrel Tracker at the beginning of every field training session, but could not recall whether he saw the device being used for any indoor training session.

19.35 Mr Rahme gave evidence that he saw Sport Science staff using the Kestrel Tracker but could not recall how often, and had no recollection of seeing the Kestrel Tracker ever being used inside the Dojo.

19.36 In her third statement, Dr Flahive acknowledged some issues regarding measurement of HSI during training:

> [I]t is suggested that the Heat Policy might be updated so that it provides greater specificity in relation to the measurement of the Heat Stress Index during training. I agree that there is value in this being done going forward. Guidance can be provided as to how often the measurements should be taken (e.g. prior to the start of training and then at intervals during training) and where the measurements should be taken (e.g. in the middle of an outdoor playing surface and in any indoor area where training is taken place).

19.37 This issue was explored with Dr Flahive during her oral evidence regarding use of the Kestrel Tracker during training scenarios. Dr Flahive explained:

> So, we will probably look at the monitor itself, and then the second piece to that would be around, you know, where exactly that is taken. I think that needs to be dictated more specifically as you can see, and the operations manual specifically talks about in the middle of the ground, and I think what we would need to have reviewed is that that's something that needs to either be done repeatedly over the course of the day, or whether in the external and internal environments.

19.38 Dr Flahive gave evidence that the review would also consider the frequency and duration of measurements, likely adopting the same "traffic light system" as for matches where training would be delayed or modified if the HSI reached certain levels, consider the particular features of an indoor training environment (such as ventilation and mechanical cooling), and minimum standards for the availability of cooling methods (such as ice baths) being available.

19.39 **Conclusions:** The evidence establishes that there were inconsistences regarding use of the Kestrel Tracker by Manly in the period between around 2018 and 2023. There was uncertainty regarding the frequency of its use, the location(s) where it should be used, and the threshold (if one existed) for its use. Much of this uncertainty is a result of the provisions of the Heat Policy which primarily provides for use of a Kestrel Tracker in a game, as opposed to training, scenario, and is based on a subjective assessment regarding its use.

19.40 There is no reliable evidence to suggest that the Kestrel Tracker ever used by Manly in the Dojo, or on 23 November 2020.

Graduated return to training

19.41 It is evident that following the Lloyd Perrett Incident, Dr Inman raised the possibility of introducing a graduated return to training for players following an offseason. When asked what he had in mind when he made his recommendation, Dr Inman gave this evidence:

> And this is I guess the difficulty were discussing about the NRL Guidelines. They recommend a period of acclimatisation in the NRL Guidelines and it's just left at that. There's the preventative measures that they mention, but there's no exact way of guiding teams or individuals on what that entails and what that means, but what it should mean is a graded increase in exposure to the heat so the body can adjust gradually and build up a tolerance to it, and that would - should be

individualised based on, like we were saying, the BMI, the weight of the athlete and their aerobic fitness and their prior training history.

19.42 Distinguished Professor Coutts was strongly supportive of the matters raised by Dr Inman and expressed the following views, referring to relevant literature:

> To reduce risks of exertional heat -related injuries, individuals should be acclimatised by exposure to exercise in the heat gradually over 1-2 weeks (Racinais et al., 2015). Heat acclimatisation involves progressively increasing the intensity and duration of physical activity. If heat acclimatization is not maintained (e.g., during the offseason), the physiologic benefits provided by this process will decay within 3 weeks (Pandolf, 1998; Racinais et al., 2015). Since deconditioning (i.e., loss of protective fitness adaptations) often occurs in the off-season break, the first 2–3 weeks of preseason typically presents the greatest risk of exertional heat injury (Yeargin et al., 2016). Therefore, preventive measures should be used during this time to address this high-risk period. To improve player safety, I would recommend that limits be made on players training exposure during the initial 1–2-weeks after the offseason break.

19.43 During his oral evidence, Distinguished Professor Coutts elaborated on this further:

> So your heat adaptations in particular, so your responses to exposure to heat, full adaptation or a very, very - a large proportion of all adaptations occur within two weeks. That's reported in the literature. Some occur within days, for example plasma volume in the blood. The blood volume will increase within a few days, but there's other, slower adaptations that may take weeks to occur, but two weeks, you've got strong adaptation if you're training in the hea[t].

19.44 As discussed above, Dr Gibbs was of the view that a graduated return to training ought to be mandatory for all clubs. There is evidence in support of this view from a number of other witnesses:

(a) Dr Inman gave this evidence:

> Q. If there is to be a period of clear climatisation(as said), it should be set out in steps in the NRL policy going forward?
> A. It has to be clear and it should be mandated. If there's a recommendation, no-one will listen to it.

(b) Mr Hasler was also asked about this issue and gave the following evidence:

> Q. That there be a mandated approach to preseason training where there's a gradual build up to 100% or maximum effort?
> A. In regard to load and how the high performance group or the high performance and the sports scientists might see that week progressing, yep.

(c) During his evidence, Mr Bonasera was asked about the views expressed by Dr Gibbs and said:

> I think he alluded to mandating it would really help make it really clear for everyone involved and I don't think it's just a rugby league thing, I think it's a sporting code thing for everyone that's performing preseasons in the hotter months of the year, that if they can mandate those return to training and work through obviously with medical intervention where required, it's a safer process.

19.45 Apart from the improvements to player welfare and safety that a graduated return to training would, Distinguished Professor Coutts also highlighted another benefit of mandating such a process in the context of competitive elite team sport:

> Q. Nathan Gibbs, a sports physician, a very experienced sports physician, gave evidence last week that an acclimatisation period should be mandated by the NRL. Do you have a view as to whether that's sensible or not?
> A. It was a part of my recommendations in my report. Absolutely. It makes – it reduces the risk absolute for everybody, and it really doesn't take away a benefit that would be required to perform at your best when you had to.
>
> Q. And any misconceptions about giving away a competitive advantage--
> A. Yeah. Yes.
>
> Q. --end with a mandated approach.
> A. Absolutely.
>
> Q. How would that be policed or enforced by the administrators?
> A. The way you'd have to do it is mandate the training duration or training load would be the ways that you could do it. Having to report - mandate reporting of training loads and training in a central - centralised system.

19.46 In her third statement, Dr Flahive addressed the above matters, which also arose from the issue of the Note, which was framed in terms of a recommendation, rather than being stated in mandatory terms:

> [I]t is suggested that there might be a mandated requirement for a graduated return to training at the start of pre-season that applies to all Clubs (eg a period of 2 weeks). In my view, it may be appropriate going forward to consider the player's fitness level at the start of preseason as part of an assessment of the risk of heat illness. It would also be relevant, in that context, to consider the period of time since the player last undertook competitive match play (for some players that will be the end of the regular season, for some the end of the final series, and for some the end of international representative football). However, the degree of acclimation that is appropriate will depend on these factors and may not necessarily be the same across all players in all Clubs or across all players in the competition. As matters presently stand I would therefore be supportive of a general principle of a graduated return to full intensity training on return, but not necessarily of fixed time periods in this regard for all players (e.g. 14 days).

19.47 Dr Flahive gave evidence that this the Note was drawn from a recommendation made by Professor Coutts (as referred to above) and explained what consideration would be given by the Jay/Casa Review:

> I think part of the [re]view […] would be to see how prescriptive we can be over that that period of a climatization. So, there is a figure of 14 days, but by three to four days, players are 70 percent climatised. And then by, you now, five, to six. So, it would be something that we would look at as part of the review and see how we can actually how we can guide the clubs.
> […]
> So, at the moment, I don't know what that looks like, but that would certainly be part of that review.

19.48 **Conclusions:** The available evidence establishes overwhelming support for the adoption of a graduated return to training for players to improve player welfare and safety, and minimise the possibility of exertional heat illness during a period when players are most at risk. The importance of such a process, and the need to avoid any possibility of variable application in the context of competitive elite team sport, suggests that consideration ought to be given to making the process mandatory.

Medical oversight

19.49 The issue of graduated return to training raised the related question of whether a Club CMO or other medical practitioner ought to provide some degree of oversight to the process itself, as well as to player screening and other assessment measures.

19.50 Dr Gibbs gave evidence regarding what he saw as the value in this:

> That that could be a good idea. As in, players may well be more honest talking to as I said, the team doctor, who they often have a better relationship with or certainly not as threatened as when they might be talking to the head coach. So, that is that's probably a good way to go forward.

19.51 Further, Mr Hasler gave evidence that he considered that it would "*add immense value*" for a CMO to be involved in any preseason screening process to ensure that players are at a suitable fitness level to participate in training.

19.52 Dr Flahive also gave evidence that she could not answer the question of whether any acclimatization period would involve "*sign-off*" by a medical practitioner. However, she postulated that oversight and/or approval of any pre-season conditioning program could be part of a Club's Emergency Action Plan.

19.53 **Conclusions:** The evidence establishes that the process of player screening prior to any graduated return to training, and the training period itself, would likely benefit from some degree of oversight from a medical practitioner. Accordingly, it ought to be the subject of consideration by the Jay/Casa Review.

Medical officer at training sessions

19.54 It is apparent that on 23 November 2020, no medical practitioner was present at either the outdoor training session or initially present inside the Dojo. Dr Delaney was called to attend the Dojo in sudden and unexpected circumstances and, as already discussed above, did so in circumstances where his ability to diagnose and treat Keith's condition was very limited.

19.55 It is not possible to conclude whether the presence of a medical practitioner during the training sessions on 23 November 2020 might have avoided subsequent events or allowed for an improved outcome. Indeed, given the challenges involved in such a speculative exercise, this was not a specific issue considered by the inquest, nor did the inquest receive any evidence about it. However, as already discussed, the inquest did consider evidence regarding potentially greater involvement by

medical practitioners in general aspects of the training process, and so further consideration is warranted in this context.

19.56 Section 33.48 of the Manual sets out the NRL *Minimum Medical Standards*. It relevantly provides that the minimum commitment for a NRL Club Doctor is to:

(a) conduct two player dedicated clinics per week which should be separate to training session in attendance, with one clinic ideally conducted early in the week for post-gain injury assessment and one later in the week for follow-up and medical clearance to play; and

(b) attend training sessions as dictated by the individual Club, which may be in addition to the player dedicated clinics but should not be substituted for such clinics.

19.57 In relation to the Lloyd Perrett Incident, Dr Inman was asked in oral evidence how he was able to determine that Mr Perrett was suffering from heat stroke:

> I then ran through the possibilities of what could be causing a collapse in an athlete and quickly determined that it was heat illness, despite the fact that it's quite a confusing picture. When they're in heat shock they're cold and quite clammy, and I'm talking about really cold, so to think of heat is the cause of the problem is something that seems counterintuitive. Really cold skin and clammy and they start to look even kind of pale and blueish in the skin.
> […]
> Again, it's part of the training of sports and exercise physicians, so I'd recently gone through exams, the sports physician exams, so it's pretty fresh in the memory. I'd never seen it before, but we do cover a lot of sport with the causes of a collapsed athlete in mind, and the most common causes..(not transcribable)..either the heart, and the heart - had issue with the heart, and the second issue is either heat stroke when it's a short duration event at max exertion, and the other thing that's the cause of collapse right up on the list with athletes is hyponatremia. That's more drinking excessive fluid at a marathon run over a long period of time, so that's pretty far and away. It's nothing you can test for, but it's got to be determined by the - more the mode of exercise that heat stroke was the obvious answer.

19.58 Dr Inman gave evidence that he usually did not attend training sessions at Manly and described it as "*fortunate*" that he was at the Academy at the time. Dr Inman also gave evidence that "*without the education, [symptoms of exertional heat stroke are] extremely difficult even for a doctor to pick up*".

19.59 During her oral evidence, Dr Flahive was asked whether she saw any difficulty with the introduction of a rule requiring a medical practitioner to be present at training sessions. Dr Flahive gave this evidence:

> It would be an extensive commitment to have a medical practitioner at all Rugby League training sessions, and - and that the - the Dojo session. So, that would be something yeah, probably outside the scope of this discussion. Certainly, I think one of the most important things about what we are discussing here about exertional heat stroke, is this is something that can be identified at every level, and not necessarily requiring, you know, medical officers to be there. That what we want to look forward to, is a system where all players and staff, you know, recognise, and consider heat. Even when the conditions are not that hot.

19.60 **Conclusions:** The attendance of medical practitioners at club training sessions is not mandated by the NRL. Rather, that attendance is left to the discretion of individual clubs. The evidence suggests that such attendance was not a common practice at Manly in the period at least between 2017 and 2020. This should be taken as an observation and not a criticism.

19.61 There is no doubt that Dr Inman's presence during the Lloyd Perrett Incident allowed for a prompt diagnosis to be made and for treatment to be instituted in a timely manner. Whilst there are significant similarities between the Lloyd Perrett Incident and the incident involving Keith, there are also relevant differences in presentation between the two players, the nature of the training being conducted, and the environment in which it was conducted. It is not suggested that any similarities between the incidents allows for a conclusion that the presence of a medical practitioner at both incidents would have resulted in the same outcome.

19.62 However, given the inherent difficulties in diagnosing exertional heat illness, the evidence at least establishes that consideration ought to be given about the circumstances in which a medical practitioner might be required to attend training sessions where the risk of exertional heat illness is elevated.

Modifications to training

19.63 It is apparent that under the NRL Heart Policy determination of the HSI dictates the implementation of defined Basic Cooling Strategies and the Full Heat Policy. It is equally apparent that these measures are directed to a game, and not a training, setting. It should be noted that the inquest did not specifically consider the application of the Heat Policy to NRL games.

19.64 Whilst recognising the value in maintaining a degree of flexibility due to the variable nature of Club training sessions, Dr Flahive agreed that there is value in having more training-specific options in the Heat Policy. Dr Flahive gave this evidence:

> If we can enhance this approach to - to our heat policy, that is a very positive thing. And certainly, there are areas that we would be more specific around training, and more prescriptive.

19.65 **Conclusions:** Whilst the Heat Policy would appear to provide appropriate guidance in the context of games, it does not provide specific guidance in a training setting. Certain cooling and heat management strategies that are triggered by the HSI are not designed for, or capable of implementation within, the training environment. Therefore, there is obviously benefit in ensuring that any policy framework intended to minimise the risk of players suffering exertional heat illness takes into account the specific features of the training environment.

Individualised training

19.66 Professor Coutts was asked to consider whether Keith's personal characteristics should have been taken into account in preparing the training program for him on 23 November 2022. Professor Coutts explained:

> Yes, best practice is that physical training programs be individualised according to an athlete's personal characteristics, such as their training history, size and fitness levels. Additionally, it is established in American football that risks of exertional heat illness are the greatest in the first 14 days of practice after the offseason, with a spike occurring in the first two sessions of the preseason (Coopper et al., 2016). Therefore, greater precautions protecting against heat-related injury should be taken during the first 2-weeks of preseason.
>
> In Keith's case, he had relatively low training age for an NRL player, was the least aerobically fit player in MWSE NRL playing list (i.e., shown by YoYo test result). He was also the third heaviest players on the MWSE NRL roster. There have been many reports showing non-environmental risk factors of heat-related injury include high body mass and poor endurance fitness. Specifically, players with a BMI >30 kg/m2 are known to be at greater risk of exertional-heat illness. In preparing the report, I could not find any evidence to show or suggest that these factors were considered in preparing Keith's training session.

19.67 Dr Flahive explained that the HSI is "*intended as a heat stress risk management tool and is not intended to be a prediction of exactly what will happen in the particular circumstances*". Accordingly, only a player's playing position (hit up forward, wide running forward, outside back) is taken into account in the model. Dr Flahive noted that this is a result of advice from Professor Jay that the fundamental differences between risk estimation are differences in approximate weight and height for players in these positions, and their rate of metabolic heat production. Other individual characteristics such as lower aerobic capacity , lack of fitness, VO2 max and training history are not taken into account.

19.68 Dr Flahive also explained that matters such as a player's lack of fitness, for instance when returning from the offseason or from injury, is a matter for a Club's medical and other staff to be cognisant of in assessing whether players are exposed to any health risks. Dr Flahive agreed that there is value in the Heat Policy having greater clarity around the risk factors relating to heat illness (such as low aerobic fitness, high BMI, history of prior heat illness and so on).

19.69 However, Dr Flahive acknowledged that further consideration should be given by the Jay/Casa Review as to whether the best way to take into account a player's lower level of fitness is by way of a change to the calculation of the HSI. Dr Flahive also considered the following:

> It may also be appropriate for there to be separate mandated assessment conducted by Clubs of these risk factors in relation to players at the start of pre-season training. This would then permit individual training plans to be determined by reference to such risk assessment where appropriate.

19.70 **Conclusions:** The evidence establishes that there is obvious benefit in having a training program tailored to meet the individual characteristics of a player. This is particularly so where such characteristics (for example, such as comparative level of fitness or increased BMI) may increase an individual's risk of exertional heat illness. The resource implications of tailoring such a program are not known and were not explored in any detail during the inquest.

19.71 However, the extent to which such individual characteristics may be taken into account by an almost objective measurement such as the HSI is uncertain. Further, there is also uncertainty regarding whether the tailoring of any such individualised program ought to be a Club's responsibility, and the degree of oversight and regulation (if any) on the part of the NRL in this process. Accordingly, these matters also ought to be the subject of consideration by the Jay/Casa Review.

Recommendations

19.72 Having regard to each of the matters set out above, further consideration of aspects of the Heat Policy is required in order to ensure that it is fit for purpose in both game and training settings. Encouragingly, the NRL has already taken steps for that consideration to occur through the Jay/Casa review. The evidence adduced during the inquest in conjunction with the helpful CA Recommendations form the basis of this review.

19.73 Accordingly, it is necessary to make the following recommendations, with the proposed CA Recommendations expanded upon and amended for consistency and clarity.

19.74 **Recommendation:** I recommend to the Chief Executive Officer, National Rugby League, that a copy of the findings in the *Inquest into the death of Keith Titmuss* be provided to Professor Ollie Jay and Dr Douglas Casa for consideration as part of their engagement to review aspects of the NRL *Advisory 2 – Heat Policy & Management of Thermal Injury/Hyperthermia*.

19.75 **Recommendation:** I recommend to the Chief Executive Officer, National Rugby League, that Professor Ollie Jay and Dr Douglas Casa be asked, as part of their engagement to review of aspects of the NRL *Advisory 2 – Heat Policy & Management of Thermal Injury/Hyperthermia* (Heat Policy), to consider whether the NRL *Operations Manual*, the NRL *Medical Officers Handbook*, and any other NRL policy, rules or procedure document ought to be amended to:

(a) mandate the reporting by NRL Clubs to the NRL of every instance of exertional heat illness involving a player in a game or training setting;

(b) mandate that NRL Clubs comply with the NRL Heat Policy during all outdoor and indoor training sessions;

(c) provide greater guidance to NRL Clubs regarding the circumstances in which environmental conditions in both outdoor and indoor training settings should be measured, and the instances and frequency of such measurements, using the method described in the NRL Heat Policy;

(d) identify what cooling and heat management strategies should be implemented in outdoor and indoor training settings in response to calculation of the Heat Stress Index;

(e) identify what adjustments should be made to indoor and outdoor training sessions and recovery activities in response to measurement of environmental conditions and calculation of the Heat Stress Index, and mandate such adjustments;

(f) mandate that:

(i) players participating in training activities be screened and classified according to any known risk factors for exertional heat illness such as fitness levels (low aerobic capacity), size, high Body Mass Index and training history; and

(ii) the training program for individual players be adjusted accordingly.

(g) mandate a 14 day period of controlled training load (acclimatisation) for players who return to training after an extended break from training.

(h) identify the circumstances and occasions when attendance by a medical officer at a training session is mandatory to ensure player welfare and safety, reduce the risk of exertional heat illness, and institute appropriate medical treatment in the event of a player experiencing exertional heat illness;

(i) mandate that a medical officer is to approve:

(i) any strength and conditioning plan for; and

(ii) any screening of

players returning to training after an off-season break or an extended break from training.

19.76 **Recommendation:** I recommend to the Chief Executive Officer, National Rugby League, that consideration be given to the extent to which the circumstances of the death of Keith Titmuss might form the basis for a case study, and for ongoing education by the NRL to raise awareness, and emphasise the significance, of exertional heat illness to NRL Clubs including, but not limited to the:

(a) risk factors which may increase a person's susceptibility to exertional heat illness such as fitness levels (low aerobic capacity), size, high BMI and training history;

(b) fact that exertional heat illness can occur even in a setting of lower ambient temperatures;

(c) signs and symptoms of exertional heat illness; and

(d) appropriate steps to be taken when signs and symptoms of exertional heat illness are present, including where appropriate and where environmental conditions warrant, the use of cooling and heat management strategies.

20. Findings

20.1 Before turning to the findings that I am required to make, I would like to acknowledge, and express my gratitude to Mr Adam Casselden SC and Mr Michael Dalla-Pozza, Counsel Assisting, and their instructing solicitors, Ms Aleksandra Jez, Mr Michael Tanazefti and Mr Paul Armstrong from the

Crown Solicitor's Office. I acknowledge the tremendous assistance that they have provided throughout the coronial investigation. The Assisting Team has worked tirelessly to gather and present all relevant evidence in a thorough, professional and objective manner. I am extremely grateful for their meticulousness, and for the sensitivity and empathy that they have shown during all stages of the coronial process.

20.2 I also thank Plain Clothes Senior Constable Matthew Jackson for his role in the police investigation and for compiling the initial brief of evidence.

20.3 The findings I make under section 81(1) of the Act are:

Identity

The person who died was Keith Titmuss.

Date of death

Keith died on 23 November 2020.

Place of death

Keith died at Royal North Shore Hospital, St Leonards NSW 2065.

Cause of death

The cause of Keith's death was exertional heat stroke.

Manner of death

Keith developed exertional heat stroke after completing the first outdoor and indoor preseason training sessions following an extended break during the rugby league offseason. The duration of the offseason, Keith's comparative level of fitness to that of his training cohort, Keith's body mass index, the duration and intensity of both the outdoor and indoor training sessions, Keith's state of involuntary dehydration prior to the indoor training session, and the environmental conditions during the indoor training session were all contributing factors to the development of exertional heat stroke.

20.4 On behalf of the Coroners Court of New South Wales, I offer my sincere and respectful condolences, to Keith's family, and in particular his parents, Lafo and Paul; his brother, Jesse; his sister, Zara; and his partner, Tatyanna. I extend these condolences also to Keith's many friends, his teammates andh his loved ones for their most tragic and devastating loss.

20.5 It is appropriate to conclude with some of the words generously shared by Lafo at the conclusion of the evidence in the inquest:

> In the Good Book, *Proverbs 29, Verse 17*, it says, "*Discipline your children and they will give you the peace and they will give you the delights you desire*." This is the foundation that Paul and I built our family on, and Keithy, this is precisely how he made us feel.

20.6 I close this inquest.

Magistrate Derek Lee
Deputy State Coroner
3 May 2024
Coroners Court of New South Wales

Appendix A

Inquest into the death of Keith Titmuss
2020/333632

RECOMMENDATIONS MADE PURSUANT TO SECTION 82, *CORONERS ACT 2009*

To the Chief Executive Officer, National Rugby League:

1. I recommend that a copy of the findings in the *Inquest into the death of Keith Titmuss* be provided to Professor Ollie Jay and Dr Douglas Casa for consideration as part of their engagement to review aspects of the NRL Advisory 2 – Heat Policy & Management of Thermal Injury/Hyperthermia.

2. I recommend that Professor Ollie Jay and Dr Douglas Casa be asked, as part of their engagement to review of aspects of the NRL *Advisory 2 – Heat Policy & Management of Thermal Injury/Hyperthermia* (Heat Policy), to consider whether the NRL *Operations Manual*, the NRL *Medical Officers Handbook*, and any other NRL policy, rules or procedure document ought to be amended to:

   (a) mandate the reporting by NRL Clubs to the NRL of every instance of exertional heat illness involving a player in a game or training setting;

   (b) mandate that NRL Clubs comply with the NRL Heat Policy during all outdoor and indoor training sessions;

   (c) provide greater guidance to NRL Clubs regarding the circumstances in which environmental conditions in both outdoor and indoor training settings should be measured, and the instances and frequency of such measurements, using the method described in the NRL Heat Policy;

   (d) identify what cooling and heat management strategies should be implemented in outdoor and indoor training settings in response to calculation of the Heat Stress Index;

   (e) identify what adjustments should be made to indoor and outdoor training sessions and recovery activities in response to measurement of environmental conditions and calculation of the Heat Stress Index, and mandate such adjustments;

   (f) mandate that:

      (i) players participating in training activities be screened and classified according to any known risk factors for exertional heat illness such as fitness levels (low aerobic capacity), size, high Body Mass Index and training history; and

      (ii) the training program for individual players be adjusted accordingly.

   (g) mandate a 14 day period of controlled training load (acclimatisation) for players who return to training after an extended break from training

(h) identify the circumstances and occasions when attendance by a medical officer at a training session is mandatory to ensure player welfare and safety, reduce the risk of exertional heat illness, and institute appropriate medical treatment in the event of a player experiencing exertional heat illness;

(i) mandate that a medical officer is to approve:

(i) any strength and conditioning plan for; and

(ii) any screening of

players returning to training after an off-season break or an extended break from training.

3. I recommend that consideration be given to the extent to which the circumstances of the death of Keith Titmuss might form the basis for a case study, and for ongoing education by the NRL to raise awareness, and emphasise the significance, of exertional heat illness to NRL Clubs including, but not limited to the:

(a) risk factors which may increase a person's susceptibility to exertional heat illness such as fitness levels (low aerobic capacity), size, high BMI and training history;

(b) fact that exertional heat illness can occur even in a setting of lower ambient temperatures;

(c) signs and symptoms of exertional heat illness; and

(d) appropriate steps to be taken when signs and symptoms of exertional heat illness are present, including where appropriate and where environmental conditions warrant, the use of cooling and heat management strategies.

To the Chief Executive Officer, Manly Warringah Sea Eagles:

4. I recommend that Manly review its record-keeping procedures to ensure that they are sufficiently robust and reliable so that any previous incidents where a player has experienced a serious adverse health event (for example, involving hospitalisation) whilst at training or during a game, and any advice or lessons arising from such an incident, are effectively communicated to all:

   (a) coaching staff;

   (b) members of the High Performance Unit; and

   (c) medical and allied health staff.

   This communication should occur whenever there is changeover of such staff or at least on an annual basis, whichever is the earlier.

Magistrate Derek Lee
Deputy State Coroner
3 May 2024
Coroners Court of New South Wales

Appendix B

Inquest into the death of Keith Titmuss
2020/333632

PROPOSED RECOMMENDATIONS OF COUNSEL ASSISTING

Recommendations directed to the NRL:

(1) That the NRL provide Professor Olly Jay and Dr Douglas J. Casa with a copy of the findings and any recommendations made by this Court in the present inquest.

(2) That the NRL ask Professor Olly Jay and Dr Douglas J. Casa to consider, in the context of their pending review, whether the NRL's Heat Policy & Management of Thermal Injury and Hyperthermia (Heat Policy), Handbook and/or Operations Manual should be amended so as to provide greater guidance to clubs as to the circumstances in which environmental conditions (including environmental conditions in all training locations whether indoor and outdoor) prior to and during all training sessions should be ascertained (using the method described in the Heat Policy).

(3) That the NRL ask Professor Olly Jay and Dr Douglas J. Casa to consider, in the context of their pending review, whether the Heat Policy, Handbook and/or Operations Manual should be amended so as to deal, specifically, as to what if any measures should be implemented during a training session (whether indoor or outdoor) if a Heat Stress Index (HSI):

   (a) Is over 150 (but less than 200)
   (b) Is over 200 (but less than 250)
   (c) Is over 250

(4) That the NRL ask Professor Olly Jay and Dr Douglas J. Casa to consider, in the context of their pending review, whether the Heat Policy, Handbook and/or Operations Manual should be amended so as to mandate adjustments to both indoor and outdoor training and recovery activities based on environmental conditions such as ambient temperature.

(5) That the NRL ask Professor Olly Jay and Dr Douglas J. Casa to consider, in the context of their pending review, whether the Heat Policy, Handbook and/or Operations Manual should be amended so as to require:

   (a) Players participating in training to be screened and classified according to the known risk factors for exertional heat illness such as fitness levels (low aerobic capacity), size, high Body Mass Index (BMI) and training history; and
   (b) That player's training plan to be adjusted accordingly.

(6) That the NRL ask Professor Olly Jay and Dr Douglas J. Casa to consider, in the context of their pending review, whether the Heat Policy, Handbook and/or Operations Manual should be amended so as to mandate a 14 day period of controlled training load (acclimatisation) for players who return to training after an extended break from training.

(7) That the NRL ask Professor Olly Jay and Dr Douglas J. Casa to consider, in the context of their pending review, whether the Heat Policy, Handbook and/or Operations Manual should be amended so as to mandate the attendance of medical officers either:

   (a) At all NRL training sessions; or

(b) At select training sessions which are identified as posing a particular risk to player safety (including, for example, the first 14 days of training after an extended break from training).

(8) That the NRL ask Professor Olly Jay and Dr Douglas J. Casa to consider, in the context of their pending review, whether the Heat Policy, Handbook and/or Operations Manual should be amended so as to provide for the sign off or approval of a club medical officer for:

(a) Any strength and conditioning plans for players returning to training after an off-season break or an extended break from training; and
(b) Any screening of players returning to training after an off-season break or an extended break from training.

(9) That the NRL ask Professor Olly Jay and Dr Douglas J. Casa to consider, in the context of their pending review, whether it ought to be mandatory for clubs to comply with the Heat Policy during training sessions (outdoor and Indoor).

(10) Consider the extent to which the tragic circumstances of Mr Titmuss' death might form the basis for a 'case study' and ongoing education and awareness by the NRL emphasising the significance of exertional heat illness including but not limited to:

(a) The risk factors which may increase a person's susceptibility to exertional heat illness such as fitness levels (low aerobic capacity) size, high BMI and training history;
(b) The fact that exertional heat illness can occur notwithstanding lower ambient temperatures;
(c) The signs and symptoms of exertional heat illness; and
(d) The appropriate steps to be taken when signs and symptoms of exertional heat illness are present, including where appropriate and where environmental conditions warrant, the use of cold-water immersion, wet towels or the application of ice.

<u>Recommendations directed to the Manly Warringah Sea Eagles:</u>

(11) Consider the extent to which the tragic circumstances of Mr Titmuss' death might form the basis for a 'case study' and ongoing education and awareness by Manly emphasising the significance of exertional heat illness including but not limited to:

(a) The risk factors which may increase a person's susceptibility to exertional heat illness such as fitness levels (low aerobic capacity) size, high BMI and training history;
(b) The fact that exertional heat illness can occur notwithstanding lower ambient temperatures;
(c) The signs and symptoms of exertional heat illness; and
(d) The appropriate management steps to be taken when signs and symptoms of exertional heat illness are present, including where appropriate and where environmental conditions warrant, the use of cold-water immersion, wet towels or the application of ice.

(12) That Manly reconsider and strengthen its record keeping procedures to ensure that any previous incidents where a player has experienced a serious adverse health event whilst at training, and any advice or lessons arising from such an incident are effectively communicated to all:

(a) Coaching staff;
(b) Members of the high performance unit; and
(c) Medical and allied health staff

on at least an annual basis.