QUEENSLAND COURTS

CORONERS COURT OF QUEENSLAND

FINDINGS OF INVESTIGATION

CITATION:	**Non-inquest findings into the death of Tyson**
TITLE OF COURT:	Coroners Court
JURISDICTION:	BRISBANE
DATE:	08/04/2024
FILE NO(s):	2022/1334
FINDINGS OF:	Ainslie Kirkegaard, Coroner
CATCHWORDS:	CORONERS: fire-related death; lithium-ion rechargeable battery; e-scooter; incompatible charger; uncontrolled thermal runaway event

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Background

1. Tyson was a young man who died at a tertiary hospital in South East Queensland on 22 March 2022. He lived in a camper trailer parked at a property where his grandmother was living in a metropolitan area.

2. Tyson's death was reported to the coroner because he died from severe burns sustained in a fire.

Tyson's living arrangements

3. Tyson was living in a camper trailer parked under an open sided carport at the northern side of the rear yard at the property.

4. The camper trailer was a 1982 Panorama ATM UP TO 1.02T Caravan Pop-up Trailer. The camper trailer was uninsured.

5. The camper trailer was being powered by an extension cord connected from the house to one port of the van.

Tyson's electric scooter

6. Approximately two weeks prior to his death, Tyson had obtained a Zero 10 electric scooter. It appears he acquired it second hand and without any power source. It is not known where he acquired it from.

The events of 21 March 2022

7. On the evening of 21 March 2022, Tyson's girlfriend Jade was staying overnight with him in the camper trailer.

8. At 8:00pm the evening, Tyson spoke with a friend about needing to get a charger for his e-scooter. They discussed whether the friend's scooter charger, a 'fast charger' designed for the Nami Burn electric scooter, would fit Tyson's Zero 10 e-scooter charging port. As a result of this conversation, Tyson decided to borrow his friend's fast charger and returned home with it. It was subsequently determined that the charger had been stolen with the Nami Burn e-scooter in early November 2021.

9. On arriving home with the charger, Tyson hooked the charger up to his Zero 10 e-scooter and placed it on charge at the rear end of the camper trailer alongside his mobile phone. Both devices were being powered by the same power board which was connected to the main house by an extension cord.

10. Tyson and Jade went to bed on the eastern side of the camper trailer which was closest to the single-entry door. The door was locked. Approximately 20 minutes later, Jade heard two loud bangs that sounded like firecrackers. She saw smoke coming from the vicinity of the e-scooter. She woke Tyson who got out of bed and ran towards the door which was near the flames coming from the e-scooter. Jade remained in bed and turned her body to protect her unborn child from the flames. She heard Tyson tell her to "get out" so she jumped out of the nearest window. Once outside, Jade saw Tyson at the tap at the rear of the house trying to turn it on to hose himself. Tyson told her to go to the neighbours across the road for help.

11. A nearby resident reported hearing a large explosion which caused the house to shake. She opened the bathroom windows and saw a huge ball of flames coming from directly behind the property where Tyson was living. She alerted her husband to the situation and then phoned 000. Her husband ran to the property and could see flames coming from the backyard area, but the house was not on fire. He entered the property, encountering Tyson and Jade walking from the backyard. Tyson was concerned about his grandmother who was inside the house. The neighbour assisted Tyson's grandmother out of the house to safety.

12. Residents of the neighbouring property were awake at the time and reported hearing a loud bang which caused them to look out their back window and see the camper trailer fully engulfed in flames.

13. None of the neighbours reported hearing any disturbance prior to the explosion and did not see any suspicious activity when coming to help the residents of the affected property.

14. Police, paramedics and Queensland Fire & Emergency Services personnel attended the scene. Three fire crews attended to extinguish the fire which was reported as being under control at around 11:13pm. The time of call out was around 11:02pm and the first fire crew arrived at the scene at around 11:09pm. The camper trailer was extensively damaged.

15. Police located Tyson and Jade at the neighbouring property, observing both had sustained significant burn injuries to most of their bodies. Paramedics were already in attendance assessing the couple. Before Tyson was taken to hospital, he was able to tell police the e-scooter had exploded while it was charging. He and Jade were both asleep when this happened. Tyson's airway was initially patent but there were burns to his lips and nose. He was assessed as having burns to greater than 90% of his body. He was given pain relief, cooling and fluids before being intubated and ventilated at the scene and transported urgently to hospital.

16. Tyson was admitted to the intensive care unit where he was assessed by specialist burns physicians. He was found to have greater than 90% total body surface area deep thermal injury (burns). The extent and depth of his burns were such that his injuries were unsurvivable. Following discussion with his family about his very poor prognosis, he was transitioned to comfort measures and died in the intensive care unit on 22 March 2022.

17. Jade sustained burns to 50% of her body. She underwent surgery to deliver her baby.

Police and fire investigation

18. Police established a crime scene at the property and commenced an investigation.

19. Fire damage was contained to the camper trailer and had not spread to other areas of the property. The camper trailer was significantly damaged, and the rear of the camper trailer appeared to have sustained greater fire damage than the front half. Remnants of a heavily fire damaged electric scooter were located at the rear end of the camper trailer.

20. Preliminary examination of the electrical wiring to the camper trailer and the scooter charger indicated the e-scooter may have been plugged in and charging.

21. Excavation was conducted of the floor of the camper trailer and a sample was collected from the burnt flooring at the western end of the camper trailer. The remnants of the burnt e-scooter, a charging unit and numerous 18650 Lithium-ion cells were collected for further electrical safety examination.

Post mortem findings

22. External examination including CT scan and review of the patient medical records confirmed the clinical finding of deep thermal injury to greater than 90% of the total body surface area. There were no other significant injuries. Toxicological analysis of hospital admission blood samples detected a level of carbon monoxide indicating a minor degree of smoke inhalation and prescription medications administered by the attending paramedics. No alcohol or other drugs were detected. Having regard to these findings, the pathologist determined the cause of death to be burns.

Electrical safety examination of e-scooter and charger unit

23. Electrical safety examination noted the Zero 10 e-scooter was rated to be supplied at 52 volts/1.7 amps whereas the charger was rated with an output of 84 volts/5 amps.

24. The remains of the e-scooter showed it was badly damaged with some type 18650 cells still located in the e-scooter. The handlebar stem was broken away from the scooter deck with much of the alloy frame having melted and the rubber tyres having been consumed in the fire. There was no observable evidence of adverse electricity activity on any cabling or connection.

25. The remains of a printed circuit board and metal enclosure end piece were found in the remains of the melted scooter, corresponding with the dimensions and appearance of the motor controller unit of this make and model e-scooter. It was not possible to identify its conductors or connections due to fire damage.

26. The charger was badly damaged, but its remains appeared to incorporate a fan and its surviving metal framework corresponded with the construction and appearance of a Nami Burn e-scooter charger. The extent of fire damage was such it was not possible to identify any evidence of adverse electrical activity on the charger or its electrical conductors or connections.

27. There were 74 type 18650 cells, all of which were noted to have vented, and many had ruptured violently. The metal cases of these cells had not melted, and in many cells the internal anode copper sheets were observed to have survived the fire but the cathode and separator sheets had been reduced to ash. The damage was such it was not possible to determine the series/parallel arrangement of the cells in the e-scooter or evaluate the internal charging regulator used in the e-scooter. The damage observed was identified as being consistent with an energetic failure of multiple Lithium-ion batteries inside the e-scooter. It was not possible to determine the e-scooter's ability to prevent overcharging its batteries from overvoltage or overcurrent, so this hypothesis as an ignition source of the fire could not be ruled out. The electrical safety investigator advised that temperature produced by overheated cell thermal runaway reactions do not reach levels that will cause the melting of pure copper. This is consistent with what was observed in this instance with the steel battery cell cases and the copper current collector sheets in the batteries anodes not having melted but a black friable material attributed to the remains of the batteries' cathode materials remaining.

28. The electrical safety investigator advised that an uncontrolled thermal runaway event and resultant fire in lithium-ion rechargeable batteries can be caused by a number of contributing factors including overcharging, mechanical damage, manufacturing defects or by exposure to excessive external heat. The electrical safety investigator could not determine specifically if the battery failures in the e-scooter were a cause or a consequence of the fire.

Fire investigation outcomes

29. Examination of the carport and the camper trailer revealed no external seats of fire and no indications of any fire developing externally and projecting to the interior of the camper trailer. While the camper trailer had provision for a 9kg LPG cylinder to be attached, no cylinder was attached to the camper trailer at the time of the incident. A 240-volt extension lead was connected to the shore power socket at the rear of the camper trailer with supply coming from the laundry of the nearby house.

30. The location and intensity of the fire related damage observed across the exterior of the camper trailer indicated the fire had initially developed inside the camper trailer.

31. The camper trailer was internally heavily consumed by fire with full consumption of the elevated roof structure. Within the camper trailer, a 240-volt service was integral and included two internal rear general purpose outlet/power outlets. The remains of a mobile phone and charge conductor were located at the near side rear in association with the internal 240-volt wiring. Electrical 240-volt conductors were observed from the internal location of the shore power electrical socket to the nearside rear area with the copper/brass remains of a 240-volt socket. Electrical 240-volt conductors were observed to travel the internal wall perimeter to the offside refrigerator but with no observed connection to that appliance. The external sheathing of the 240-volt conductors had been consumed by fire.

32. Examination of all 240-volt conductors and general purpose outlet connections within the camper trailer revealed no evidence of an arcing event.

33. Observations of the location and intensity of the fire-related damage at overhead, mid structure and floor level across the camper trailer indicated the fire developed at the rear centre floor area. Lateral fire spread had occurred to the surrounding ignitable items and hard furnishings.

34. All the camper trailer contents were observed to have sustained prolonged exposure to high concentrations of heat and smoke, and many ignitable items and hard furnishing displayed significant damage from direct flame contact directional to the rear centre floor area. The fire consumption of ignitable materials within the centre and radially outward within the camper trailer was very intense.

35. Heavily fire damaged remains of an e-scooter and an associated charger unit and charge conductor were located at the rear centre of the camper trailer. The most significant and hottest evidence of fire was the consumption of most of the aluminum chassis of the e-scooter with deep charring to the timber flooring at that location. This was determined to be the area of the fire. An exact point of origin was not able to be identified due to the extensive fire damage.

36. The fire investigation determined that during the fire a lithium-ion battery pack of dozens of type 18650 cells associated with the e-scooter exploded, depositing the cells within and external to the camper trailer by several metres. These cells displayed significant heat, decay and over pressure damage resulting from being involved in a rapidly developing heat and fire event.

37. While the fire investigation did not confirm the exact source of ignition, it determined the only electrical appliances in use at the time of the incident were the e-scooter charger and a mobile phone being charged. There was a butane canister cooker in a disabled/housed orientation. The butane canister had over pressurised and vented during the fire.

38. The fire investigation concluded it was possible that a heating/arc/fire event involving the e-scooter and/or its charger with the combination of the Zero 10 e-scooter (with a lithium-ion type18650 cell battery specification of 52 volts/1.7 amps) connected to a charger for a different brand/model e-scooter capable of 84 volts/5 amps) caused the fire and rapid intense fire damage. The investigation could not categorically rule out human initiated ignition.

Consumer safety risks of lithium-ion batteries

39. Lithium-ion batteries are very common products in Australian homes with a significant consumer uptake of this battery technology, including uptake of e-transportation (e-scooters, e-bikes, e-vehicles).

40. While all batteries present risks, the consequences of lithium-ion battery failure can be catastrophic given they are energy dense and contain material that is highly flammable. Uncontrolled failure can cause an intense self-sustaining fire. Multiple cells are often linked within a battery pack and may create a chain reaction creating a larger fire event. Thermal runaway is the name given to an internal battery overheating reaction which occurs when heat in a lithium-ion battery increases faster than it can be dispersed to its surroundings. The high temperature causes the cell materials to decompose in a reaction that creates more heat, causing the materials to decompose at a faster rate and result in one or multiple cells bursting and releasing toxic, flammable and explosive gases.

41. Using incompatible chargers or overcharging batteries is one of a number of risk factors leading to Lithium-ion battery incidents.

Findings required by s.45

Identity of the deceased – [De-identified]

How he died – Tyson died from severe burns sustained in a fire most likely caused by an uncontrolled thermal runaway event and resultant fire in lithium-ion rechargeable batteries involving a Zero 10 e-scooter (rated to be supplied at 52 volts/1.7 amps) that was being charged by a charger rated to supply a different make and model of e-scooter at 84 volts/5 amps. It is possible though not able to be proven conclusively that overcharging the e-scooter's internal batteries with excessive voltage and current from an incompatible charger may have caused the fire. I am satisfied Tyson's death was an accident as there is no evidence of the involvement of any other person in the incident.

The circumstances in which Tyson died serve as a tragic reminder of the importance of only using chargers that are supplied with the equipment or device, or certified third-party charging equipment that is compatible with the battery specifications. Using chargers with incorrect power delivery (voltage and current) can cause damage to the battery that can lead to rapidly developing, intense and self-sustaining fires. Large batteries and equipment such as e-scooters should be charged away from living spaces and in an area equipped with a compliant smoke alarm.

Place of death – [De-identified]

Date of death – 22/03/2022

Cause of death – 1(a) Burns

I close the investigation.

Ainslie Kirkegaard
Coroner
CORONERS COURT OF QUEENSLAND
8 April 2024