QUEENSLAND COURTS

OFFICE OF THE STATE CORONER
FINDINGS OF INQUEST

CITATION:	Inquest into the death of Kesler Lee James
TITLE OF COURT:	Coroners Court
JURISDICTION:	Cairns
FILE NO(s):	2012/688
DELIVERED ON:	3 June 2016
DELIVERED AT:	Cairns
HEARING DATE(s):	8,9 and 10 June 2015
FINDINGS OF:	Kevin Priestly, Coroner
CATCHWORDS:	Coroners: Child with rheumatic heart disease, exacerbation with acute heart failure, need for transfer to higher level of care, deterioration and death during organisation of retrieval, access to Paediatric Intensivist advice, retrieval co-ordination and capability.

REPRESENTATION:

Counsel Assisting:	Ms J Franco, Office of the State Coroner
Counsel for Ms Jennifer James:	Mr B Wessling-Smith I/B Maurice Blackburn Lawyers
Counsel for North West Hospital and Health Service, Townsville	

Hospital and Health Service, Retrieval Services Queensland:	Ms J Farr I/B MinterEllison
Counsel for Dr George Waters:	Ms J Rosengren I/B Avant Mutual Group Limited
Counsel for Dr Pat Ryan:	Ms S Williams I/B K & L Gates Solicitors
Counsel for Nurse Cromley:	Ms Sally Robb I/B Roberts & Kane Solicitors

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Background

Short Narrative

Kesler James was five years of age and lived with his mother Jennifer James and siblings at Mt Isa.

On 26 January 2012 Kesler became unwell, suffering fever and difficulties walking with painful ankles. There were a number of presentations to Mt Isa Hospital where his condition was investigated. During presentation on 6 February, the possibility of acute rheumatic fever was considered. Kesler was transferred to Townsville Hospital for further investigation and treatment. The diagnosis of acute rheumatic fever was made and appropriate treatment given till he was well enough for discharge back to Mt Isa Hospital on 16 February 2012 for continuing treatment. On review on 21 February, he was progressing well, and asked to return for further review in a week.

On 24 February 2012 Kesler was admitted urgently through the Emergency Department at Mt Isa Hospital. Although diagnosed as suffering acute heart failure, his condition appeared to stabilise then later deteriorated. Arrangements were made with Retrieval Services Qld and Royal Flying Doctor Service for transfer to Townsville Hospital. However, before transfer, Kesler's condition further deteriorated and he became unresponsive. CPR was started but was unsuccessful. Kesler was pronounced deceased at 10.54am.

The death was reportable as the unexpected outcome of health care and a coronial investigation started. Dr Urankar, Forensic Pathologist, conducted an autopsy and certified that death was due to acute bronchopneumonia and diffuse alveolar damage secondary to acute rheumatic carditis.

Initially, all medical records from Mt Isa Hospital and Townsville Hospital were obtained and reviewed with the assistance of a Forensic Medical Officer, Dr Les Griffiths, to identify any issues warranting further investigation. Dr Griffiths had the benefit of the autopsy report.

He found that the clinical management prior to Kesler's last admission to Mt Isa Hospital did not require further investigation but thought there were opportunities for a better outcome in the last admission and suggested expert review.

Statements or reports were obtained from the treating clinicians to supplement the information in the medical records. Dr McCaffery, Consultant Paediatric Intensivist at Lady Cilento Children's Hospital was commissioned to conduct an expert review of clinical management and he identified a number of opportunities for improvement.

During the course of the coronial investigation, other reports of experts relating to Kesler's clinical management were provided to the court.

The Role of the Coroner

It is important that the reader understand the role of the coroner. The Coroners Act 2003 requires the coroner to make findings about who died, when and where the person died, what caused the person to die and how the person died. The coroner is prohibited from making any statement in the findings or comments that a person is or may be guilty of an offence or civilly liable for something (s45(5)). The focus of a coronial investigation is public health and safety and exploring ways to prevent death from happening in similar circumstances in the future. This power is traditionally reflected in the form of recommendations.

A coroner may give information about a person's conduct in a profession obtained while investigating a death, to the profession's disciplinary body if the coroner reasonably believes the information might cause the body to inquire into, or take steps in relation to, the conduct. In this context, I have power to give information to the Office of Health Ombudsman if I reasonably believe that such information might cause that body to inquire into the conduct of a health care professional's conduct in the clinical management of Kesler.

I make it clear from the outset that there is no evidence to support the exercise of this power. The focus of this coronial investigation, when it reached hearing, was identifying opportunities for better clinical management of retrievals of acute ill children like Kesler. The comments of reviewing experts were with the benefit of hindsight.

Issues for Consideration

At directions hearings, the following issues list was finalised after consultation with the parties.

1. The findings required by s.45(2) of the Coroner Act 2003 namely the identity of the deceased person, when, where and how they died and what caused their deaths.
2. Timely recognition of the extent of deterioration during the final presentation.
a) What was clinically available to assist in assessing the extent of any deterioration?
b) What clinical assessment was made as to the extent of any deterioration and how?
c) What was considered as the likely or possible cause(s) of any deterioration?
d) What if any differential diagnosis was considered?
e) What was considered as the risks associated with deterioration relevant to future management?
f) If deterioration and associated risks were not fully recognised, why not?
g) Did cognitive limitations have any impact on clinical decision making?
h) If so, how might any such limitations be mitigated?
i) Might a complete set of CEWT charts have played a role in mitigating cognitive limitations?
j) What attention was paid by clinicians to the concerns of the family (in particular the mother) and was Ryan's Rule applied?
3. Escalation of Clinical Management
a) If there was not timely and full recognition of the extent of deterioration, was there a missed opportunity to escalate the level of care?
b) If yes:
i. How would the level of care of care have been escalated in the existing practices and procedures at Mt Isa Base Hospital in terms of higher level specialist advice, co-ordination, retrieval and treatment?
ii. What is the prospect of a better outcome following that path?
iii. Is there a better clinical path for cases of this nature and how is that path to be achieved in practice in terms of clinical structures and processes?

As the evidence developed and evolved, the significance of issues changed - some becoming more, and others less important.

The parties also agreed on a chronology of clinical observations and events (Appendix A).

Acute Rheumatic Fever

It is important that the reader understand the nature of the medical condition which Kesler suffered.

Dr Vanaja Sabesan, Consultant Paediatrician, provided a detailed report about the clinical management of Kesler at Townsville Hospital. In the course of the report, Dr Sabesan provided important background material about Acute Rheumatic Fever that helped me understand the medical evidence. To similarly assist the reader to understand and follow my analysis of the expert evidence, I include that background material.

4. The Australian Guideline for prevention, diagnosis and management of Acute Rheumatic fever and Rheumatic Heart Disease 3

4.1 Acute Rheumatic Fever (ARF) is an autoimmune condition that affects heart, joints, brain and skin. ARF often causes lasting damage to the heart valve.

4.2 Rheumatic Heart Disease (RHD) is the heart disease/damaged valves caused by Acute Rheumatic Fever (ARF).

4.3 ARF predominantly affects children aged 5 to 15 years. ARF is rare in Australia; however it is a significant cause of disease among Aboriginal and Torres Strait Islander children. Reduced rate of ARF in industrialised countries occurred due to reduced rate of Group A Streptococcal (GAS) transmission related to improved living conditions and improved hygiene standards, access to appropriate health services and increased access to penicillin antibiotic. However, in many countries ARF and RHD are the most common cause of cardiac deaths in children and young adults.

4.4 Following a respiratory tract infection or in certain populations skin infection with GAS bacteria, antibodies are produced by the immune system to fight the infection. Unfortunately, in susceptible individuals, the antibody that is produced by the body to fight the infection affects the heart, joints, brain and skin or combinations of them. Not all the GAS infection will lead to ARF in susceptible individuals.

4.5 When it affects the joints the individual may present with arthritis (painful and swollen joints) or just arthralgia (painful joints without swelling). One or more joints may be affected. Usually, the larger joints are affected.

4.6 ARF may lead to carditis (inflammation of the heart). It may affect the muscle of the heart, inside lining of the heart including heart valves (valvulitis) and outside lining of the heart (pericardium). This can be detected by presence of cardiac murmur (valvulitis), heart failure, and abnormal ECG or echocardiograph findings. Clinical findings of heart failure in children may be variable. It may include shortness of breath, respiratory distress (struggling to breath) increased respiratory rate, increased heart rate, facial puffiness and elevated Jugular Venous Pressure (JVP).

4.7 Other manifestations of ARF may include rash, nodules in the skin, abnormal movements (Sydenham Chorea), fever and raised inflammatory markers (CRP and ESR).

4.8 Combination of the above manifestations (see Jones criteria, Australian Guidelines)and evidence of recent GAS infection on the blood test or throat swab are used tomake the diagnosis of Acute Rheumatic Fever. Evidence of GAS infection on the blood test (streptococcal serology) or throat swab is essential to make the diagnosis of ARF. After the initial infection, it takes about -3weeks for the symptoms of ARF to appear.

4.9 Most of the symptoms resolve after the initial period, however damage to the heart valves may remain even after the acute episode has resolved. This is known as rheumatic heart disease (RHD). Repeated episodes of ARF causes more and more damage to the heart valves.

Based on the Australian Guidelines, Dr Sabesan summarises the patient management regime:

Acute/initial Management

5.1 Admission to hospital

5.2 Establishing diagnosis of ARF and excluding other illnesses presenting with similar symptoms (blood tests including streptococcal serology, inflammatory markers CRP and ESR, throat swab looking for GAS infection ECG, and echocardiograph)

5.3 Treatment with oral penicillin followed by monthly penicillin injection for long term prophylaxis (preventing repeated infections with GAS bacteria and ARF)

5.4 Treatment of joint symptoms with aspirin once the diagnosis of ARF is established. Minor joint pains can be treated with paracetamol or codeine alone.

5.5 Carditis/heart failure: Bed rest is required initially (reduce strain on the heart). Gradual mobilisation as tolerated in patients with heart failure or severe valve disease during the first four (4) weeks.

5.6 Medical management of heart failure with diuretics (e.g.: frusemide) for mild to moderate failure. ACE inhibitors (another group of drugs) may be used for severe heart failure, particularly if aortic regurgitation is present. Glucocorticoid (prednisolone) is optional for severe carditis.

5. 7 Valve surgery is for life threatening acute carditis. Chordae tendinae or valve leaflet rupture are very rare, can lead to severe regurgitation (leaky valve) and emergency cardiac surgery is required for this to save lives.

6. Discharge

6.1 Bed rest until heart failure has largely resolved.

6.2 Discharge patients who are asymptomatic or only mildly symptomatic and their inflammatory markers are clearly improving.

6.3 If patients come from remote communities or other settings with limited access to high quality medical care, it is advisable to discuss the discharge timing with the local primary health care team.

6.4 Long term follow up should be organized before discharge

7. Long term

7.1 First dose of intra muscular penicillin injection to prevent repeated episodes of ARF during the hospital admission.

7.2 Register with central registry (Rheumatic Heart Disease Program) and local follow up for ongoing injection and monitoring.

7.3 Education on need for long term penicillin and review and dental care.

When the findings at autopsy are addressed, the reader will need to understand what is a chordae rupture and its relevance to acute rheumatic fever.

By way of comment about chordae tendinae, Dr Sabesan reported this was a rare complication of Acute Rheumatic Fever. When chordae tendinae rupture occurs, it will lead to severe mitral regurgitation (severe leaky mitral valve), lung congestion, respiratory failure and heart failure.

Clinical Narrative – Earlier Presentations

Although the clinical narrative of the earlier presentation is non-contentious, it is summarised to provide a background to the final presentation that is the subject of detailed examination.

On 29 January 2012 Mrs James presented Kesler to the Mt Isa Base Hospital with a history of fever and pain in both ankles which prevented him from walking. Examination revealed a respiratory rate of 42, he was febrile and tachycardic. The admitting doctor considered the possibility of acute rheumatic fever but thought a chest infection was the primary diagnosis. Investigations were ordered. The subsequent review by the locum Paediatrician, including review of the available blood results, considered acute rheumatic fever unlikely, noting there was no signs of bacterial infection. Viral studies were ordered and Kesler was commenced on IV fluids and bronchodilators.

During the morning ward round on 30 January, Kesler remained febrile, lethargic and unable to walk. Further investigations were ordered including repeat blood tests, ECG and chest x-ray. On review that evening, Kesler seemed much brighter, was a febrile, alert and able to walk to the toilet. The chest x-ray and ECG were normal. Investigations continued. Nursing notes on 31 January indicated Kesler became diaphoretic overnight and his temperature spiked. That afternoon, nursing notes recorded a low grade fever with improved oxygen saturation (normal on room air). Paediatric review that evening noted that an adenovirus had been grown from a nasopharyngeal aspirate and this agent was thought to have accounted for the prolonged fever, anorexia and respiratory symptoms. However, it did not explain the ankle pain. The reviewing Paediatrician discussed the matter with a Paediatric Rheumatologist in Brisbane with the final diagnosis remaining uncertain. The plan was to monitor Kesler overnight while Streptococcal and Mycoplasma serology were pending.

On review by Paediatrician Dr Stewart (Paediatrician) on the morning of 1st February, it was noted that Kesler settled overnight, remained a febrile with normal oxygen saturation and was drinking well.

Kesler was discharged from hospital on a macrolide antibiotic for follow-up with Dr Stewart on 2 February. A repeat of blood for serology was ordered.

Dr Stewart reviewed Kesler on 2 February, noting he was still febrile although settling. He reported and appeared well. The Streptococcal titres were raised but 'no change'. There was no heart murmur. Dr Stewart ordered Kesler be started on penicillin until the planned echocardiogram on 13 February. He also planned to review Kesler on Monday with a repeat of all of the blood tests, including streptococcal antibody titres, acute-phase reactants and more viral studies.

On 6 February Kesler was readmitted to Mt Isa Base Hospital with fever and unable to walk. A review of the earlier ordered investigations by the admitting doctor revealed a mention of a positive isolate of adenovirus from nasopharyngeal secretions. The admitting doctor also detected a loud systolic murmur. The reviewing Paediatric Registrar ordered further investigations including repeat of all of the acute-phase reactants, more viral studies and Mycoplasma serology. Oral penicillin was continued. That evening, Dr Quereshi, Consultant Paediatrician, detected a pan systolic murmur radiating to the axilla. Dr Quereshi suspected acute rheumatic fever, subacute bacterial endocarditis or Kawasaki's disease. Kesler was started on aspirin, intravenous ampicillin and gentamicin in preparation to transfer to Townsville Hospital for further assessment, including an echocardiogram.

On 7 February Kesler was transferred and admitted to Townsville Hospital. Dr Vanaja Sabesan, Consultant Paediatrician, reviewed Kesler and arranged for a paediatric echocardiography, an investigation that was not available at Mt Isa Hospital. A pan systolic murmur was heard on admission indicating he had leaky mitral valve but he was not in heart failure. Based on various tests and observations undertaken on the day of his admission, a diagnosis of acute rheumatic fever was confirmed. Dr Sabesan reported that the echocardiogram results indicated a moderate leaky mitral valve and mild leaky aortic valve. His left ventricle had normal function even though it was slightly dilated due to a leaky valve. The thickened mitral valve was due to changes that occurred following the inflammation. Dr Sabesan changed the antibiotic treatment to oral penicillin. Ms James was provided with information and education about the Rheumatic Heart Disease Program and what was involved in the immediate and long-term treatment of Kesler.

On the night of 9 February Kesler develop signs of heart failure. There was a raised pulse rate of 136, raised respiratory rate of 32, enlarged liver, raised jugular venous pressure, and abnormal chest x-ray. He was started on prednisolone and frusemide to treat carditis/heart failure. Bed rest was reinforced. Echocardiogram revealed Kesler had carditis and, relevantly to the later narrative, no chordae rupture.

The next morning, repeat echocardiogram showed leaky mitral valve, slight enlargement of heart and normal cardiac function. His treatment was continued. Over the following days, his condition continued to improve with his heart rate and respiratory rate returning to normal. Eventually, Kesler was allowed to mobilise gently while the symptoms of heart failure were controlled on frusemide. He had a normal CRP level. Ms James was educated about the need to maintain strict control over Kesler and not to allow him to run or physically exert himself.

On 15 February, following discussions with the treating team and Ms James, the decision was made to transfer Kesler to Mt Isa Hospital as an inpatient. His clinical status was much improved and stable. A cardiology referral was faxed to the Mater Children's Cardiology Unit (as it then was).

On 16 February, Kesler was transferred to Mt Isa Hospital under the care of the Paediatric team. He did not have any evidence of pneumonia or heart failure on transfer. Dr Sabesan, Consultant Paediatrician at Townsville Hospital, summarised the clinical management of Kesler, concluding:

- On admission, appropriate tests were carried out to reach a definitive diagnosis of ARF;
- Once the diagnosis was confirmed, antibiotics were administered in accordance with the Australian guidelines;
- When Kesler demonstrated signs of heart failure, medical management included administration of diuretics (frusemide) and steroids (prednisolone) with strict instructions for bed rest;
- Kesler was transferred back to Mt Isa Hospital when inflammatory markers were clearly improving; and
- Discharge arrangements included discussions with the primary health care team in Mt Isa as well as a referral to Mater Children's Cardiology Unit for further follow-up in care.

Dr Les Griffiths, Forensic Medical Officer, assisted my investigations team in conducting the initial reviews of Kesler's clinical management. In addition to reviewing the medical records and later reviewing the statements of the treating clinicians, Dr Griffiths confirmed that Kesler's clinical management at Townsville Hospital was in accordance with the updated guidelines for the diagnosis and management of acute rheumatic fever. Dr Griffiths reported:

"In fact after reading the file, I was impressed with the thoroughness in detail of Kesler's initial examination by the TTH paediatric registrar Dr Khan."

As to clinical management at Mt Isa Hospital, Dr Griffiths queried whether there was an earlier opportunity to transfer Kesler to Townsville Hospital for investigation of the suspected acute rheumatic fever. However, he concluded that the treatment he received at Mt Isa Hospital prior to transfer to Townsville Hospital did not adversely affect the eventual outcome. Kesler got appropriate higher-level care at Townsville in accordance with his clinical needs.

On readmission on 16 February, Kesler was reviewed and continued on both oral penicillin and frusemide pursuant to the management plan from Townsville Hospital. On 18 February, Dr Rhys Parry, Director of Paediatrics, reviewed Kesler and discharged him with instructions that he remain on frusemide and return for review on 21 February. Oral penicillin was reduced in light of the fact that Kesler had his first benzathine penicillin injection on discharge from Townsville.

Clinical Narrative – Final Presentation

The clinical narrative for the final presentation is largely not contentious. However, the clinical narrative requires more detailed exposition and analysis for the purpose of identifying opportunities for improvement.

Initial Management

At 11.08pm on 24 February Mrs James presented Kesler to the Emergency Department at Mt Isa where Dr Dawn Harris together with Dr Bianca Byrnes reviewed him. Mrs James reported he'd been well but during that day he started having trouble breathing while sleeping and was unable to lie on his side. He vomited once when he woke up. She hadn't noticed any fevers prior to attending hospital. Examination revealed Kesler was alert but distressed, he was maintaining his own airway, and crying and telling his mother he wanted to go home. In her statement, Dr Harris reported on her observations:

> "Kesler was tachypnoeic with a respiratory rate of 42, oxygen saturations of 92% and his heart rate was 175 beats per minute. There was no use of the accessory respiratory muscles. Chest auscultation was clear with good bilateral air entry. Cardiovascular examination revealed a regular pulse and systolic murmur in the mitral and aortic regions. I could not feel any enlarged lymph nodes in Kesler's neck. I was unable to examine his throat as Kesler was crying and not complying fully with examination. His abdomen was soft and appeared non-tender to examination."

Dr Harris placed Kesler on 8 litres of oxygen. His saturations improved to 100% with a respiratory rate of 29. His pulse rate was 188 bpm and had a temperature of 38.1°. Dr Harris telephoned Dr Andrew Stewart, the on-call paediatrician, and requested an urgent review. Shortly afterwards, Dr Stewart arrived in the Emergency Department and took over the care of Kesler.

Dr Stewart started work as a Locum Paediatrician at the Mt Isa Hospital in January 2012.

Dr Stewart saw Kesler shortly before midnight and noted clinical signs of cardiac failure. He commenced Kesler on Frusemide and arranged for a chest x-ray which showed pulmonary oedema, confirming the need for admission. Kesler was given additional oxygen to maintain his saturation above 95%. Intravenous access was attempted in the Emergency Department but was unsuccessful.

Dr Stewart reported in his statement:

> When I attended to Kesler at 0045 hours I noted his heart rate had decreased and the gallop rhythm had settled and his work of breathing was easier. I considered at that time that the working diagnosis was an exacerbation of his existing rheumatic carditis and mitral regurgitation and that the observations indicated that the treatment for heart failure was moving in the right direction. I noted in the chart that he should have further Frusemide and in the morning I would discuss and arrange further investigation and management with Townsville Hospital where he had recently been managed for acute rheumatic fever.

There was another review at 1.30am. Dr Stewart reported:

> At 0130 hours I examined Kesler again after he had been admitted to the children's ward and noticed his heart rate was 170, his chest was clear and his oxygen saturations were 96% and he was on three litres of oxygen per minute. At the time I considered that these levels were acceptable and that Kesler was stable.
>
> I spoke to the nurse who was looking after Kesler and explained my plan and requested that she call me if Kesler deteriorated, particularly if the oxygen demand increased. I then left the hospital to go to my accommodation.

At about 2.15am, Dr Stewart was called and told that Kesler required an increase in oxygen to 6 litres per minute. Dr Stewart immediately returned to the ward.

Dr Stewart reported:

> Upon examination it was clear that he was deteriorating and he needed to be transferred to a larger centre for further assessment and management as soon as possible. I telephoned Dr Pat Ryan, Consultant Paediatrician … at Townsville Base Hospital and discussed with him the options for retrieval of Kesler. We agreed that I would commence IV hydrocortisone, antibiotics and give a further IV Frusemide. An intravenous line was put in place.

At 2.40am Kesler was intravenously given Frusemide 40mg, Ampicillin 500mg, Ceftriaxone lg and Hydrocortisone l00mg.

Dr Stewart participated in a conference call with Dr Ryan and Retrieval Services Qld (RSQ) during which he explained the clinical situation and it was decided to transfer Kesler to Townsville by Royal Flying Doctor Service (RFDS). At that stage, Dr Stewart reported that Kesler was self-ventilating without respiratory distress but on 6 litre of oxygen per minute. Shortly after concluding the retrieval arrangements, Dr Stewart left the hospital to return to his accommodation.

Dr Pat Ryan was a Consultant Paediatrician at Townsville Hospital. He appears to recall the sequence of events slightly differently, referring to two telephone calls. In his statement to the court, Dr Ryan reported:

> In the early hours of 25 February 2012 I received a telephone call from the MIBH paediatrician on call (whom I now understand to be Dr Danny Stewart) informing me that Kesler had been admitted earlier that evening with acute breathing difficulties. I recall we discussed his clinical features and the uncertainty about the cause of Kesler's breathing difficulties. We were perplexed about why a child with rheumatic fever would so suddenly go into heart failure. I recall we discussed other possible causes such as asthma and pneumonia and Dr Stewart agreed to instigate treatment for all three and to closely monitor his response. I do not recall if the options for retrieval were discussed at the first call made by Dr Stewart but it is likely that they were.

Dr Ryan recalls a second telephone conversation:

I recall receiving a second telephone call from Dr Stewart indicating that Kesler had not responded adequately to treatment and requesting that he should be transferred to TTH. I accepted his request and contacted Retrieval Services Queensland to facilitate Kesler's transfer. I had a number of telephone discussions regarding Kesler's transfer with personnel from Retrieval Services, TTH and MIBH. I do not have any specific recollection of the detail of the discussions or the participants.

Whether it was one or two telephone calls is immaterial. It was clear from the conversations involving Dr Stewart, he explained that Kesler had crashing heart failure and he needed to be taken to Townsville Hospital.

Retrieval Arrangements

Dr Caroline Hwang was the Retrieval Co-ordinator with RSQ involved in arrangements for Kesler. She is a Staff Specialist in the Emergency Department at QE2 Hospital. As a Retrieval Co-ordinator, her role was to provide advice and support in facilitating retrievals through liaising with referring hospitals, the receiving hospital and the retrieval team and aircraft. Nurse Co-ordinator Natalie Meldrum, who facilitated communications as well as information gathering and recording, supported Dr Hwang. All teleconferences were recorded. The transcripts and recordings are exhibits in this inquest.

Initially, there was a teleconference between Dr Hwang, Dr Stewart and Nurse Meldrum; in which it was made clear that Dr Stewart thought Kesler required retrieval as soon as possible.

Another participant in the teleconferences was Dr Michael Catchpole from Royal Flying Doctor Service (RFDS), the initial retrieval service.

Dr Hwang provided a statement to the court. She had limited recollection of the matter and was reliant on the notes of Nurse Meldrum and access to the recordings of teleconferences and telephone calls. Dr Hwang reported in her statement:

- At about 3.20am there was a teleconference with Dr Pat Ryan and Dr Mick Catchpole. There was difficulty linking Dr Stewart into the teleconference.
- She formed the impression that Kesler was very unwell and required management beyond the expertise of Mt Isa Hospital.
- RSQ attempted to find the quickest means of transferring Kesler to Townsville Hospital.
- Kesler was not thought to require airway support at the time of the discussion.
- Kesler was categorised as high dependency based on discussion with Dr Ryan indicating that Kesler was very unwell. He did not currently require intubation, inotropes to support heart and blood pressure or infusions.
- If first contact was about 3.20am, a full clinical picture about what was happening probably didn’t emerge till at least 4am.
- RFDS was the closest available aeromedical asset.
- Taking into account the Fatigue Risk Management System under which RFDS operates and the rostering system (6pm to 6am was the current shift), Kesler was categorised as an immediate priority transfer with an early page at 5am for a fresh RFDS crew to transfer to Townsville.

In an addendum statement of Dr Hwang prepared after the benefit of reviewing audio transcripts of the recordings, she reported that Dr Ryan said Kesler was unlikely to require respiratory support. Dr Ryan later states that any such statement by him must have been based on information from Dr Stewart as he did not have the benefit of clinically reviewing Kesler.

In an email from Dr Hwang to the Deputy Medical Director of RSQ written the following day, she noted:

> Only involved just before the stated teleconference time of 320am. Had a very short discussion with Dr Stewart from Mt Isa just before the teleconference - 5y.o. Dx acute heart failure from mitral regurgitation from rheumatic heart disease. Recently been in Townsville with rheumatic fever. Had been acutely treated with frusemide 40mg oral and 40mg iv and antibiotics. After getting off the phone with Dr Stewart, immediate tasking given so discussed case with Dr Mick Catchpole Mt Isa night MO and conferenced him with accepting paediatrician Dr Pat Ryan from Townsville who Dr Stewart had referred case to discuss management and issue of 5.00am page earliest response aeromedically. Discussed with Dr Mick Catchpole whether he could go and review the pt and whether the Mt Isa RFDS Dr in the morning would be able to do the transfer (discussed that the morning RFDS Mt Isa Dr had anaesthetic background so could probably look after an intubated child if the child needed intubation). It was left with Dr Mick Catchpole to review the child and contact the morning Mt Isa RFDS Dr and to get back to us if there was any issue with the immediate tasking or after reviewing child.
>
> ~ 630am sitrep from the Mt Isa RFDS Dr to inform us that the child will need intubation for transfer as was clinically not improved but worse so handed this over to Dr Ben Close to continue discussions with paediatricians 1VL and Mt Isa ?can still go to 1VL ?needs jet now.

Therefore, there was a discussion between Dr Hwang and Dr Stewart prior to the teleconference although it appears there may have been difficulty linking Dr Stewart into the teleconference with Dr Ryan and Dr Catchpole. An issue emerges about the quality of the clinical information available to those making the retrieval arrangements for Kesler, particularly in assessing the clinical trajectory and potential need for intubation. It is worth noting that the diagnosis at the start of discussions is acute heart failure with mitral regurgitation from rheumatic fever.

A statement from Dr Michael Catchpole was admitted into evidence without any need for him to attend to give evidence. According to Dr Catchpole's recollection, there was a slightly greater degree of uncertainty about Kesler's condition. He was reliant on Dr Hwang's report about what Dr Stewart reported to her. He said:

> Dr Hwang described the child as being provisionally diagnosed as acute pulmonary oedema, although asthma was possible. The following information was provided by Dr Hwang in teleconference with Dr Pat Ryan, a specialist paediatrician at Townsville hospital.

> The child had one month previously been admitted to Townsville Hospital with mild mitral regurgitation due to rheumatic fever. The child had been taking frusemide, a diuretic. Other past medical history was asthma.
>
> Acute treatment provided included oral frusemide, establishment of intravenous therapy, blood for pathology testing and intravenous hydrocortisone.
>
> The chest xray showed some infiltration changes in the lungs possibly due to pulmonary oedema, but the heart was not big on xray. It was thought that myocarditis was possible and that the child was not acting like a pneumonia.
>
> The child was generally described as asleep, reasonable oxygen saturation, coughing, sweaty, and a bit shut down.
>
> Observations provided were 18kg weight, temperature 37.5° C, pulse 170, blood pressure 80/40, respiratory rate 42, peripheral oxygen saturation 98% (on an oxygen mask at 6litres a minute flow).

Based on this information, Dr Catchpole said he felt uneasy about the stability and safety of transporting Kesler although Dr Ryan was of the opinion the child was 'not needing imminent respiratory support'. It will be recalled that this was the understanding of Drs Ryan and Hwang, all apparently in reliance on the assessment of Dr Stewart. Dr Catchpole noted the decision to transfer with the day crew being called at 5am and was comfortable with this arrangement, stating:

> … if the child was improving, we could be more confident about the safety of transport and, likewise, if the child was deteriorating, assessment of the need for further intervention prior to transport could then be made.

At 3.28am, Dr Catchpole contacted Mt Isa Hospital for an update on Kesler (presumably from the nursing staff) and reported in his statement:

> The child was noted to have an increasing oxygen need but was still on 6 litres of oxygen per minute by a facemask. He was described as settled, asleep but still working hard (with his breathing). The child had been febrile in the emergency department but this had settled, was peripherally shutdown, pulse 170 to 180, respiratory rate 50 to 60. One intravenous line was in situ and the child had been administered the antibiotics ceftriaxone and ampicillin.

At 4.53am, Dr Catchpole contacted the hospital (presumably the nursing staff) for another update prior to handover to the new duty RFDS Medical Officer Dr Barbara Ngai at 5am. He reported in his statement:

> The child was noted to be about the same, with increasing loose cough. He had had a small urine output after frusemide. Peripheral oxygen saturation percentages were falling to low 80s off oxygen and he was cold and clammy. Pulse was 150, blood pressure 80/50, and respiratory rate 60 to 70.

RFDS Review and Rethinking Retrieval Arrangements

Dr Ngai provided a statement to the court and it was admitted without the need for her to give evidence. She took over from Dr Catchpole through a 'hand over' by telephone about 5.10am. The history given was consistent with the clinical narrative and sufficiently detailed. Dr Ngai immediately telephoned the hospital for an update. She reported:

> I followed Dr Catchpole's call with my own call to the paediatric ward and was informed the current clinical observations were T 37.5, BP 80/48, heart rate between 150-170/min, respirations 60-70min, oxygen saturations 98% on Hudson mask with oxygen flow 6/litre/min. Patient's weight 17 .5 kg, mother 100kg.

Dr Ngai put her aircrew on standby then went to the hospital. Her initial concern was that Kesler had been dyspnoeic with a rate of at least 60 respirations per minute for several hours with known cardiac complications. Dr Ngai reviewed Kesler at about 6.15am and reported in her statement:

> At 06.15 respiratory rate 60/min, heart rate 155/min, sats. 85-89% on Hudson mask Fi026 L/min oxygen, BP 80/50 I informed the nursing staff of his deteriorating oxygen saturations and rang the paediatrician on call who requested that the Fi02 be increased to 101/min. I voiced my concerns in a telephone call to the on call paediatrician about transporting this patient and the need for him to be intubated before to transport. I was informed by Dr Stewart, that the patient's condition had been unchanged since he arrived on the ward about 01.00. He indicated that he would come to see the patient again.
>
> I had also expressed my view to the mother about the need for the child to be ventilated for transfer as the child was very tired after breathing so hard for prolonged period and had a heart condition. She informed me that the child had become suddenly short of breath while attending his own and his twin brother's birthday party, the afternoon prior to admission.
>
> In the meantime, I saw some of the blood results available for the patient, he had a neutrophilia > 25,000 and I ordered venous blood gas. The CXR appeared to show no cardiomegaly but had infiltrates. There was difficulty contacting the Townsville clinical coordinator but I eventually spoke with Dr Ben Close, (before the blood gas results were known). I indicated again that I believed that this patient needed to be intubated before transfer, as evidenced by deteriorating oxygen saturations in a child who was tiring and had cardiac decompensation. Dr Close suggested that Townsville hospital may not accept a child who was intubated and therefore may need to be alternatively transferred to Brisbane, he indicated that the paediatrician in Townsville should be informed of the situation.

Dr Ngai noted the following test results:

> Venous blood gas results on Fi02 10 litres/min at 06.42. Ph 7.374 pC0236 p02 68 BN-4 HC03 .21 m.mol, 02 sat 93%, lactate. 2.01

Dr Stewart returned to the ward on hearing that Dr Ngai was present. Although Dr Stewart reports that he took a telephone call from the hospital to notify him of Dr Ngai's attendance, the statement of Dr Ngai suggests she had a telephone conversation with Dr Stewart before he returned to the hospital. In any event, Dr Stewart reported in his statement he had a conversation with Dr Ngai and she expressed the opinion that Kesler needed intubation to safely transfer and she did not have the crew mix to deal with a ventilated transfer.

Dr Stewart reviewed Kesler and reported in his statement:

> At 0615 hours, Kesler's oxygen saturation levels had dropped and Kesler was on 10 litres of oxygen per minute however he was less sweaty and his pulse was normal. He was thirsty and I commenced him on restricted IV fluid. A venous gas at 0645 hours showed a pH of 7.374, PCOZ of 36 and a Base Excess of -4 indicating normal ventilation.

Dr Ben Close, an Emergency Specialist with Townsville Hospital, started as the Retrieval Co-ordinator at 6am, taking over from Dr Hwang. Dr Close recalls Dr Ngai and the flight nurse reporting to him that they thought Kesler was very sick and required intubation before transfer. Dr Ngai reported they did not have the skill set to safely transfer Kesler to Townsville. Dr Close stood that team down and began searching for a retrieval team who had the skill set to maintain the appropriate standard of care during Kesler's transfer.

From this point onwards, there are two separate but related narratives; firstly, the events that unfold in relation to the clinical management of Kesler at Mt Isa Hospital, and secondly, attempts to organise an alternative retrieval team. I address Kesler's clinical management first.

According to Dr Stewart's statement (at paragraph 23):

- He called Dr Ryan to discuss the clinical situation and transport requirements.
- He was involved in further telephone discussions with Townsville Intensivists and retrieval services where the decision was made for a team to come from Townsville.
- The Townsville team recommended that he call the Mt Isa Anaesthetist with a view to elective intubation and ventilation prior to the retrieval team's arrival.

Dr Close reported to the court on the same teleconference. The participants were himself, Dr Stewart, Dr Ryan, and Dr Siva Senthuran (an Intensive Care specialist at TTH). He reported the purpose was to provide clinical advice and support. He recalled the following items were addressed:

- Dr Ryan reported his impression that Kesler had a likely pulmonary oedema for medical management and confirmed Townsville would accept Kesler; and
- Dr Senthuran confirmed the Intensive Care Unit had a bed if an endotracheal tube was required.

His account did not claim to be exhaustive and it's not in conflict with subsequent actions of participants. I suspect each participant remembers the matters of most relevance to their interest and responsibilities.

Dr Silva Senthuran, an Intensivist and Anaesthetist at Townsville Hospital, provided a statement about this sequence of events. He was on-call in the Intensive Care Unit and recalled participating in a teleconference at 6.30am, facilitated by RSQ. He recalls one participant was Dr Stewart and the consensus view was that Kesler required transfer to TTH for higher level of care not available locally. He recalled a retrieval team attended Mt Isa and considered Kesler too unwell to transfer because he required intubation. Dr Senthuran recalled Dr Stewart did not consider Kesler so unwell as to require intubation. Dr Senthuran reflected on the differing opinions and suggested Dr Stewart contact the on-call Anaesthetist to review Kesler.

Returning to the narrative, at about 7.45am, Kesler's oxygen saturation fell below 90% and a non re-breather bag was used. His condition deteriorated.

At about 8am, Dr Stewart telephoned Dr George Waters, a Consultant Anaesthetist and Director of Anaesthetics and Intensive Care at Mt Isa Hospital. There are variations in the accounts of each doctor about what was said relevant to the urgency of the matter.

Dr Waters prepared a statement later on the day of the death of Kesler in which he reported:

- Dr Stewart said he had a five year old child admitted with heart failure following recent onset of rheumatic fever;
- Dr Stewart said the child needed intubation for transfer to Townsville and asked him to be available for pre-transfer intubation or intubation earlier if that was necessary;
- They discussed the probable time of arrival of the retrieval team from Townsville, a likely 9.30am departure Townsville and arrival about midday.
- Dr Waters asked if he had time to finish his shower and come in; which was agreed.
- At 8.19am, Dr Waters telephoned the ICU at Mt Isa and asked the nurse in charge to prepare for an intubation and ventilation of a 5 year old.
- He arrived at the Paediatric Ward about 8.40am and reviewed Kesler.

At the time of this review, Dr Stewart was dealing with another patient in the neo-natal unit. Dr Waters reported in his statement that Kesler looked pale, clammy with moist skin, tolerating and wearing a Hudson mask with rebreathing bag most of the time, was restless, and very rapid respiration rate. Registered Nurse Ryan, then nursing Kesler, reported she was present during this review and at 9am, Kesler's heart rate was 158, his respiratory rate was 80 and his oxygen saturation was 72-76%. She said that from these observations, it was apparent that Kesler was deteriorating. Nurse Ryan asked Dr Waters whether she should make a medical emergency call but Dr Waters replied he would confer with other medical staff and 'wait'.

Dr Waters reported:

> I assumed from the semi-urgent semi-elective non-time critical nature of the call from the paediatrician at 08.01 that the child had been in this such state for some hours.

Dr Waters obtained some history from Ms James and explained Kesler's condition to her. He then telephoned Dr Stewart, explained he was very concerned about Kesler's condition and he required urgent intubation. Dr Waters then started arrangements in preparation for

intubation, including calling in another Anaesthetist and contacting ICU in Townsville for advice.

Nurse Ryan then reported:

> At 0914 hours Kesler's heart rate decreased to 130. His oxygen saturations decreased to 50 and Kesler's eyes rolled back and he 'flapped'. I noted the 'child unresponsive'. I called out for Dr Waters who was at the desk and I called out for the crash trolley. I recall Kesler's mother screaming.

A Medical Emergency Team call was made. A MET attended (including Drs Stewart and Waters) and started resuscitation. However, after comprehensive and prolonged efforts to revive Kesler, he was pronounced deceased at about 10.35am.

There was evidence at the hearing suggesting discrepancies in some of the times recorded, and possibly changed, in the medical records near the time of the MET call. During the hearing, I indicated that I did not propose to resolve any conflict, giving as the reason that timing of those events had no bearing on the outcome for Kesler.

Retrieval Arrangements – The Parallel Path

It will be recalled that Dr Ngai from RFDS reviewed Kesler about 6am, concluding intubation was required for transfer and her crew did not have the skill set to transfer an intubated patient. Subsequent teleconferencing facilitated by RSQ concluded with the decision to source a retrieval team from Townsville.

Dr Close from RSQ was responsible for sourcing another retrieval team. He contacted Careflight Medical Service (CMS) in Townsville and was advised that its Medical Officer 1 was on fatigue leave till 1630 and due to a roster shortfall, there was no Medical Officer 2 available. After a period, another Townsville based doctor with the requisite skill set, Dr Julie Brahm, was located and agreed to fill the role of Medical Officer 1 with Careflight. Dr Brahm and Flight Nurse Lowe were airborne at 9am hours with an estimated time of arrival at Mt Isa at about 11.10am hours. At about 10.39am, following discussing with the Mt Isa team, Dr Close instructed the retrieval aircraft, then nearing Mt Isa, it was no longer required.

Understanding Severity, Recognising Deterioration and Intervening to Stabilise

The clinical narrative gives rise to issues about understanding the severity of Kesler's condition and its likely, as well as possible, trajectories; recognising any deterioration and identifying options and resources to stabilise his condition pending access to a higher level care. Initially, I consider the evidence of Dr Stewart and Dr Waters about this aspect; then consider the evidence of the reviewing experts.

Dr Stewart – Paediatrician Mt Isa

Dr Stewart gave evidence at the hearing. He acknowledged that Kesler was in acute heart failure when he first saw him in the Emergency Department but appeared to respond to initial treatment and stabilise. On that basis, the plan was to wait till the morning to arrange further investigation and management with Townsville Hospital. However, when he was called back at

2.15am, Kesler's condition had deteriorated and retrieval was necessary. Kesler was in a remote location with no clear reason for the acute heart failure and needed to be at a place that offered a higher level of care.

Dr Stewart acknowledged that deterioration of a patient with acute heart failure on a background of rheumatic fever did give rise to the possibility of chordae tendinae rupture. Although 'very rare', it's 'usually catastrophic'. He reported having worked at a location in New Zealand for over 12 years where he dealt with a 'lot of cases' of rheumatic fever. In two of those cases, the patients decompensated and ended up in cardiac surgery. However, the timeline for their deterioration was over days, not hours. Dr Stewart also told the court that Kesler was the first retrieval that he'd asked for in North Queensland. His experience in New Zealand was that after requesting a retrieval, where the child goes and how the child is transported are decisions that 'rest with the major centre' and 'they take responsibility for those decisions'.

As to the absence of totals on the CEWT (Children's Early Warning Tool) scores[1] on the clinical observation charts, Dr Stewart said he was aware of the critical observations from his own assessment and CEWT scores would not have assisted him. Similarly, Dr Stewart did not think that he would have been assisted by a MET call earlier in the morning, for example at 2.15am (as would have been indicated by the CEWT scores if totalled) as he was fully aware of Kesler's condition and the calling of other doctors would not have assisted his assessment or treatment. Also, when he was called back to review Kesler, he called Dr Ryan to discuss the management of Kesler. Townsville Hospital was contacted because of its past treatment of Kesler and it was the referral centre for Mt Isa.

It was also put to Dr Stewart that early intubation and ventilation of Kesler while stable would have provided respiratory support. He responded with a number of propositions. Firstly, Kesler was in cardiac failure and not respiratory failure. Secondly, although he had pulmonary oedema impairing respiratory function, that did not affect his capacity to shift air in and out. Thirdly, due to the possibility of 'flooding' the lungs – if you 'have' to intubate and ventilate, you have to be ready for the consequences.

> So if you have to do it, you have to do it. But you then have to be prepared for the consequence of doing that which basically means you have to ventilate at very high pressures requiring all the equipment and expertise that is required to do that. So I personally would have not entertained intubating at that stage somebody who is managing on their own ventilation; certainly not in Mount Isa.

Dr Stewart was taken to the evidence of Dr Ngai that Kesler required intubation for retrieval. He explained that Kesler was self-ventilating at the time of her assessment and intubation was a precautionary step to avoid the risk and challenge of intubation in the air if the need arose.

[1] Child Early Warning Tool chart is a suite of tools designed to assist bedside clinicians in detecting critically abnormal physiology or progressive deterioration, and compel escalation of care where appropriate.

> So there's a big difference. There's a difference between what do you need and what equipment you need to stabilise somebody with intubation so that you can fly them for two hours, as opposed to doing it in a room at a hospital in Mount Isa.

Between the time of Dr Ngai's assessment and contact with Dr Waters, Dr Stewart stated:

> … there had been a lot of (a) deterioration, and (b) discussion with the intensivists in Townsville. And there comes a point whereby you don't have any other option to intubate, however dangerous that might be. So there were completely different situations …

Dr Stewart asserted that observations remained stable from review at 2.15am till about 6am when Kesler's oxygen saturation dropped requiring an increase in oxygen to 10 litres per minute. This was about the time of Dr Ngai's review and so she saw the end of a stable period and the start of his deterioration.

It was put to Dr Stewart there was evidence to suggest Kesler might have been intubated and ventilated earlier, say on initial deterioration after 2.15am and that he would have had a better chance till retrieval. Dr Stewart responded he would not have contemplated intubating and ventilating him. He was also asked about his knowledge of the capability at Mt Isa Hospital to intubate and ventilate. Dr Stewart said he did not know if that capability existed. It will become evident that the answer to this question is not straightforward. Much depends on the condition of Kesler, the skill set of the Anaesthetists and the equipment available.

Dr Pat Ryan – Paediatrician Townsville Hospital

Dr Pat Ryan, Paediatrician gave evidence at the hearing. On initial discussion with Dr Stewart, they were baffled about what was the underlying cause of the acute heart failure but agreed that he needed intensive care and therefore transfer to Townsville Hospital. He said Townsville ICU had previously dealt with critically unwell children and he didn't consider Kesler 'too serious' for Townsville Hospital to manage. Dr Ryan said the possibility of mitral chordae rupture was not considered.

Dr Ryan said he was at home at the time of the calls from Dr Stewart and RSQ. He reiterated his role was to facilitate a transfer to Townsville Hospital and provide advice to a peer about the clinical management of Kesler. However, he was emphatic that Dr Stewart was primarily responsible for the management of Kesler as the doctor in attendance with the patient.

Dr Ryan was asked about his use and reliance on CEWT scores. His responses were consistent with others that he thought CEWT scores were more for the assistance of nursing and junior medical staff as an alert for a more senior review, rather than Consultants present with the patient.

As to what consideration was given to earlier intubation, Dr Ryan said they were in two minds about it because it was going to be a hazardous, dangerous procedure. Dr Ryan 'was not sure' if Dr Stewart was aware of the capability of local anaesthetic staff and equipment for that task. His initial thoughts were to transfer Kesler out of Mt Isa on a RFDS flight without intubation, but as things progressed and he deteriorated further, we thought anaesthetic staff should be called in to assess him.

It is not clear where in the clinical narrative these discussions and thoughts occurred. Later in his evidence, Dr Ryan told the court that he did not recall detailed discussions with Dr Stewart about intubation and suggested the 'main discussion' was through RSQ with RFDS about whether they were prepared to transfer him without intubation.

Dr Ryan did not recall a Paediatric Intensivist being involved in similar retrieval discussions in the past to which he was a party, noting at that time the Paediatric Intensive Care Unit was not established at Townsville Hospital (as it is now).

Dr Waters – Anaesthetist Mt Isa Hospital

Dr Waters reported that at the time of reviewing Kesler, intubation required a sophisticated experienced team of paediatric intensivists with appropriate equipment and appropriately experienced senior paediatric nursing staff. However, if Kesler only required elective intubation before transfer, the minimum requirements were an Anaesthetist, another medical officer to administer medications and co-monitor, two senior experienced nursing staff and appropriate equipment.

Review of Dr Griffiths – Forensic Medical Officer

Dr Griffiths, Forensic Medical Officer, initially reviewed the clinical management of Kesler and provided a report to me. He recommended specialist opinion be obtained about whether there was delay in recognising Kesler's clinical deterioration in the early hours of the morning and delay in intubation and ventilation.

Expert Review of Dr McCaffery, Paediatric Intensivist

Based on this recommendation, Dr Kevin McCaffery was engaged to review and report on those issues. Dr McCaffery is a Senior Staff Specialist (Paediatric Intensivist) in Paediatric Intensive Care Medicine at Lady Cilento Children's Hospital. His report is dated 20 July 2014. He had the benefit of reviewing the clinical records and coronial investigation documents gathered at that time, including the statements of Drs Stewart, Waters, Catchpole and Ngai. Prior to giving evidence, he had the opportunity to review all of the exhibits including further statements of medical witnesses and experts.

By way of an important introductory observation, Dr McCaffery approached the review from the perspective of identifying how the clinical management of Kesler might have been better managed from a systems perspective to build a better clinical pathway for future use.

In summary, Dr McCaffery was of the view that Kesler presented on his final admission in cardiogenic shock with evidence of new pulmonary oedema, the severity of his illness was underestimated, his increased mitral valve incompetence was not identified. As a consequence, all decisions about treatment escalation and retrieval were inadequate 'in retrospect'. Dr McCaffery considered cognitive biases explained the clinical course while there were a number of latent system failures around retrieval coordination and obtaining second opinions for remote patients. The latter were amenable to systems based solutions.

Dr McCaffery made the following recommendations to reduce cognitive errors in clinical management:

Recognition of critical illness

- Medical and nursing education to include cognitive errors and appropriate debiasing strategies;
- Clinicians should use debiasing tools (eg Children's Early Warning Tool) appropriately;
- CEWT charts should accompany children transferring between institutions;
- Patients re-presenting in a short timeframe with the same diagnosis should have their observations plotted on the same observation chart as previously;
- Ryan's Rule should be implemented throughout all Queensland Health facilities

Differential diagnoses

- Diagnostic momentum should be consciously considered.
- Unexplained deterioration or new clinical findings require explanation.

Referral pathways

- All patients requiring inter-facility transfer should be carefully assessed to define diagnosis and *anticipated clinical needs*.
- Referring units require accurate information around service capability of secondary and tertiary receiving institutions. This must be accessible and should comprise part of an orientation package for new staff. If required, referring practitioners should directly ensure specific patient needs can be met by accepting centre.

Retrieval coordination and capability

- Retrieval coordination offers clear opportunity for cognitive checking and debiasing. This would be further optimised by:
    - Use of tools such as CEWT;
    - Clinical experts undertaking retrieval coordination;
    - Awareness of cognitive errors in clinical medicine;
    - Low threshold for conferencing-in specific expertise eg. PICU, Cardiology;
- Systems require the ability to identify the optimal retrieval team response.
- Retrieval co-ordinators require a good working knowledge of retrieval capabilities, particularly complex responses such as Extracorporeal Life Support.

State-wide subspecialty advice and support

- Systems review to ensure that key investigations (eg. Radiology, Pathology, Cardiology) are available to clinicians involved in remote patient consultations.

Joined-up thinking

- Consideration around improving interaction between institutions and jurisdictions, particularly around methodology and information sharing would be beneficial.
- In this case, meaningful improvements are unlikely to occur without the involvement of key participants (MIBH, TTH, Retrieval Services Queensland, Paediatric Cardiac service, PICU).

I think the recommendations as outcomes of his review give some insight into the constructive nature of his review process and that his comments are not suggestive of any shortcoming on the part of any individual.

I now turn to the detail in his report and his evidence at hearing.

In the introduction to the report, Dr McCaffery importantly notes that his was a retrospective review of a clinical case with a known severe adverse outcome. From his perspective, the rationale for retrospective clinical reviews is to identify contributory factors in adverse events to facilitate the design and implementation of solutions to prevent future occurrences – 'to learn from tragedy'.

Later in his report, Dr McCaffery makes another important acknowledgement, stating:

> It should also be emphasized that Kesler had a severe disease process and that it remains quite possible that even had he received optimal management he may still not have survived. Furthermore, his geographical remoteness would have always delayed time to definitive care even in a perfect system.

Dr McCaffery approached the retrospective analysis applying the following reasoning:

> Autopsy demonstrated that Kesler died from Rheumatic carditis complicated by rupture of his mitral valve chordae. Knowing this it appears obvious that Kesler presented to Mount Isa Base Hospital on the 24th February 2012 in cardiogenic shock manifested by tachycardia, hypotension, respiratory failure and evidence of impaired organ perfusion (abdominal pain, subsequent oliguria). Furthermore, his new symptoms of orthopnoea and respiratory failure in conjunction with chest x-ray changes consistent with acute pulmonary oedema make the diagnoses of left ventricular failure or acute exacerbation of mitral valve incompetence the two clear diagnoses to exclude.
>
> All the relevant clinical information needed to establish both the final diagnosis and the critical nature of his illness were identified prospectively. Furthermore, experienced medical and nursing staff closely monitored Kesler, and his case was discussed with a previously involved specialist in the Townsville Hospital. Despite this however, Kesler's severity of illness was probably not fully appreciated at any point prior to his cardiac arrest. As a consequence, all subsequent decisions around treatment, timing of referral for transfer and destination were inappropriate in retrospect.

He then poses the question: Why was Kesler's crucial illness not obvious and alarming to the senior and experienced clinicians involved in his care? Dr McCaffery refers to the dual process model of human decision making:

> In this, two systems exist for making decisions. System 1 is rapid and intuitive and relies on heuristics (cognitive shortcuts or patterns) while System 2 is a slow and saturable hypothetico-deductive model. Individuals switch freely and usually unconsciously between systems, and each system may influence the other subconsciously.

He explains that errors in the acquisition, processing or interpretation of data are referred to as cognitive biases and account for around 80% of missed diagnosis. Conscious biases are subconscious influences which may alter how information is weighted or processed and thus may increase the chance of reaching the wrong conclusion. Many cognitive biases active in medical decision-making have been identified. Dr McCaffery summarised the apparent biases that influenced decision-making relevant to Kesler's management:

- The diagnosis of rheumatic fever featured prominently due to:
    - Framing – Kesler presented as a known case of Rheumatic Fever and assessed as such;
    - Recency – this was a new and active diagnosis;
    - Diagnostic momentum – established diagnoses tend to stick even in the face of new or conflicting information;
- Further diagnoses would tend not to be sought due to:
    - Confirmation bias – the tendency for supporting information to outweigh conflicting information, or to direct investigation towards only proving that which one already believes to be present. This may lead to…
    - Self-satisficing bias – confirming a diagnosis frequently terminates the search for further information. This may result in…
    - Premature closure – The case is regarded as essentially completed.
- Factors potentially leading to downplaying perceived illness severity include:
    - Representativeness heuristic – the tendency to expect a disease to behave like a perceived prototype of the condition constructed from cases one has personal experience with.
    - Visceral bias – the unconscious desire for the best outcome when presented with a range of possibilities based on personal factors eg. compassion, having a child of similar ages etc.
    - Confirmation bias – seeking and anchoring onto those features at review which imply stability or improvement instead of evaluating the clinical picture in its entirety.
- Factors impairing ability to predict outcomes:
    - Framing – Kesler has already developed and recovered from (with frusemide) an episode of cardiac failure during this illness.
    - Red herring – While the diagnosis of rheumatic heart disease was correct and not a true red-herring as such, it prevented recognition of the new and severe complication, that of mitral valve chordae rupture leading to catastrophic mitral insufficiency.
    - Confirmation bias – New information which contrasts with previous established paradigm is downplayed relative to information which supports the paradigm.
- Affective influences with the potential to affect quality of decision-making:
- Stress – Kesler was severely unwell and his mother was very worried, even if these cues were not consciously registered by attending staff.
- Fatigue – Kesler's final admission occurred through the night.

In the course of addressing debiasing strategies, Dr McCaffery observed:

> Sadly, one of the most powerful tools specifically developed to counteract certain cognitive biases was used incorrectly and thus failed to prevent his tragic outcome. This tool is the Children's Early Warning Tool (CEWT).

He later explains:

> CEWT is a suite of tools designed to assist bedside clinicians (usually junior medical and nursing) in detecting critically abnormal physiology or progressive deterioration, and compel escalation of care where appropriate. Careful human factors design optimised it to fulfil the following functions:
>
> - Tracking physiological observations over time in a graphical manner, specifically highlighting deterioration or critically abnormal values (*anti- confirmation bias, situational awareness*)
> - Providing an age-appropriate reference range for physiological values *(anti-Knowledge deficit*)
> - Triggering Medical Emergency Team response to critically abnormal physiology (*Framing effect*)
> - Compelling escalation (*opposes barriers to calling for help, flattens authority gradient*)
> - Improves communication (*Facilitates handover of key information*)
> - Improves assessment of efficacy of interventions (*situational awareness*)

According to Dr McCaffery, Kesler's physiological observations were very abnormal from the moment he presented and this was readily apparent on his chart. In comparison with CEWT charts from any of his previous admissions, he was far more physiologically abnormal in his final admission than at any point in any previous admission.

> Further, there was a failure to complete observations appropriately as well as a failure to add scores. On admission, a full set was not completed and a review of previous admissions demonstrated the same finding. This suggested an endemic institutional problem with the use of early warning tools. None of Kesler scores were calculated at any point during his final admission. Scores were important as different scores compel different responses from attending clinical staff. Had scores been calculated appropriately, Kesler would have triggered MET calls following every set of physiological observations.

Dr McCaffery commented on the absence of any differential diagnosis in the face of unexplained clinical deterioration. Kesler presented on his final admission in cardiogenic shock, a feature missing from previous admissions. At the time of presentation, he should have been recovering from acute carditis. Further, there were new clinical findings of orthopnoea and acute pulmonary oedema. He noted no evidence from the records to suggest construction of a differential diagnosis list to account for this deterioration. According to Dr McCaffery, while worsening myocardial function from rheumatic carditis would certainly feature on such a list,

his severe cardiogenic shock required more intensive intervention than was provided while other possibilities would necessitate substantially different management strategies.

Dr McCaffery considered Kesler's initial referral to the Townsville Hospital to establish his diagnosis and provide management appropriate to his initial clinical state was entirely appropriate. However, during his final presentation Townsville Hospital was not an appropriate destination for any child with acute pulmonary oedema and cardiogenic shock except for stabilisation prior to on-transfer to a paediatric cardiac intensive care unit.

Dr McCaffery recommended that all patients requiring inter-facility transfer should be carefully assessed to define diagnosis and *anticipated clinical needs*. Referring units require accurate information around service capability of secondary and tertiary receiving institutions. This must be accessible and comprise part of an orientation package for new staff. If required, referring practitioners should directly ensure specific patient needs can be met by accepting centre.

As to retrieval co-ordination and capability, Dr McCaffery reported that Retrieval Services Queensland is well placed to meet the majority of the workload volume and complexity it faces. However, Kesler's case identified a number of areas of vulnerability around complex paediatric patients that are amenable to improvement. Retrieval co-ordination offers the opportunity for a second opinion as well as a portal through which to access subspecialist advice. Kesler's case was complex but the clinical picture available prospectively was that of a clinical deterioration and cardiogenic shock. Involvement of paediatric critical care services and paediatric cardiology were indicated. It is likely that the most reliable method in the future of ensuring relevant consultation is to review and modify the rescue coordination processes. An echocardiogram with telemedicine support from a paediatric cardiologist on admission would likely have stabilised Kesler's severe mitral regurgitation.

Expert Review of Associate Professor James Tibballs, Paediatric Intensivist

Dr Tibballs is a Paediatric Intensivist at the Royal Children Hospital Melbourne and provided a report (dated 13 January 2015) on the clinical management of Kesler at the request of legal representatives for Ms James.

Dr Tibballs explained the use of CEWT:

> CEWT is the "Children's Early Warning Tool". It a method to detect critical illness and to warn of a deteriorating state before cardiac arrest occurs. It is based on the two premises that cardiac arrest in children is almost always preceded by deteriorating clinical signs and that intervention with treatment at an early stage of deterioration will prevent cardiac arrest and death. The individual parameters of illness - that is, the observations of respiratory rate, respiratory distress, oxygen requirement, Sp02, temperature, heart rate, blood pressure, capillary refill time and level of consciousness are each assigned an arithmetic score (0, 1, 2 or 3) based on the degree of deviation from normal values. The individual scores are added to constitute a total score. The higher the total score, the more serious is the clinical state. Various interventions are mandated according the total score. A total CEWT score of 8 or greater mandates an emergency call by bedside nurses (or others) to summon urgent medical assistance. Such assistance is commonly provided by a "medical emergency team" or a "rapid

> response team". Such mandatory requirement is adopted by healthcare institutions because medical and nursing staff, irrespective of their seniority, sometimes has difficulty recognizing critical or deteriorating illness in their patients. Activation of the system brings other staff, usually more experienced in acute resuscitation and able to make a new appraisal of the situation to the patient's bedside. In addition, in the CEWT system, whenever an individual score for respiratory rate, respiratory distress, oxygen treatment, oxygen saturation, heart rate, or blood pressure is plotted on the observation chart as a "3", an emergency call must likewise be placed.

As to the how CEWT was used and its implications for the management of Kesler, Dr Tibballs reported:

> From the time of admission to the ward (01: 10 hrs) until after 08:20 on 25/2/2012 when Kesler had a cardiac arrest, his CEWT had been between 8 and 14 but an anaesthetist was not summoned until around 08:01 hrs and a call for emergency assistance was not made until after the cardiac arrest. Indeed, the individual parameters of critical illness had not been added up to establish a total score at any of the 15 times that observations were recorded between 01: 10 hrs and 08:20 hrs on 25/2/2012. Individual measurements of respiratory rate, respiratory distress, oxygen treatment or heart rate, were scored as "3" on 23 occasions from 01: 10 and 08:20 hrs on 25/2/2012. Thus, although Kesler's CEWT total scores well exceeded the mandatory threshold to summon emergency assistance at every time of observation during the period from 01: 10 and 08:20 hrs on 25/2/2012, and there were 23 occasions at which an individual measurement was scored as "3", emergency assistance was not summoned until 09:14 hrs when he had a cardiac arrest. In other words, staff failed to recognise the severity of illness and failed to act in time to prevent cardiac arrest, contrary to the institution's requirement to do so.

Dr Tibballs then comments on what action should have been taken at admission:

> Considering that Kesler was in pulmonary oedema from the time of presentation to the emergency department and admission to the ward, the appropriate medical treatment ought to have been instigation of mechanical ventilation with oxygen via endotracheal intubation and administration of an inotropic drug by intravenous infusion, along with diuretic therapy.

He then states:

> The actions described (mechanical ventilation, inotropic and diuretic therapy) if instituted before cardiac arrest would have permitted transfer to a centre with staff and facilities to enable consideration of emergency valve repair or replacement.

The proposition was put to Dr Tibballs for comment in his report to the effect that Kesler’s cardiac condition deteriorated acutely due to mitral chordae rupture which could not have been predicted and which could not have been effectively treated by mitral valve surgery in the time available. Dr Tibballs responded, asserting that the opportunity to intervene and

prevent arrest was during a period of at least 8 hours when Kesler could have been intubated. He could be stabilised and transferred to a higher level of care.

Dr Tibballs gave evidence at the hearing. He considered CEWT scores to be of great value to experienced senior clinicians:

> Even senior physicians sometimes are unable to recognise serious illness and these scores are a guide to tell them when the child has actually got a serious illness. I would defy any doctor, including paediatricians, to tell me what the normal values are for all the – for all of the physiological variables dictated, like heart rate, respiratory rate, blood pressure, etcetera, for all age groups. No one can possibly know all that information and so the scores actually serve as a guide to tell the person, whoever they may be, junior, middle grade or senior, it tells them about the severity of a child's condition. In that way, the score is very helpful.

As to the benefit of CEWT scores triggering the attendance of other doctors, even doctors less senior than an attending Consultant, Dr Tibballs said there were significant benefits:

> First of all, it gets other people to the scene, new eyes on the scene, new persons who can make their own assessment of the situation, and it also usually brings senior people to help with the intervention, whatever may be required, but an important aspect it brings a new person to the scene to look at the situation anew. They may not have been contaminated – or they won't have been contaminated by what's happened to the child previously. For example, if the heart rate goes up by 5 per cent, to a person who's been looking after that child for the last 10 hours, a 5 per cent rise may not be important and they may not regard it as such, but if a new person comes along and sees that the heart rate is now well outside normal limits, it's an alarm bell, okay, which – an alarm bell which the previous experienced person hasn't recognised.

Dr Tibballs later added:

> After many, many years of observation and by development of the system of MET. I developed it initially as the world first at the Royal Children's Hospital in Melbourne in 2002. I borrowed from adult experience and constructed a system of calling for MET, which is based upon the physiological variables that we were talking about here: heart rate, respiratory rate, blood pressure, oxygen saturation and other factors, including parent or worry by a staff and from then – and from there the system has been published in various journals and it's spread throughout the world and now the International Liaison Committee on Resuscitation recommends that such an early warning system be adopted or be performed by every paediatric hospital in the world as their standard of care and since then, 2002, I have supervised the running of the MET system at my hospital and I have noticed on many, many occasions that despite the seniority of people at the bedside, they sometimes – sometimes are not able to recognise what they're looking at. They do not perceive that the child is in dire straits, and in fact, a new person on the scene will instantaneously recognise, for example, this child needs mechanical ventilation, this child needs more oxygen treatment, this child needs intravascular volume support, or something like that.

Dr Tibballs was also asked to comment about the risks associated with earlier intubation of Kesler. He said that when Kesler was in extremis just prior to his cardiac arrest, any amount of sedative or hypnotic drug would cause arrest. Dr Tibballs said that when Dr Waters attended on Kesler he was in extremis, and Dr Waters was in an invidious position of having to treat Kesler when all of the signs were that he was going to die. However, small doses of the drugs given long before by a competent anaesthetist or emergency physician to establish mechanical ventilation would have carried only a possible risk of cardiac arrest.

Dr Tibballs was asked whether intubation while stable would be appropriate without the benefit of an echocardiograph to fully understand the underlying cause of the heart failure. He replied that Kesler had cardiorespiratory failure and needed mechanical ventilation. The chest xray showed pulmonary oedema, the recognised treatment is diuretic therapy which was given and proved unsuccessful. The next stage is inotropic support and mechanical ventilation which was not done. As to the suggestion that there might be differential diagnoses where intubation was contraindicated, Dr Tibballs said Kesler needed cardiorespiratory support whatever was the underlying diagnosis. Later in his evidence, Dr Tibballs identified the opportunity for intubation was about 2am, possibly earlier, based on the clinical observations (heart rate 175bpm and oxygen saturation of 93% despite 6 lpm – respiratory distress).

There is an issue about the capability of Mt Isa Hospital to intubate and manage a ventilated child. Even if a mechanical ventilator was not available, Dr Tibballs thought hand ventilation could be managed.

It was suggested to Dr Tibballs that Dr Stewart fully appreciated the seriousness of Kesler's condition and this was reflected in his communications with Dr Ryan and RSQ in reporting that Kesler had crashing heart failure and really needed evacuation to Townsville. Dr Tibballs replied that Dr Stewart did not call upon local resources to assist at that time (2.40am). When challenged about that assertion, Dr Tibballs said there was a Consultant or Staff Specialist in the Emergency Department and Anaesthetists who could have been called to assist.

Expert Review of Dr Drew Wenck, Intensivist

Dr Drew Wenck is the Director of the Intensive Care Unit at Cairns Base Hospital and provided an expert review of the clinical management of Kesler. He reported that although clinical observations were performed and charted, they were not added to provide a CEWT score. While accepting this should have been done, Dr Wenck reported the score of itself is not of clinical assistance to a Consultant. Its role was to guide nursing and junior medical staff about when to call for senior help. In this case, a senior Consultant, Dr Stewart, was already in attendance and managing the patient. Further, a MET call triggered by a high CEWT score in the early hours of the morning at Mt Isa would bring, at best, a junior Medical Registrar and Intern.

As to earlier intubation and ventilation, Dr Wenck reported that in the absence of a current echocardiograph, there were a number of possibilities and each may warrant different treatment with the possibility of worsening the situation in the event of misdiagnosis.

The first possibility was worsening of the mitral regurgitation.

> Here the autopsy report states mitral chordae rupture but the exact time of the acute rupture is unknown. The haemodynamic effects of the rupture are also unknown. Prof Tibballs feels that because the child had an acute presentation waking from sleep with breathlessness and cough that it occurred prior to admission. However pulmonary oedema often occurs a few hours into sleep because of supine position and fluid shifts. This of itself is not sufficient to give a certain time to the rupture. The child appeared to settle initially and a venous blood gas timed at 0635hrs showed a normal Ph and a normal lactate. If this test was correct then the valve likely ruptured after this not before. The only way to be sure of the timing was to have done an acute echo. Therefore the timing of valve rupture is unknown and the severity of the effect on the circulation is unknown. From a personal experience I have attended two young children with acute mitral valve incompetence from chordae rupture from rheumatic carditis and both had catastrophic circulatory collapse which did not respond to aggressive treatment including ventilation and inotropes. Without any certain knowledge of the time of rupture and the severity of the mitral regurgitation it is in my opinion unknown if early intubation would have stabilised the child.

The other possibilities included severe reduction in left ventricular function, deterioration in aortic valve function and pericardial effusion. Certainly, the process of considering possible underlying conditions and the consequences of intubation is a process that would have been aided by higher level advice, such as that of Paediatric Intensivist and or Paediatric Cardiologist, or even an Anaesthetist.

Dr Wenck brings another perspective to the sequence of events, suggesting that the deterioration after 6.30am was consistent with rupture of the mitral chordae. However, the point other experts are making is that earlier respiratory support would provide relief to the excessive workload that Kesler's heart was enduring.

Dr Wenck detailed the likely clinical and logistical challenges of any retrieval. The tasking of a paediatric retrieval team from Townsville would take a minimum of 2 – 3 hours. The available Oxylog 3000 ventilator was unlikely to cope with the fulminant pulmonary oedema necessitating hand ventilation. Townsville had no Paediatric Cardiac surgical facility and further transfer to Brisbane was required. The alternative was transfer to Brisbane with further delays in tasking a team from Brisbane, travel to Mt Isa, and return to Brisbane while hand ventilating a child with ruptured mitral valve and possible very poor ejection fraction. Dr Wenck considered the prospect of survival as 'stretching credulity to the limit'.

He reported:

> In summary a child with Acute Rheumatic Carditis complicated by a ruptured mitral valve will die unless they are in a state of the art Paediatric surgical facility. To expect a general paediatrician and a general anaesthetist with no echo training and no paediatric intensive care training to diagnose and stabilise this child and then undergo a long flight and transfer is unreasonable.

Dr Wenck commented on the situation that Dr Waters faced when asked to intubate and ventilate Kesler for retrieval.

> On first glance he obviously realised he had a very sick child with many possibilities to consider. He had no acute echo …
>
> …
>
> The situation he was faced with is very difficult. He has no idea what is actually wrong with the child. Even laying the child down could have caused cardiac arrest. Was the child septic? Did he have just heart failure? Was this cardiac tamponade? Did he have severe pneumonia? The rupture of a mitral valve is so unlikely he probably didn't include this in the differential diagnosis.
>
> Giving even a small dose of opiates may result in death. Anaesthetic induction drugs may well be lethal in any dose. Placing this child successfully onto mechanical ventilation would test an experienced Paediatric Intensivist or Paediatric Cardiac Anaesthetist. Dr Waters is neither of those.

Again, Dr Wenck highlights the drama and lack of opportunity for a full and carefully considered investigation and opinion.

Dr Wenck gave evidence at the hearing. He maintained his view that CEWT scores were of limited value to experienced senior clinicians. He agreed with Dr Tibballs that intubation and mechanical ventilation would assist a child experiencing acute heart failure but that such intervention was dangerous. With a benefit of an echocardiograph, that intervention could be greatly finessed (and presumably the risk reduced). The question was posed: If Kesler presented to Cairns Base Hospital with the same clinical observations in the early hours of the morning, could he have been intubated and ventilated pending retrieval to a higher level of care? The response, yes; an ICU Consultant would be available and capable. Dr Wenck later explained that he had a higher skill set as an Intensivist than a Paediatrician or a general Anaesthetist when it came to intubating a very sick child. Given the skill levels of the doctors caring for Kesler, intubation would have been a last resort.

I discussed with Dr Wenck the concept of a possible trajectory of Kesler's deterioration, adopting the concept of 'between the flags' where the possibility of effective intervention (in this case, intubation for stabilisation) opens and later, as the slope steepens, effectively closes when the child is in extremis. The aim is to stop or slow the rate of deterioration pending higher-level care and definitive treatment. As to the application of this concept to Kesler's management, he said:

> …the trouble with the clinical course is that there is some getting better and some worsening and I think that that – it's not a straight inexorable course down and I think that's – leads the doctors who don't want to make that commitment, because they're not trained in that commitment of intubation and ventilation, to focus on the improvement rather than on the deterioration and so I think that's what inhibited them intubating and ventilating that child. I would have thought that, as Dr Tibballs said, around the 2.15 mark would have – the child was very unwell and if you are skilled in

> intubation and ventilation – certainly if I was in that situation, I would have intubated the child at that time, but …. I've got a different skill set completely.

Dr Wenck accepted the proposition that if a child in acute heart failure did not immediately required intubation, but there was the potential for delay in retrieval with a trajectory that included the risk of acute deterioration; a pre-emptive intubation might be required. He also accepted the proposition that intubation of a child presenting in Kesler's condition does provide cardiac and respiratory support, reduces the workload of the heart and lungs, and extends the opportunity for higher level intervention; subject to the availability of appropriate personnel and ventilation.

Expert Review – Dr Scott Simpson, Paediatric Intensivist, Townsville Hospital

Dr Scott Simpson is a Staff Specialist in Anaesthesia and Intensive Care at the Townsville Hospital where he has worked full time in that capacity since 2007. He was appointed Director of Paediatric Intensive Care Services in 2013, and is currently the Chair of the Paediatric Intensive Care Advisory Group to the Statewide Intensive and Critical Care Network of Queensland Health. His experience includes medical retrieval and transport since 1991 and has an ongoing professional interest in rheumatic heart disease (RHO), working in collaboration with local Paediatricians to screen children with known or suspected RHO, monitoring their progress with echocardiography in consultation with Paediatric Cardiologists in Brisbane and Cairns.

Dr Simpson provides relevant context to the circumstances of Kesler's death by reference to his clinical experience with rheumatic heart disease. He reports:

> As noted by others, mitral chordal rupture is a rare, but dreaded complication of RHO, because it has a reputation for causing fulminant and relentless cardiac failure that very rapidly leads to death. It is not always the case. One of my colleagues suffered this lesion (as an adult) and was rendered moderately breathless at rest, but was stabilised on medication before a non-urgent surgical repair several weeks later. I have detected ruptured mitral chordae in children with no symptoms, coincidentally found as part of general echocardiography screening for RHO. In those patients, as I recall, it has been associated with isolated mild to moderate mitral valve regurgitation.
>
> I have also witnessed two cases of acute mitral chordal rupture in adolescents with RHO. Both of them presented in florid, severe pulmonary oedema that resembled haemoptysis (coughing up blood), rapidly developed cardiogenic shock, and died. Both were diagnosed retrospectively at autopsy. I have knowledge of another case of acute mitral chordal rupture in a child, as described to me by colleagues in Cairns, which also presented in an acute and irretrievable shock state with frothy pulmonary oedema. Diagnosis was made at autopsy.

Dr Scott, like Dr Wenck, thought the mitral valve chordal rupture occurred later in the admission. He reported:

> In this case, if mitral chordal rupture caused catastrophic mitral valvular incompetence, then Kesler did not have it at the time he presented to hospital, as he did not display

> signs of severe heart failure (acute pulmonary oedema, enlarged liver, low blood pressure). It would have occurred later in his admission, possibly after 0630. The timing of such an event is absolutely impossible to verify. Kesler's deterioration was more gradual, and fit a pattern more expected of acute bronchopneumonia in a partially immunosuppressed patient.

On review of all of the now available information, Dr Simpson concluded that death was due to a combination of acute heart failure from rheumatic carditis, complicated by mitral chordae rupture; and rapidly progressive bronchopneumonia. The latter was not clinically detected due to attenuation of Kesler's symptoms by immunosuppression (prednisolone).

Dr Simpson thought that Dr Stewart understood the severity of Kesler's condition in communication with RSQ when he stated that Kesler was in crashing heart failure and wanted him transferred as soon as possible. RSQ was not using CEWT to guide their decisions and was wholly reliant on the description and assessment of Dr Stewart. Dr Simpson reported:

> Having received a number of similar calls over many years I can attest that it takes a high index of suspicion to detect the subtle 'red flags' in the history that might have led to deeper questioning about the physical signs, earlier investigations, alternative treatments (such as inotropes and non-invasive ventilation) to be recommended, and a more senior retrieval team being dispatched.

As to his analysis of the clinical course, Dr Simpson reported:

> I believe Kesler's pneumonia caused a more gradual decompensation of the pre-existing heart failure until all compensatory mechanisms were exhausted, which then lead to a rapid decline which began at or around 0600 on 25/02/2012. It is entirely possible that the mitral chordal rupture occurred in the final hours, and made his condition unsalvageable. There is no way of knowing this with certainty.

Dr Simpson concluded:

> … it is unreasonable to expect an isolated specialist with limited resources to detect and treat any of these conditions effectively without interventions that are usually conducted by Intensive Care Specialists or Anaesthetists working in high technology environments, assisted by skilled registrars and intensive care trained nursing staff.
>
> If Kesler had been intubated and ventilated some hours earlier, as Prof Tibballs and Dr McCaffery suggest he should, this would have created a new problem: how to ventilate him safely. There is no ventilator at MISH that is suited to a small 5 year old with such severe lung and heart pathology, so hand ventilation would have been required. As noted in the resuscitation transcripts there was a self-inflating bag and eventually a PEEP valve was found. Manual ventilation of a child requires skill and experience, and cannot be managed for hours on end by one individual. The pneumonia was extensive and it would have been challenging to maintain adequate ventilation without a sophisticated ventilator, and an expert to drive it. In order to tolerate the endotracheal tube Kesler would have required sedative medications which would have adversely affected his heart failure. In fact, it is likely he would have suffered a cardiac arrest as a

> consequence of receiving these medications. In order to counteract these effects he would certainly have required the insertion of a central venous catheter for strong medications called inotropes to support his heart function and blood pressure, and once again this is outside the scope of practice of general Paediatricians, many Retrieval Doctors, and even some Anaesthetists.

According to Dr Simpson, the burden of disease killed Kesler, and this outcome could only have been altered by extraordinary actions of a highly skilled team, had they been present or immediately available. That wasn't the case in Mt Isa.

As to opportunities for improvement, Dr Simpson agrees with Dr McCaffery that paediatric expertise should be recruited early in the coordination process for children and such tools as CEWT are useful in clarifying the severity of illness. Similarly, access to pathology and radiology should be extended to home based servers for coordinators and other expert participants in retrieval coordination.

Dr Simpson follows up on his suggestion about earlier involvement of a Paediatric Intensivist with the conclusion:

> If an Intensivist had been consulted earlier it is likely they would have recommended the use of either CPAP or "Hi flow'' nasal blended air/oxygen, rather than standard Hudson mask oxygen, to provide some nasopharyngeal pressure which assists breathing air in, and reduces the amount of effort required to breathe comfortably. The pressure also helps to maintain alveolar (lung tissue air cell) patency and reduces pulmonary oedema (fluid in the alveoli). This treatment is particularly effective for treating heart failure, but is also beneficial in treating pneumonia. I doubt these treatments were available, as otherwise I expect it would have been used. There is scope to introduce the equipment and training for these therapies with minimal expense, and a modest amount of education.

Dr Simpson was questioned about how Kesler might have been managed if the Paediatrician had consulted him as a Paediatric Intensivist. He said:

> …I get confronted with this problem quite frequently and I have to make an assessment of the capability of the paediatrician, the environment in which they're in and whether or not they're going to be able to follow the advice and/or deal with any severe consequences that might occur and it's a very tricky thing to talk somebody through the anaesthesia that's required to render the child insensible so they can have their intubation, which is tricky in its own right, plus the setting up of the ventilator, because there are a number of difficulties that can arise following that.

Dr Simpson said if the patient was in a hospital, he would normally get the local Anaesthetist involved and channel that information through that person.

Dr Simpson was questioned about the equipment available at Mt Isa to ventilate Kesler. He reported that there was a ventilator for intubating a five year old but the severity of the heart and lung pathology required a very sophisticated ventilator that could handle high pressures and different ventilating conditions. He said an 18 to 20 kilo 5 year old can be managed on a

standard transport ventilator in most instances when they are being transported for something such as trauma or something that's not related to their lung pathology, but in this instance, given the changes on his X-ray and the condition as it unfolded throughout the night, Dr Simpson thought Kesler needed a very sophisticated ventilator to oxygenate him. He also referred to the issue of capability of the retrieval team. Careflight and RFDS had limited ventilator capability (ex Townsville and Mt Isa) and sometimes were dependent on the mobile ventilator that a PICU team might take from Townsville Hospital for the purpose of retrieval. He understood that both organisations were changing over to more sophisticated ventilators like that available to the PICU team during next round of replacements. That resource was not available in 2012.

I took Dr Simpson to past RCA reports and an earlier inquest that dealt with a child from Doomadgee who died from complications of rheumatic fever. The inquest recommended that a Paediatrician become involved in every admission of a seriously unwell child to an outlying clinic. Now we are dealing with the next level of care. I then posed the question: How do we ensure that Paediatric Intensivists are involved in supporting clinical decisions about retrieval of seriously ill children. He replied:

> I think that the structure of Retrieval Services Queensland in the way that it deals with paediatric patients needs to be looked at, and – and I think there probably should be a conference of meeting of minds of people involved in this sort of activity to look at a restructure of how it happens, because at the moment children are getting tacked onto the existing adult retrieval services. And they're brilliantly staffed by keen and enthusiastic people who can manage adults, and they do a very fine job and they're a very impressive service. But my – my opinion is that children don't get the same level of attention because children aren't retrieved as often and it's happening less frequently.

He later added:

> … I believe that the service that the Townsville Hospital provides, from a paediatrics point of view and from a paediatric intensive care point of view, should be seen as a foundation for building something that actually works as a network from the north, that looks out – after its own region, and consults with the southern region for cardiac cases or oncology cases where it's outside the capability of the Townsville Hospital. And I would like to think that – I don't have an answer. I've been wrestling with this model for some time and I don't have a very prescriptive model that's going to work. It needs to be something that's got some flexibility built into it. It's going to take some funding.

Retrieval Management

The clinical narrative gives rise to issues about retrieval management.

Dr Hoggard is the Clinical Director of Northern Operations, Retrieval Services Qld and started in that role in 2006, initially part time and then on a full time basis since early 2013. He explained that one of the roles of RSQ is to provide clinical co-ordination for the aeromedical retrieval and transfer of all patients from parts of northern New South Wales to the Torres

Strait. It co-ordinates the retrieval of patients to the nearest, most appropriate facility in a timeframe that meets the clinical needs of the patient.

There are two geographic zones, Northern (north of Rockhampton) and Southern (south of Rockhampton). From 0800 to 2230, there is a retrieval co-ordinator on duty to each zone – the Northern is Townsville based and the Southern is Brisbane based. However, from 2230 to 0600 Monday to Friday and 1830 to 0600 on Saturday and Sunday – one Brisbane based retrieval co-ordinator is responsible for both zones.

In February 2012, paediatric retrievals for the southern zone were co-ordinated by a Paediatric Medical Co-ordinator (PMC), a Paediatric Intensivist located at the then Royal Children's Hospital. In contrast, paediatric retrievals in the northern zone were co-ordinated by the northern retrieval co-ordinator, an emergency specialist based at the Townsville Hospital, or by the single statewide coordinator from Brisbane after hours. In February 2012, Townsville Hospital did not have a paediatric intensive care service. Therefore, while the southern zone had the benefit of a paediatric Intensivist, northern zone did not.

Currently, Dr Hoggard reports that the position remains the same. There is no specialist paediatric retrieval service funded for the northern zone.

Aero-medical resources available now and at the time of Kesler's death have not materially changed. There was no significant issue about aircraft availability. RFDS was available in Mt Isa. Careflight had availability out of Townsville. The issue was more about the capacity of medical staff. Dr Hoggard reported that although all retrieval staff have capacity to transport intubated children, the level of expertise required for paediatric transfers was variable.

A transport of complex, critically unwell paediatric patients will often require the expertise of experienced paediatric critical care specialists. This is outside the expected skill capability of a retrieval registrar or consultant who has a more broad experience base.

Dr Hoggard told the court that most paediatric retrievals were well managed by a general or duty retrieval teams. It was only in complex, acute cases where a higher skilled team, including an Intensivist, might be required. Townsville Hospital would normally be approached to see if a Consultant Paediatric Intensivist from the new Paediatric Intensive Care Unit was available. Unfortunately, he reported they were not always available and they were not funded to provide that service.

Dr Hoggard confirmed that if Kesler had presented to a hospital in the southern zone and required retrieval, a paediatric Intensivist would have been the co-ordinator. However, Dr Hoggard was able to report that, with the establishment of a Paediatric Intensive Care Unit at Townsville Hospital, that Unit has agreed to assist with clinical advice but not co-ordination of complex paediatric cases. He told the court that the clinical coordinator would 'today' likely involve the on-call Paediatric Intensivist.

As to access to and use of CEWT charts, Dr Hoggard told the hearing that the nurse assisting the retrieval coordinator gathers information such as clinical observations including clinical scores, the service does not have the benefit of accessing the charts directly. The systems is still paper based and documents must be scanned and emailed or faxed. Dr Hoggard

acknowledged RSQ was reliant on updates and reports from the referring clinicians about changes in a patient's condition. This limits the extent to which debiasing strategies might apply. As to the recent introduction of electronic records, there is limited roll out of the system to hospitals in Qld, and RSQ does not presently have access to the electronic records where they do exist.

Another issue that arose from Dr Hoggard's evidence was the sophistication of the ventilators available on aircraft. He said:

> …so every base and every aircraft has ventilators, retrieval equipment, standard equipment required in most retrieval circumstances. However it must be noted that ventilators, transport ventilators are not as intuitive, advanced or capable as the ventilators that are used in the hospitals. So for very, very complex patients, adult or paediatric, the transport ventilators may not be capable of ventilating them.

During the hearing, there emerged an issue about capability to intubate and ventilate Kesler at the hospital (dependent on the condition of Kesler) and the capability of retrieval services to maintain an equivalent level of support. The key variables were the condition of Kesler and prospect of deterioration, the sophistication of the ventilators at the hospital and on the aircraft, and the skill set of the clinicians involved at each stage.

Dr Simpson also reported on Paediatric retrieval in NQ. He referred to the dedicated and funded paediatric retrieval service in the south east corner of Queensland and contrasted it with that available in the north, where response times are measured in days rather than hours. While the newly established Paediatric Intensive Care Unit at Townsville Hospital participates in both coordination advice and provision of staff where and when necessary and possible, he thought this life preserving activity is not sustainable in the face of increasing demand.

He then, very importantly, states:

> It is my opinion that the current arrangements of alternating the clinical coordination between centres in the north and south depending on the time of day, or day of the week, is a flawed system that should be changed. There is also a discrepancy between the north and south on the paediatric experience of the coordinator at first point of contact. In both regions there are pros and cons for their respective systems.
>
> In this particular case the QCC coordinator first contacted was Dr Caroline Hwang, who was acting in the capacity as the adult, or general, coordinator for the state, and she is based in Brisbane. If the call had been made during the day it would have been put through to the northern zone coordinator, who also acts in a general capacity. Dr Ben Close, who was involved later in this case, was fulfilling that role. The difference is that the northern zone coordinators know the resources available in the northern regions, and would, in all likelihood, have not relied on Dr Ryan and Dr Stewart for the paediatric aspects of this case, but would have consulted someone like me, even though not on call. This has happened in the past.
>
> I am not criticising Dr Hwang, who followed the recommended and established chain of communication, and expressed concern that the severity of illness was greater than

> it was being portrayed. I do not know if earlier involvement of a Paediatric ICU specialist would have changed the outcome, but it would, most likely, have changed the intensity with which he was managed.

Clearly, there are opportunities to do better which will be explored.

Other Investigations and Recommendations

Mt Isa Hospital and RSQ engaged in their own reviews about how Kesler was managed with a view to identifying opportunities for improvement.

Associate Professor Alan Sandford started in the role of Executive Director of Medical Services at Mt Isa Hospital on 5 May 2014. He provided a statement to the court in which he attached a Root Cause Analysis (RCA) Report from an internal investigation commissioned in August 2012 (completed December 2012) into the circumstances of Kessler's death. A number of recommendations were made in the report. Dr Sandford was also called as a witness in the hearing.

The RCA report acknowledges there existed the opportunity for more comprehensive use of CEWT charts and scores. And the absence of documented scores may have resulted in a failure to earlier recognise the seriousness of Kessler's condition and delayed activation of a MET call.

About the use of CEWT charts, the RCA report recommended:

- The CEWT Emergency Department tool be adopted for use;
- All paediatric patients with a CEWT score of 8 or more be assessed by a Paediatrician and transferred to a tertiary facility or admitted to the secondary facility ICU or Neonatal Unit;
- All Emergency and Paediatric nursing staff to complete online program "Recognition and Management of the Deteriorating Patient";

Dr Sandford was able to report to the court that all key measures for implementation of these recommendations were met.

The RCA report also identified as a contributing factor the absence of a clear documented process in relation to acutely ill children for escalation and consultation from Paediatricians to Paediatric Intensivists and Paediatric Cardiologists, possibly facilitated through Telehealth (video conferencing). The RCA report recommended there must be discussion with a Paediatric Intensivist for any child considered for transfer or retrieval, and that consultation occur with a Paediatric Cardiologist for all children with known or suspected carditis. Dr Sandford was able to report, with audit results, showing these recommendations were successfully implemented. Indeed, one case is worthy of specific mention. It was reported:

> The 12 month audit was performed in December 2013. One chart was identified for review. The chart was chosen for audit as the provisional or principle diagnosis met the audit criteria of 'known or suspected carditis'. Initial notification was to the Cairns based Paediatric Cardiology during a consultation to discuss urgent transfer of the patient to a tertiary centre for a severe mitral valve incompetency post-acute rheumatic fever. A

> discussion between several clinicians occurred and a decision made to send to Townsville hospital. The child was later assessed as requiring hemi surgery to replace the incompetent valve. This was undertaken in Brisbane and the Brisbane based Paediatric Cardiologist became involved in her care and ongoing follow up.

Clearly Mt Isa Hospital has extracted valuable lessons to be learnt, translated those lessons to changes within their systems and has the audit results to show successful implementation.

Dr Hoggard was designated investigating officer in his then role as Deputy Medical Director of RSQ when in February 2012 the circumstances of this retrieval were formally reviewed. He identified the following issues arising:

- Absence of formal specialist paediatric intensive care advice and capability in NQ;
- Paediatric critical care skill capability of retrieval teams in NQ;
- Timing of referral precluded immediate response – unavoidable;
- No Careflight (CMS) medical officer cover for shift.

Dr Hoggard concluded:

> A review and recommendation for a PICU service for TTH is currently being finalised. This includes recommendations regarding the provision of a paediatric retrieval service for NQ.
>
> CMS ability to ensure full flight MO coverage, for Townsville in particular, continues to be a challenge. This is further hampered by the continued concurrent use of flight MOs for alternative and conflicting non QH Contract rosters.

Again, there is clear recognition about the need for Paediatric Intensivist involvement, both in an advisory role as well as within retrieval teams for complex cases. However, the finalisation of the Paediatric Intensive Care Unit at Townsville Hospital has only partially addressed the needs considered in this coronial investigation.

Comment and Analysis

Three critical elements

The retrieval of acutely unwell patients is dynamic and complex, with those involved in managing them facing numerous and substantial challenges. The differing opinions of the clinicians and experts about 'what might have been done and when' for Kesler reflects that proposition.

As best I can, I have approached the analysis of the complexities of this case by considering what happened and what's possible against the following elements:

1. The acuity of Kesler's condition and trajectory (risk of deterioration plotted against time), likely and possible.
2. Local capability in terms of clinical skills and equipment to provide respiratory support, the risk of complications deploying that capability and the capacity to manage the complications.
3. Similar considerations for retrieval team capability.

What Happened

At about 2.30am, Dr Stewart recognised that Kesler was deteriorating, he required a higher level of care than was available at Mt Isa, it was required as soon as possible, and he initiated a transfer to Townsville Hospital for definitive investigation and treatment. From this moment onwards, the clinicians were primarily managing a risk of further deterioration. This involves understanding the acuity of Kesler's condition, the possible trajectories (the likely as well as possible clinical course over time), and the resources available to meet his clinical needs until he reaches definitive treatment.

The initial planning of the retrieval was entirely reliant on the assessment and judgement of Dr Stewart as to his acuity and clinical needs. There were no further investigations that might have been pursued at Mt Isa. Dr Stewart discussed the clinical management and transfer with Dr Ryan from TTH, a fellow Paediatrician. Dr Ryan made it clear to the court that while he discussed clinical management, he deferred to the clinical judgement of Dr Stewart as the attending clinician.

However, Dr Ryan became the principal participant in conversations with RSQ about Kesler's condition and needs, based on his conversations with Dr Stewart. Dr Ryan did not have the benefit of reviewing any clinical records or charts. There was difficulty linking Dr Stewart into subsequent teleconferences involving Dr Catchpole from RFDS. Dr Stewart had returned to his accommodation. It is during these teleconferences that the possible need for intubation was raised and Dr Ryan reported that Kesler did not 'presently' require airway support. He was reporting what Dr Stewart had reported to him. There was also a discussion between Dr Ryan and Dr Hwang, initiated by Dr Hwang, about the possibility of deterioration. Dr Ryan reported to her that Anaesthetists at Mt Isa could intubate and ventilate Kesler if required before transfer. According to the transcript of the teleconferences, these conversations took place after 3am. From the same transcripts, it is clear the tasking to RFDS was on the basis that intubation was likely not required but that would be reviewed later that morning when Dr Ngai started. Even then, it appears the clinicians were considering the need for intubation as a precautionary or pre-emptive step to avoid the risk of deterioration and the need for intubation mid-flight.

In summary, the expectation in planning the retrieval was Kesler was not in need of respiratory support, he was stable pending retrieval likely about 6am later that morning, and he could be intubated (if required as a precautionary step) for transfer.

Based on this expectation, Kesler would have been medically evacuated stable and out of Mt Isa at about 6.30 or 7am, arriving Townsville about 9.30am.

Returning to the three critical elements:

1. *Acuity of the condition and trajectory (deterioration over time), likely and possible.*
    - The acuity of his condition, measured by his need for respiratory support, was missed. His actual condition was worse than assessed.
    - The risk of possible deterioration was not expressly considered, nor was a plan considered for that contingency.

2. *Local capability in terms of clinical skills and equipment to provide respiratory support, the risk of complications and the capacity to manage the complications;*
    - In the absence of any discussion about deterioration, there was no discussion about local capability beyond intubation as a precautionary step for transfer.
3. *Retrieval team capability in terms of clinical skills and equipment to provide respiratory support, the risk of complications in providing that support and the ability to manage any complications*
    - This was considered but only to the extent that the team might be transferring a child that was intubated on a precautionary basis.

What is possible?

With Paediatric Intensivist input, the management and planning may have taken a different course. I say 'may have' because it is impossible to quantify, even through the use of terms such as 'likely' or 'possible', the prospect of a better outcome. There are stages in the clinical management of Kesler that, managed differently, may have improved his prospect of survival, but whether such gains would have been achieved at each stage, and whether the stages would have cumulatively resulted in a change of outcome is impossible to assess.

Acuity of the condition and trajectory

The first stage in decision making about Kesler's clinical management is the best understanding of the acuity of his condition and clinical needs.

Most of the Intensivists involved in reviewing this matter reported that Kesler needed respiratory support, preferably through intubation and ventilation, by 2.30am. The fact that this was not recognised is not an adverse reflection on the competency of Dr Stewart or Dr Ryan. The reviewing Intensivists have greater expertise in this field. However, this immediately suggests that Kesler's clinical management could have benefited from the involvement of a Paediatric Intensivist to better understand the acuity of his condition and clinical needs. However, that of itself might not have been enough.

A potential limiting factor is access to the best clinical information. The reviewing Intensivists had the benefit of access to the clinical records and charts including CEWT. These were not available to the participants in the RSQ teleconferences. So when reviewing clinical management with a view to constructing an alternative and better pathway, consideration must be given to ensuring participants in retrieval discussions have access to the best available information, not just that reported by the attending clinician. Clearly, the CEWT charts need to be complete and added so the scores are readily apparent. The concept of best available information might also involve the Paediatric Intensivist seeing the patient. In that event, telemedicine or telehealth would need to be engaged. Mt Isa is reported to have that capability.

With the best available clinical information and the advice of a Paediatric Intensivist, the retrieval coordinating team would have had a better understanding of the acuity of Kesler's condition. Understanding his immediate acuity and needs is not the end of the matter. Definitive intervention is some time away. Therefore, the next stage is developing possible

trajectories, mapping the risk of deterioration over time; or in other words, what should happen and what could happen? The length of the time line under consideration in each trajectory must match the time it would take to get a patient like Kesler to definitive treatment. Essentially, this involves contingency planning, matching a clinical response to needs for each contingency.

For example, if Kesler's management had the input of a Paediatric Intensivist and he was assessed as not requiring respiratory support for a few hours (what should happen), consideration would then turn to a possible trajectory of deterioration and need for respiratory support (what could happen). What then?

If considered at the initial planning stage, local capability and retrieval capability will naturally arise for discussion and can be explored. What happened here was the clinicians discovered plan A was unable to be implemented and plan B had to be devised, a reactive mode of management ensued.

Local Capability

On considering the risk of deterioration and possible need for respiratory support, management options will depend on local capability. What is it? Who can be asked to assist, with what skill set and equipment?

While there is not an Intensive Care Unit at Mt Isa, there are Anaesthetists and Emergency staff specialists. The Director of Anaesthesia was Dr Waters and if called at about 3 to 3.30am, he would have been able to report to the retrieval coordinating team on the capability of his staff and equipment to conduct an intubation and ventilation of Kesler. Dr Waters and the Paediatric Intensivist could explore options for respiratory support, refine any assessment of the risks and how they could be managed, balancing any residual risk against the risk of not acting. Less invasive forms of respiratory support could also be considered if the residual risk was considered too high. The Paediatric Intensivist would provide valuable input about drugs and techniques that a consultant in general anaesthesia might lack relevant to a paediatric case. Importantly, again, this decision making process is done in the framework of trajectories factoring retrieval options and 'what if' scenarios.

The involvement of Dr Waters with a PI on the line would have increased and refined the options for managing the risk of deterioration.

While it is impossible to determine when the mitral valve chordae ruptured, it is clear that clinicians manage cases of acute heart failure, and respiratory distress in particular; by reducing the effort or workload of the cardiorespiratory system to reduce the risk of catastrophic failure. It will be recalled that one of the first observations of Dr Ngai from RFDS was that Kesler needed to be ventilated for transfer as the child was very tired after breathing so hard for a prolonged period. Therefore, there was a prospect that early respiratory support would reduce the workload on the cardiopulmonary systems and the risk of deterioration as well as extend the time frame for definitive intervention.

Retrieval Team Capability

Continuity of care depends on the retrieval team matching the capability of Mt Isa Hospital. Although intubation and management of the risk of complications associated with that procedure would be addressed at Mt Isa, the skill set of the retrieval team and sophistication of the equipment available would likely have exceeded the capability of RFDS. There is a small possibility that Kesler might have stabilised sufficiently to be retrieved by the RFDS crew. However, the risk of further deterioration might have forced the retrieval coordinating team to escalate the required retrieval team capability. Again, in the planning stages, the retrieval coordinating team would have earlier considered a better skilled and equipped retrieval team from Townsville or Brisbane. Although Dr Close was able to find an alternative Careflight retrieval team out of Townsville, there is insufficient evidence to enable me to assess what was achievable if that need was recognised at about 4am.

Opportunities for Improvement

In developing a better systems approach to the retrieval of critically unwell children in rural and remote areas, there are opportunities for improvement that can be extracted from what happened and what's possible.

I am going to refer to clinical and retrieval management, the former is inseparable from the latter when retrieval is under consideration.

Potential for Cognitive Errors in Clinical Decision Making

There needs to be a better understanding at a clinical level of the potential for cognitive limitations and errors in clinical decision making. Dr McCaffery's views should be considered in the context of the many peer reviewed publications he cited in his report. His view should also be considered in light of the great work that has already been done in the areas of human factors and neuroscience. The simple concept of a checklist, used in aviation for many decades, was resisted in medicine[2]. The evidence suggests that CEWT charts might play a greater role than triggering a MET call or summoning the treating doctor. CEWT charts have a role to play in contributing to a better understanding of acuity, whether as a debiasing tool or an objective benchmark. Further, a MET call, even involving more junior staff, might bring a fresh perspective and that should not be diminished.

I accept and endorse the recommendations of Dr McCaffery about opportunities to reduce cognitive errors and limitations in clinical and retrieval management. The issue for discussion at the roundtable is how to implement those ideas in the clinical and retrieval process.

Collaborative Model for Clinical and Retrieval Team Management

The structure and processes of clinical and retrieval management of children requires a serious rethink. Children have different needs compared to adults, hence the field of Paediatrics. But as Dr Simpson notes, the differing needs is not reflected in the paediatric retrieval process which is 'tacked' on to the adult system.

[2] The Checklist Manifesto, Atul Gawande, 2009

It is not sufficient to think of the participants in retrieval as the referring hospital, the receiving hospital, the RSQ co-ordinator and retrieval team; each with discrete roles and responsibilities. A better approach would be to think collaboratively and to form a clinical and retrieval management team, initiated on a request to RSQ for assistance. The elements of this approach which require review include:

- Developing NQ capability for 24/7 clinical and retrieval management;
- Procedures for access to sub-specialty advice including Paediatric Intensivists;
- Procedures to access the best available clinical information (clinical charts and medical records);
- Access to members of the treating team for first-hand information;
- Team access to patients through telemedicine or telehealth;
- Understanding local capability for further investigation that will help refine the diagnosis and clinical management options;
- Structured decision making - Developing patient trajectories for what should happen (based on diagnosis and prognosis) and what could happen (based on differential diagnosis and or alternative prognosis) – matching local capability and retrieval team capability (clinical management capability) with each trajectory (clinical needs pending definitive intervention).
- Professional development of team managers ('coordinators' in the old model) in new processes.

Again, how this is done is for discussion at the roundtable conference. Although the second last point is briefly stated, it will prove the most complex to address.

Benchmarking Retrieval Crew Availability and Capability

The collaborative model will need to incorporate the availability and capability of service providers such as RFDS and Careflight. I have already addressed requirement to match clinical needs with skill set and equipment of the retrieval team. How this might be better achieved will be addressed in the roundtable conference. In relation to Kesler, there were serious logistical challenges. Initially, a crew was not available until 5am due to fatigue management issues with the aviation crew. When the higher needs of Kesler were appreciated, the availability of a Careflight crew was affected by rostering issues. Although these matters were not investigated during the hearing, there is a clear need to monitor the extent to which such issues impact on service delivery. Benchmarks need to be established against which performance is monitored. If an additional resource is required, the bench marked performance results should support the business case. The results might also identify opportunities for changes in rosters, the need for additional skill sets and the need for additional or upgraded equipment. Benchmarking might also facilitate review of contractual performance standards with service providers and drive new ideas about better service delivery. The importance of these issues should not be left for assessment based on anecdotal material.

Findings

Section 45 of the Coroners Act 2003 specifies the findings I am required to make. Accordingly, I find:

Identity of Deceased:	Kesler Lee James
Where he died:	Mt Isa Base Hospital Camooweal Street MOUNT ISA QLD 4825 AUSTRALIA
When he died:	25 February 2012
Cause of death:	Acute bronchopneumonia & diffuse alveolar damage due to acute rheumatic carditis against a background of mitral valve chordal rupture
How he died:	Kesler died when his clinical needs exceeded the capability of the treating team in Mt Isa and the retrieval team initially tasked to do the retrieval.

Comments / Recommendations

Section 3 of the Coroners Act 2003 provides that an objective of the Act is to help to prevent deaths from similar causes happening in the future by allowing coroners at inquests to comment on matters connected with deaths, including matters related to public health or safety. This object is followed up in section 46 which provides a coroner may, whenever appropriate, comment on anything connected with a death investigated at an inquest that relates to public health or safety; or ways to prevent deaths from happening in similar circumstances in the future.
As foreshadowed at the conclusion of evidence in this inquest, findings were prepared and circulated but not published. A roundtable conference was convened in Townsville on 15 April 2016 where key medical stakeholders were invited to review my findings and discuss how the identified opportunities for improvement might be addressed in recommendations. Clearly, I have formed views about identified opportunities during the hearing. However, I preferred to hear the views of others with relevant expertise and some of whom were involved in the hearing. The participants were informed that my findings must be accepted as the basis for discussion. Dr Stephen Rashford chaired the conference in my presence. The only lawyer permitted to attend was Ms Franco, Counsel Assisting, for the purpose of note taking. A draft copy of the recommendations was circulated to each of the parties with the opportunity to make any submissions.

The participants were:

a. Chair: Dr Stephen Rashford, Medical Director Queensland Ambulance Service, Adjunct Professor QUT;
b. Associate Professor Alan Sandford, Executive Director of Medical Services, Northwest Hospital and Health Services;
c. Dr Brett Hoggard, Medical Director, Retrieval Services Queensland;
d. Dr Emmiline Finn, Director Clinical Operations, Care Flight, Queensland
e. Dr Oscar Whitehead, Director of Medical Services, Royal Flying Doctor Services, Queensland Section;
f. Dr Robert Scott Simpson, Director, Paediatric Intensive Care Services, The Townsville Hospital;
g. Dr Paul Holmes, Paediatric Intensive Care Specialist, Director for Paediatric Retrieval Services, Lady Cilento Children's Hospital
h. Dr Kevin McCaffery, Senior Staff Specialist in Paediatric Intensive Care Medicine, (Lady Cilento Children's Hospital) and
i. Dr Clinton Gibbs, Director of Northern Zone Retrieval Service

The roundtable conference was very constructive and I thank the participants for their contributions.

Specific Recommendations

Better Use of Children's Early Warning Tool (CEWT)

1. Each District Health Service to:

    a) Take steps to ensure that every child admitted to a hospital has clinical observations charted and scores completed using CEWT;
    b) Periodically audit all hospitals to assess the extent of compliance with the required use of CEWT, identifying any shortcomings and take appropriate remedial action to ensure full compliance;
    c) Review the role of CEWT and publish guidelines or pathways appropriate to each hospital, addressing:
        i. Pre-determined triggers for escalation;
        ii. The nature of the escalation, preferable a stratified approach (MET call, consultant review etc)
        iii. Early notification to Retrieval Services Queensland ("RSQ")of the possible need for retrieval; and
        iv. Paediatric Intensivist consultation.
    d) Incorporate into professional development programs for medical and nursing staff at hospitals, education in cognitive errors and limitations, in the context of the role of CEWT as a debiasing tool;
    e) Ensure CEWT charts accompany children when transferring between facilities;
    f) Ensure children re-presenting in a short timeframe with the same diagnosis have their observations plotted on the same CEWT chart;
    g) Ensure that administrative arrangements be in place to facilitate the electronic scanning and transmission of CEWT charts on a 24/7 basis

Paediatric Intensivist Consultation and Retrieval

2. Each District Health Service to ensure every child admitted to a hospital who is critically unwell and may require retrieval to a higher level care facility is discussed with a Paediatric Intensivist in conference with RSQ, and the treating doctor as soon as possible, to develop a consensus clinical management plan. The plan should, amongst other things, take into consideration an assessment of the risk of deterioration during the retrieval period and contingency plans for the capability to respond.
3. The Townsville Hospital be additionally resourced (time, training and equipment) to enable Paediatric Intensivists and Paediatric Intensive Care Nurses to participate in the retrieval of critically unwell children, if that level of care is considered necessary. The current participation is not resourced and if that continues, may impact on the availability of that capability.

Northern Co-ordination of Retrievals

4. The Northern hub within RSQ be expanded to provide 24/7 co-ordination of retrieval services. While in theory it is possible with current information technology to co-ordinate retrievals from Brisbane, the 'joined up thinking', personal relationships and

local knowledge (amongst other elements of a resilient health care model) are missing with the potential to impact negatively on the quality of service.

Clinical Pathway

5. Queensland Health initiate the development of a State-wide, evidence based clinical pathway for the management of children with acute cardiac conditions to ensure a stratified risk approach to timely access to the best available care within Qld wherever the child resides.

Retrieval Model of Care

6. Queensland Health initiate, in collaboration with RSQ and other stakeholders in retrieval services (eg RFDS, EMQ and Careflight), a consensus model of care for clinical management of acute patients requiring retrieval. The model should detail, amongst other things:

    a) Requirements for early notification to RSQ;
    b) The participants access to the medical records, preferably on a shared platform;
    c) A share communication platform facilitating contemporaneous communication with each team and team member;
    d) The co-ordinator (RSQ), referring team, retrieval team, receiving team to jointly confer at the first available opportunity and agree a consensus clinical care plan for the retrieval;
    e) Access to further specialist/consultant advice;
    f) Respective roles and responsibilities of each team during the retrieval;
    g) The contents of the consensus clinical care plan including:
        a. an understanding of each teams capability; and
        b. a detailed risk assessment about possible deterioration over the likely duration of retrieval (to definitive care) and contingency plans about what capability will be deployed by who and when (triggers).
    h) Monitoring and reporting to all teams on progress with implementation of the care plan.

Kevin Priestly
Northern Coroner
Cairns
3 June 2016

Appendix A

CHRONOLOGY

KESLER JAMES
MT ISA HOSPITAL ADMISSION – 24-25 FEBRUARY 2012

Date/time	Entry	Source
24.02.2012 2308 hours	Emergency Department presentation Tachypnoeic, vomit x1, unwell for past 2 hours	Mt Isa Hospital Emergency Department Clinical Record
2311 hours	Nursing observations Temperature 37.5°C Pulse rate 175/min; respiratory rate 42/min; oxygen saturations 92%	Mt Isa Hospital Emergency Department Clinical Record
2315 hours	Review by Dr Harris, RMO, Emergency Department Recently diagnosed with rheumatic heart disease 2 weeks ago in Townsville. Echo showing mitral and aortic incompetence on 14/2/12 and treated for heart failure Well today Sleeping tonight and appeared to Mum to be in respiratory distress. Unable to lie on side. Woke up and vomited x1 No fevers since discharge. Discharged from Mt Isa on 18/02/12 with rest at home O/E – Distressed at being in hospital. Alert. No use of accessory muscles Chest auscultation clear with good bilateral air entry. Cardiovascular examination revealed a regular pulse and systolic murmur in the mitral and aortic regions. Commenced on 8 litres of oxygen.	Mt Isa Hospital Emergency Department Clinical Record Statement of Dr Harris
2320 hours	Nursing notes Patient upset, crying *'wants to go home'* O2 insitu. Medical officer examining patient. ECG performed (2314 hours). Nursing observations Pulse rate 188/min, blood pressure 113/90, respiratory rate 29, temperature 38.1°C, 8 litres of oxygen by mask, oxygen saturations 100% Glasgow Coma Score 15	Mt Isa Hospital Nursing Worksheet Statement of RN Marshall
2340 hours	Nursing observations Pulse rate 181, respiratory rate 26, oxygen saturations 100% on 8 litres of oxygen	Mt Isa Hospital Nursing Worksheet
2350 hours	Nursing notes Review by Paediatrician Secondary survey Kesler sitting up, observing surroundings and upset that he is in hospital Alert, upset and crying *'want to go home'*.	Mt Isa Hospital Nursing Worksheet Statement of RN Marshall

Date/time	Entry	Source
	Maintaining own airway, dry cough. Oxygen saturations 94% on room air, respiratory rate 36 Pulse rate 173, warm skin, pale. Blood pressure 113/90	
25.02.2012 0020 hours	Medication order 40mg oral Frusemide ordered and administered	Paediatric Medication Chart
0030 hours	Nursing notes Attempted IV insertion, unsuccessful Patient demonstrating desaturation when on room air to 87% Chest x-ray performed Review by Dr Stewart, Paediatric Consultant on call Known rheumatic fever (RF) with mitral regurgitation (MR) and left ventricular (LV) dilatation Last seen 3 days ago well Tonight vomiting/tachycardia/cough O/E pale, tachycardia Sat 98 in air Occasional rhonchi in chest. Otherwise clear ECG: Sinus tachycardia Prolonged PR RAD LVH Plan 1. start Lasix 40mg 2. CXR pulmonary oedema 3. admit 4. O2 to keep sat > 95%	Mt Isa Hospital Nursing Worksheet Progress notes Statement of Dr Stewart
0045 hours	Nursing observations Pulse rate 172/min, respiratory rate 26, oxygen saturation 87% on room air Review by Dr Stewart HR Gallop Breathing easier Frusemide AM D/W Townsville AM	Mt Isa Hospital Nursing Worksheet Progress notes Statement of Dr Stewart
0050 hours	Nursing observations Pulse rate 169/min, respiratory rate 23, oxygen saturation 97% on 4 litres of oxygen via nasal prongs	Mt Isa Hospital Nursing Worksheet
0110 hours	Admission to Children's Ward Admitted to Children's Ward with increased work of breathing, cough and 1x vomit this PM. Known rheumatic heart disease with mitral and aortic valve incompetence. Chest x-ray shows probable pulmonary oedema ?cardiac failure	Progress Notes

Date/time	Entry	Source
	Nursing observations Temperature 36.7, Respiratory rate 52, oxygen saturation 82% on room air, heart rate 165, blood pressure 81/51	Children's Early Warning Tool (CEWT)
0120 hours	Nursing observations Respiratory rate 52, oxygen saturation 95% on 3 litres of oxygen via nasal prongs	CEWT Statement of RN Cromley
0130 hours	Review by Dr Stewart Heart rate 170 Chest clear Oxygen saturation 96% on 3 litres of oxygen	Progress notes Statement of Dr Stewart
0145 hours	Nursing observations Respiratory rate 60, oxygen saturation 90% on 3 litres of oxygen and pulse rate 165/min	CEWT Statement of RN Cromley
0215 hours	Nursing observations Respiratory rate just below 50 , oxygen saturation 93%, oxygen 6 litres via face mask Pulse rate 175/min Review by Dr Stewart Contacted by nursing staff regarding increasing O2 requirements. Returned to review Kesler Telephone to Dr Pat Ryan, THHS to discuss options for retrieval. Agreed to commence IV hydrocortisone, antibiotics and administer further Frusemide IV sited	CEWT Statement of RN Cromley Statement of Dr Stewart
0221 hours	Telephone conversation RN Natalie Meldrum, QCC and Dr Ryan	RSQ voice tape
0222 hours	Telephone conversation RN Meldrum and Dr Stewart	RSQ voice tape
0240 hours	Medication orders Medication orders documented by Dr Stewart: 1. Frusemide 40mg IV (administered 0240 hours) 2. Ampicillin 500mg IV (administered 0245 hours) 3. Ceftrixione 1000g IV (administered 0250 hours) Telephone conversation RN Meldrum, Dr Stewart and Dr Caroline Hwang	Paediatric Medication Chart RSQ voice tape
0245 hours	Nursing observations Respiratory rate 50, oxygen saturations 95% on 6 litres of oxygen Pulse rate 170/min	CEWT Statement of RN Cromley
0250 hours	Telephone conversation QAS EMD and Dr Hwang	RSQ voice tape
0300 hours	Telephone conversation RN Meldrum, Dr Michael Catchpole, RFDS and Dr Hwang	RSQ voice tape
0309 hours	Telephone conversation	RSQ voice tape

Date/time	Entry	Source
	RN Meldrum and Dr Hwang	
0311 hours	Telephone conversation RN Meldrum, Dr Hwang, Dr Catchpole and Dr Ryan	RSQ voice tape
0312 hours	Telephone conversation Daniella, RSQ and Dr Ryan	RSQ voice tape
0315 hours	Nursing observations Respiratory rate 45, oxygen saturations 93% on 6 litres of oxygen Pulse rate 170/min Review by Dr Stewart Deteriorated with continuing cough, sweaty and gallop rhythm Plan 1. transfer to Townsville 2. FBC 3. U&E 4. BC 5. Hydrocortisone 100mg IV 6. Ampicillin 500 mg IV 7. Ceftriaxone 1g IV 8. Lasix 40mg IV 9. continue O2	CEWT Progress notes
0330 hours	Telephone conversation Dr Michael Catchpole, RFDS and Children's Ward	RFDS Health Consultation Record Statement of Dr Catchpole
0345 hours	Nursing observations Respiratory rate 60, oxygen saturations 90% on 6 litres of oxygen Pulse rate 165/min	CEWT Statement of RN Cromley
0400 hours	Nursing observations Respiratory rate 58, oxygen saturations 90% on 6 litres of oxygen Pulse rate 155/min	CEWT Statement of RN Cromley
0430 hours	Nursing observations Respiratory rate 60; oxygen saturations 90% on 6 litres of oxygen Pulse rate 160/min	CEWT Statement of RN Cromley
0453 hours	Telephone conversation Dr Catchpole and Children's Ward	Statement of Dr Catchpole
0500 hours	Nursing observations Respiratory rate 62; oxygen saturations 93% on 6 litres of oxygen Pulse rate 155/min, blood pressure 80/50	CEWT Statement of RN Cromley

Date/time	Entry	Source
0500 – 0510 hours	RFDS Handover (by telephone) Dr Catchpole and Dr Barbara Ngai, RFDS Telephone conversation Dr Ngai and Children's Ward	Statements of Dr Catchpole and Dr Ngai
0530 hours	Nursing observations Respiratory rate 60; oxygen saturations 95% on 6 litres of oxygen Pulse rate 157/min	CEWT Statement of RN Cromley
0531 hours	Telephone call Richard, QCC and Dr Ben Close, RSQ	RSQ voice tape
0600 hours	Nursing observations Respiratory rate 60; oxygen saturations 87% on 6 litres Pulse rate 157/min O2 10 litres Review by Dr Ngai where she reports Kesler pale, sweaty with intercostal recession and tracheal tug. No crepitations or wheeze on auscultation Telephone conversation Dr Ngai and Dr Stewart Nursing notes RFDS have arrived to assess if Kesler requires intubation prior to transfer to Townsville. Currently condition remains stable, nil changes. IVT continues. Currently RFDS and Dr Stewart deciding if intubation is required and if paediatric transfer team is required.	CEWT Statement of RN Cromley Statement of Dr Ngai Progress notes
0604 hours	Telephone conversation (from 26:27min) Daniella, RSQ; Dr Hwang and Dr Catchpole Dr Ngai Dr Stewart	RSQ voice tape
0605 hours	Telephone conversation (from 2:27min) RN Meldrum and Dr Close	RSQ voice tape
0615 hours	Review by Dr Stewart Discussion (on the ward) between Dr Stewart and RFDS regarding transfer of Kesler. RFDS confirmed Kesler would require intubation for transfer. Dr Stewart advised by RFDS that they did not have the crew mix to deal with a ventilated transfer and were unable to effect the transfer of Kesler Progress notes Oxygen saturations dropped. Kesler on 10 litres of oxygen however, less sweaty and pulse normal. Commenced on restricted IV fluid.	Statement of Dr Stewart Progress notes
0620 hours	Nursing observations Respiratory rate 62; oxygen saturations 95% on 10 litres; heart rate 160/min	CEWT Statement of RN Cromley
0638 hours	Telephone conversation RN Meldrum, Dr Hwang and Dr Close	RSQ voice tape

Date/time	Entry	Source
? time (before VBG)	Telephone conversation Dr Ngai and Dr Close	Statement of Dr Ngai
0645 hours	Venous blood gas pH 7.374, PCO2 36mmHg, base excess -4mmol Telephone conversation Dr Stewart and Dr Ryan Dr Ryan and Dr Ngai	Progress notes Statement of Dr Stewart Statement of Dr Ngai
0646 hours	Telephone conversation QAS EMD and Dr Ryan	RSQ voice tape
0650 hours	IV Fluid Commenced 0.45% Normal Saline with 2.5% Dextrose and 20mmol KCL/litre at 36 mls/hour	IV Fluid Order Form
0700 hours	Nursing handover RN Cromley hands over to RN Ryan	Statement of RN Ryan Statement of RN Cromley
0710 hours	Telephone conversation Joanne, RSQ and Dr Close	RSQ voice tape
0714 hours	Telephone conversation (from 1:33min) Simon, QCC and Dr Close	RSQ voice tape
0731 hours	Telephone conversation Simon, QCC, Dr Ngai and Dr Close	RSQ voice tape
prior to 0740 hours	Telephone conversation Dr Ngai and Dr Close. RFDS Mt Isa crew to stand down. Crew to be activated from Townsville	Statement of Dr Ngai
0741 hours	Telephone conversation Joanne, RSQ and Dr Close	RSQ voice tape
0745 hours	Nursing observations Respiratory rate 44; oxygen saturations 90% on 10 litres; heart rate 160/min Commenced on non-re-breather mask	CEWT Statement of RN Susan Ryan
0751 hours	Telephone conversation Joanne, RSQ and Dr Close	RSQ voice tape
0753 hours	Telephone conversation Simon, QCC, Dr Close and Dr Emeline, RSQ	RSQ voice tape
0756 hours	Telephone conversation Joanne, RSQ and Dr Siva, ICU THHS Dr Siva and Dr Close (from 3:15min)	RSQ voice tape
0800 hours	Medication order IV Frusemide 40 mg (administered 0830 hours)	Paediatric Medication Chart
0801 hours	Telephone conversation Dr Stewart and Dr George Waters, Anaesthetist	Progress notes

Date/time	Entry	Source
0806 hours	Telephone conversation Richard, QCC, Dr Close and Dr Emeline	RSQ voice tape
0810 hours	Review by Dr Stewart Awaiting call from Townsville intensivist. Current intention is to bring transport team from Townsville and take back intubated. Currently Kesler is fractious but is maintaining saturations of 92 in 10 litres. Have spoken to anaesthetist here with a view to intubation.	Progress notes Statement of Dr Stewart
0819 hours	Telephone conversation Dr Waters and Mt Isa Hospital ICU RN Telephone conversation Richard, QCC and Dr Close	Progress notes RSQ voice tape
0820 hours	Nursing observations Respiratory rate 60; oxygen saturations 86% on 10 litres; heart rate 160/min; blood pressure 80/54	CEWT Statement of RN Ryan
0832 hours	Telephone conversation Sheree, Townsville and Simon, QCC Simon, QCC and Andrew, Townsville (from 00:47min)	RSQ voice tape
About 840 hours	Review by Dr Waters Dr Water's obtained history from Ms James. At one point saturations dropped to 72%. Kesler very restless Loud, moist respiration sounds 84/min. Unable to hear heart sounds	Progress notes Statement of Dr Waters
0845 hours	Nursing observations Respiratory rate 60; oxygen saturations 84% on 10 litres; heart rate 152/min	CEWT Statement of RN Ryan
0900 hours	Nursing observations Respiratory rate 80; oxygen saturations 72-76% on 10 litres; heart rate 158/min	Progress notes Statement of RN Ryan
0901 hours	CareFlight Medical Service airborne Telephone conversation Sheree, Townsville and Simon, QCC	Statement of Dr Close RSQ voice tape
About 0900 hours	Dr Waters made various calls from the paediatric ward desk where the hospital phone was located	Progess notes Statement of Dr Waters
0904 noted from the Nurses Station 0914 hours noted from Kesler's room clock.	Nursing observations Heart rate 130/min; oxygen saturations 50% on 10 litres Kesler *'unresponsive'* RN Ryan informed Dr Waters and called for the crash trolley. Dr Waters on phone to Townsville ICU at time.	Progress notes Statement of RN Ryan Progress notes

Date/time	Entry	Source
	MET call MET call by Dr Waters. Bag and mask ventilation commenced with 100% oxygen. Kesler intubated with a size 5.5 endotracheal tube. Copious amounts of pink, frothy fluid flowing up the endotracheal tube. Nasogastric tube inserted to deflate the stomach	
0915 hours	Kesler's care handed over to MET team (involving Dr Cameron) as well as Dr Stewart and Dr Waters who continued with ventilation and intubation of Kesler. 1.7mg adrenaline	Statement of RN Ryan Resuscitation record Progress notes
0917 hours	Heart rate 24; 1.7mg adrenaline	Resuscitation record
0920 hours	Second IV line inserted; IV fluids commenced Heart rate 154; temperature 34.2°C	Statement of RN Ryan Resuscitation record
0923 hours	Oxygen saturations 93%; CPR still in progress	Resuscitation record
0924 hours	0.4mg atrovent	Resuscitation record
0925 hours	Heart rate 158; oxygen saturations 90% 1.7 mg adrenaline	Resuscitation record
0925 hours	Heart rate 148; oxygen saturations 95%	Resuscitation record
0926 hours	CPR ceased CPR recommenced Social worker contacted to come in	
0927 hours	Size 12 naso-gastric tube inserted	Statement of RN Ryan Resuscitation record
0928 hours	Suction catheter used to suction prink frothy fluid around Kesler's mouth	Statement of RN Ryan Resuscitation record
0929 hours	Heart rate 147; oxygen saturations 88% 1.7mg adrenaline	Resuscitation record
0930 hours	0.4mg atropine	Resuscitation record
0935 hours	CPR continued 1.7mg adrenaline	Resuscitation record
0937 hours	Heart rate 150 X-ray chest - done	Resuscitation record
0938 hours	1.7mg adrenaline	Resuscitation record
0940 hours	1.7mg adrenaline	Resuscitation record
0941 hours	Telephone conversation Joanna, RSQ and Dr Close	RSQ voice tape
0945 hours	1.7mg adrenaline	Resuscitation record
0946 hours	Telephone conversation Sheree, Townsville and Simon, QCC	RSQ voice tape
0947 hours	Venous blood gas	Progress notes

Date/time	Entry	Source
	pH 6.855; PCO2 87.9mmHg; PO2 31mmHg; base excess -18mmol Telephone conversation Lynne, THHS and Joanna, RSQ	RSQ voice tape
0952 hours	Intraosseous line inserted	Resuscitation record
0953 hours	1.7mg adrenaline	Resuscitation record
10000 hours	1.7mg adrenaline 25mmol sodium bicarbonate	Resuscitation record
1004 hours	CPR continued 1.7mg adrenaline	Resuscitation record
1005 hours	Telephone conversation Simon, QCC and Sheree, Townsville	RSQ voice tape
1006 hours	1.7mg adrenaline 0.4mg atropine	Resuscitation record
1008 hours	400ml Normal Saline IV bolus	Resuscitation record
1010 hours	No femoral pulse	Resuscitation record
1014 hours	Venous blood gas pH 6.557; PCO2 >130.0mmHg; PO2 19mmHg; lactate >20mmol Telephone conversation Dr Scott Cameron, Emergency Medicine Consultant and *'Paediatric Intensive Care Consultant'* Townsville Hospital	Progress notes Statement of Dr Cameron
1015 hours	25mmol sodium bicarbonate Dr Stewart speaks with Mrs James	Resuscitation record
1019 hours	Temperature 34.1°C 1.7mg adrenaline	Resuscitation record
1021 hours	Warm blanket applied	Resuscitation record
1023 hours	1.7mg adrenaline Social worker arrives	Resuscitation record
1025 hours	Blood in ETT	Resuscitation record
1027 hours	Telephone conversation Simon, QCC and Paul, Townsville Simon, QCC and Cath Johnson (from 2:00min) Simon, QCC, Michelle and Cath Johnson (from 4:04min)	RSQ voice tape
1029 hours	BSL 8.0mmol	Resuscitation record
1030 hours	Heart rate 168; oxygen saturations 99% 25mmol sodium bicarbonate Telephone conversation Dr Close and Dr Gordon	Resuscitation record Statement of Dr Close
1031 hours	Telephone conversation	RSQ voice tape

Date/time	Entry	Source
	Simon, QCC, Sheree, Townsville and Dr Close	
1035 hours	Good CO2 trace and end tidal CO2 31 1.7mg adrenaline Retrieval team due in 1110 hours Telephone conversation Dr Close and Dr Stewart	Resuscitation record Statement of Dr Close
1037 hours	Telephone conversation Dr Close and Simon, QCC Simon, QCC and Sheree, Townsville (from 1:08min)	RSQ voice tape
1038 hours	Telephone conversation Dr Close and Joanna, RSQ	RSQ voice tape
1040 hours	Suctioned	Resuscitation record
1041 hours	1.7mg adrenaline	Resuscitation record
1046 hours	Blood gas taken	Resuscitation record
1053 hours	1.7mg adrenaline	Resuscitation record
1054 hours	CPR ceased. Kesler pronounced deceased	Resuscitation record