



IN THE CORONERS COURT
OF VICTORIA
AT MELBOURNE

Court Reference: COR 2019 1966

FINDING INTO DEATH WITHOUT INQUEST

Form 38 Rule 63(2)

Section 67 of the Coroners Act 2008

Findings of:	Caitlin English, Deputy State Coroner
Deceased:	BT
Date of birth:	3 December 1993
Date of death:	19 April 2019
Cause of death:	1(a) Multiple system failure 1(b) Ingestion of sodium nitrite
Place of death:	Royal Melbourne Hospital, 300 Grattan Street, Parkville, Victoria

INTRODUCTION

1. On 19 April 2019, BT was 25 years old when he died after he ingested sodium nitrite with the intention of taking his own life. At the time of his death, Mr BT lived at Moonee Ponds with his mother, MT.

THE CORONIAL INVESTIGATION

2. Mr BT's death was reported to the Coroner as it fell within the definition of a reportable death in the *Coroners Act 2008 (the Act)*. Reportable deaths include deaths that are unexpected, unnatural or violent, or result from accident or injury.
3. The role of a coroner is to independently investigate reportable deaths to establish, if possible, identity, medical cause of death, and surrounding circumstances. Surrounding circumstances are limited to events which are sufficiently proximate and causally related to the death. The purpose of a coronial investigation is to establish the facts, not to cast blame or determine criminal or civil liability.
4. Under the Act, coroners also have the important functions of helping to prevent deaths and promoting public health and safety and the administration of justice through the making of comments or recommendations in appropriate cases about any matter connected to the death under investigation.
5. The Victoria Police assigned an officer to be the Coroner's Investigator for the investigation of Mr BT's death. The Coroner's Investigator conducted inquiries on my behalf, including taking statements from witnesses – such as family, the forensic pathologist, treating clinicians and investigating officers – and submitted a coronial brief of evidence.
6. I also obtained statements from the Royal Melbourne Hospital and advice from the Coroners Prevention Unit as to the events leading to Mr BT's death.
7. This finding draws on the totality of the coronial investigation into Mr BT's death, including evidence contained in the coronial brief and the additional material I obtained. Whilst I have reviewed all the material, I will only refer to that which is directly relevant to my findings or necessary for narrative clarity. In the coronial jurisdiction, facts must be established on the balance of probabilities.¹

¹ Subject to the principles enunciated in *Briginshaw v Briginshaw* (1938) 60 CLR 336. The effect of this and similar authorities is that coroners should not make adverse findings against, or comments about, individuals unless the evidence

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

Identity of the deceased

8. On 19 April 2019, BT, born 3 December 1993, was visually identified by his mother, MT.
9. Identity is not in dispute and requires no further investigation.

Medical cause of death

10. Senior Forensic Pathologist, Dr Michael Burke, from the Victorian Institute of Forensic Medicine (VIFM), conducted an inspection on 22 April 2019 and provided a written report of his findings dated 24 June 2019.
11. Toxicological analysis of ante-mortem and post-mortem samples identified the presence of diazepam,² olanzapine,³ ranitidine,⁴ metoclopramide,⁵ paracetamol, lignocaine,⁶ and methaemoglobin.
12. Dr Burke provided an opinion that the medical cause of death was “*1(a) Multiple system failure*” and “*1(b) Probable ingestion of sodium nitrite*”.
13. Further toxicological analysis detected the presence of nitrate/nitrite. After receiving these results, Dr Burke provided a supplementary report dated 16 December 2019 in which he concluded that toxicological analysis for nitrates and nitrites showed evidence of an intentional overdose of sodium nitrite.
14. I accept Dr Burke’s opinion. However, given the further toxicological analysis and Dr Burke’s supplementary report in which he states that the evidence demonstrates Mr BT’s ingestion of sodium nitrite was intentional, I will remove “*probable*” from 1(b) and direct that the cause of death be amended to “*1(a) Multiple system failure*” and “*1(b) Ingestion of sodium nitrite*”.

provides a comfortable level of satisfaction as to those matters taking into account the consequences of such findings or comments.

² Diazepam is a sedative/hypnotic drug of the benzodiazepines class. Metabolites of diazepam include nordiazepam, temazepam, and oxazepam.

³ Olanzapine is an antipsychotic drug.

⁴ Ranitidine is used for the treatment of duodenal ulcer and gastric ulcer.

⁵ Metoclopramide is an anti-emetic drug used for the treatment of nausea and vomiting.

⁶ Lignocaine is a local anaesthetic often administered to patients prior to surgery or during resuscitation attempts.

Circumstances in which the death occurred

15. Mr BT was born in India. He, with his mother and older brother, migrated to New Zealand while he was a child. Mr BT's father joined them some years later but later passed away unexpectedly after a battle with mental illness. In 2012, Mr BT was diagnosed with bipolar affective disorder.
16. After obtaining a degree in finance marketing and working as a content writer for a period, Mr BT became unemployed. According to his mother, MT, unemployment had a detrimental effect on her son's mental health, and he began to experience severe depression and anxiety. He began to "*spiral*" and was unable to return to any form of work.
17. In August 2018, Mrs MT migrated to Australia for work.
18. Later that year, Mr BT decided to try electroconvulsive therapy to assist with his depression. Mrs MT stated that after the therapy failed to help, her son lost hope that he would ever feel better.
19. In March 2019, the family gathered in Calcutta in India for the funeral of Mr BT's grandfather. At this time, Mrs MT observed bandages on her son's wrists and when she asked him about them, he indicated he had self-harmed with the intention of taking his own life.
20. Concerned for her son's safety, Mrs MT decided her son would return with her to Australia. They subsequently arrived on 20 March 2019.
21. On 22 March 2019, Mr BT consulted Dr Hugh Gallagher at Monee Ponds Medical Centre. After reporting chronic depression and suicidal ideation, he was referred to a psychologist.
22. The next day, Mr BT was assessed at Waratah Clinic, Inner West Area Mental Health Service (which is part of NorthWestern Mental Health). He described his long-term struggle with mental illness, which had included multiple psychiatric admissions and trials of different medications. He had attempted to take his own life on three occasions, including the incident in India. He was thereafter overseen by the treating team at Waratah Clinic, which included the introduction of quetiapine and other medications.
23. On 24 March 2019, Mr BT again consulted Dr Gallagher with worsening depression and suicidal thoughts and was referred to the Royal Melbourne Hospital. Mr BT was subsequently admitted to the Royal Melbourne Hospital as a psychiatric inpatient for a period of two days.

24. On 2 April 2019, Mr BT returned to Dr Gallagher and complained of chronic insomnia, which had been previously managed with zopiclone. Dr Gallagher prescribed 28 tablets of zopiclone 7.5mg.
25. On 10 April 2019, Mrs MT arrived home to find her son in a disorientated state. He disclosed that he had taken some pills. Mrs MT monitored her son until the next morning at which time he revealed he had ingested 10 lorazepam pills. He was thereafter assessed by his key clinician at Waratah Clinic. Mr BT described his suicide attempt as impulsive. He did not want to be admitted to hospital but was agreeable to increased community psychiatric support and a crisis plan was discussed.
26. After becoming aware that Mr BT was accessing excessive amounts of prescribed benzodiazepines, his treating psychiatrist at Waratah Clinic cancelled his outstanding prescriptions given the potential for overdose with these medications. He remained on quetiapine. According to Mrs MT, the treating team at Waratah Clinic thereafter refused to prescribe lorazepam, which upset her son.
27. On 16 April 2019, Mr BT attended what was to be his last assessment at Waratah Clinic. He informed his doctor of his mother's plan to send him to a spiritual retreat in Thailand and requested one month's supply of his medication. Given the high level of risk and his recent overdose, he was informed that permission would need to be sought from his psychiatrist. At this point, Mr BT became frustrated and anxious and expressed an overwhelming desire to suicide. He noted that his mental health had not improved at all over the past several years and he could not identify any positive aspects in his life other than his mother. He was encouraged to use quetiapine to assist with his anxiety, the dose of which was increased to 50mg twice daily.
28. On 17 April 2019, Mr BT woke up "*very fresh*", which his mother thought was unusual. He thereafter went on an outing with his mother and aunt to Melbourne Zoo. Mrs MT recalled that her son was his usual self during this time. At approximately 2.30pm, Mr BT said he was feeling tired and wanted to go home to bed and returned home alone.
29. Approximately two hours later, Mr BT sent his mother a text message in which he said he felt suicidal and was making his way to hospital.
30. Mr BT arrived at the Royal Melbourne Hospital at 4.50pm. A short time later, he was joined by his mother and aunt.

31. During initial assessment, Mr BT reported increasing depression/ anxiety and suicidal ideation during the previous week. The emergency mental health clinician noted that Mr BT was settled and euthymic with apparent low risk of suicide, noting that Mr BT was feeling more intensely suicidal earlier that day. He agreed to remain in hospital overnight and be discharged the following morning for his scheduled review with his key clinician at the Waratah Clinic. He did not disclose any thoughts, plan, or intent to harm himself whilst in hospital. Collateral information was obtained from his key clinician at Waratah Clinic, including accessing benzodiazepines from multiple doctors and his current high risk of harm to self. His key clinician agreed with the proposed treatment plan.
32. The psychiatric nurse noted that Mr BT would likely benefit from PRN (as needed) medication overnight to ease his distress and promote rest.
33. Mr BT was eventually transferred to a room in the Behavioural Assessment Unit (**BAU**) for further assessment. His mother and aunt stayed with him until approximately 7.15pm.
34. Closed circuit television (**CCTV**) footage captured Mr BT leaving the room for two minutes at 8.16pm before he returned and got back into bed. He watched television until 8.54pm, when he got up and paced around the room.
35. At 9.01pm, Mr BT was given diazepam 5mg and olanzapine 10mg and he returned to bed to watch television. During the next half hour, Mr BT left his room on two occasions before returning to bed.
36. At 9.57pm, Mr BT got out of bed and walked over to a table. He removed a small packet from his pocket, which is now believed to have contained sodium nitrite. He opened the packet and poured the contents into a cup on the table before moving to a chair and then returning to bed.
37. At 10.03pm, Mr BT got out of bed and drank the contents of the cup and some water from another cup on the table. He returned to bed. Over the next 15 minutes, Mr BT got out of bed twice, and again drank from the cup containing the sodium nitrite and then water from the second cup. At 10.26pm, he sat in the chair in the corner of the room.
38. Less than 10 minutes later, two nurses entered the room and found Mr BT unresponsive in the chair. He rapidly deteriorated to cardiac arrest. He was provided with prolonged resuscitation attempts, including use of extracorporeal membrane oxygenation (**ECMO**, a form of heart lung bypass).

39. He was moved to the intensive care unit at 12.07am.
40. A diagnosis of severe methaemoglobinaemia was made, which is a disorder of the oxygen carrying protein in the blood that prevents it from carrying oxygen to the body. It may be induced by certain poisons, including sodium nitrite. A lethal dose is in the range of one to 10 grams.
41. Mr BT passed away at 4.13pm on 19 April 2019.
42. After his death, Mr BT's journal was found. His entry on 16 April 2019 indicates his intention to take his own life after enduring an indescribable amount of pain.

REVIEW OF CARE

43. As part of my investigation, I obtained advice from the Coroners Prevention Unit (CPU) regarding the mental and medical care Mr BT received from Waratah Clinic and the Royal Melbourne Hospital.
44. The CPU is staffed by healthcare professionals, including practising physicians and nurses. Importantly, these healthcare professionals are independent of the health professionals and institutions under consideration. They draw on their medical, nursing, and research experience to evaluate the clinical management and care provided in particular cases by reviewing the medical records, and any particular concerns which have been raised.
45. I also obtained further documents from the Royal Melbourne Hospital, including a statement from the psychiatric nurse who assessed Mr BT, a further statement from Associate Professor Mark Putland (Director of Emergency Medicine at Royal Melbourne Hospital), relevant policies and guidelines applicable to the BAU, and internal investigation documents.

Mental health care

Waratah Clinic

46. After reviewing the available evidence, the CPU advised that the care provided by Waratah Clinic was appropriate, proactive, and contemporary. I agree with and accept this advice.

Royal Melbourne Hospital

47. In June 2020, Mrs MT wrote to the Court outlining her concerns regarding the mental health care her son received at the Royal Melbourne Hospital. Her concerns included the following:

- (a) despite providing a history of her son's previous suicide attempts, staff did not monitor Mr BT; and
- (b) staff did not check whether Mr BT was carrying any substance or object with which he could harm himself.

48. The CPU noted Mr BT had taken himself to hospital because he felt unsafe in the context of increased suicidal thinking and he reported he felt safer at the time of assessment. He spent some time discussing his concerns with the psychiatric nurse and expressed a willingness to remain in hospital overnight to reduce the potential risk of harm to himself. He did not disclose any thoughts, plan, or intent to harm himself whilst in hospital. He engaged well with the psychiatric nurse and presented as forward planning and confirmed plans to engage with his community treatment team the next morning at his scheduled appointment.
49. The CPU identified the psychiatric nurse had recommended Mr BT to receive his regular medications in the emergency department and PRN medication as required.⁷ At that time, Mr BT's regular medication included quetiapine 50mg twice per day. However, I also note her statement, which notes she advised that Mr BT "*would likely benefit from PRN medication overnight to ease his distress*". In his further statement, Professor Putland confirmed that there is no record of Mr BT being administered 50mg of quetiapine on the evening of 17 April 2019.
50. Actions to prevent Mr BT from having brought the sodium nitrite into the BAU is problematic and was addressed by Professor Putland in his statement to Victoria Police. Professor Putland noted that as a voluntary patient, who was neither intoxicated or confused, and who had no history of bringing weapons into the hospital, Mr BT was not searched, and his belongings were not secured. He was managed in the least restrictive way possible. He did note that some voluntary patients in the BAU may be subjected to a 'pat down' search for weapons, and some large bags would be generally secured. However, the wallet of a voluntary patient who is alert would not routinely be opened or confiscated.
51. The CPU explained that Professor Putland's explanation was a reasonable representation of the usual practices of admitting and caring for patients in an emergency department/ BAU. Trying to prevent similar deaths through greater searching of people their belongings is unlikely to be practical and its legality not clear.

⁷ Transition/ Discharge Summary, dated 17 April 2019.

52. The CPU reviewed the policies and guidelines provided and noted that they appeared contemporary.
53. I am satisfied that Mr BT received appropriate mental health care at Royal Melbourne Hospital. There is no evidence that the administration of quetiapine would have prevented Mr BT's death, although it may have further reduced his anxiety.

Medical care

54. The hospital provided me with a copy of the Safer Care Victoria Sentinel Event Program Root Cause Analysis report (**the RCA**), dated 2 July 2019, and the Recommendation Monitoring Report, dated 8 October 2019.
55. The RCA identified that there was a delay in the recognition of methaemoglobinaemia, which meant that the opportunity to administer methylene blue in a timeframe that might have prevented hypoxic brain injury was lost.

Timeline of events after Mr BT was found unresponsive

56. The RCA outlined the following timeline after Mr BT was found at 10.26pm in an unresponsive state.
57. At 10.37pm, the first venous blood gas reading identified MetHb (methemoglobin) level of 70.1 percent, which was displayed at the point of care analyser screen and on the printout. I note that high levels of MetHb result in a form of hypoxia and can be lethal, particularly at levels over 70 percent.
58. Importantly, the normal/abnormal reference range was not included in the printout. This meant that the emergency department consultant did not identify the abnormal MetHb reading.
59. The abnormal result MetHb reading was not entered into Melbourne Health's Laboratory Information System (**LIS**), which does provide the normal ranges.
60. At 10.42pm a MET (medical emergency team) was called due to Mr BT deteriorating. He was thereafter intubated. As Mr BT's heart was not producing an output, further intensive resuscitation attempts commenced.
61. At 10.50pm, a Code Blue was called, and Mr BT was commenced on ECMO. When ECMO not effective, staff excluded the possibility of mechanical failure and raised the possibility of an unidentified poison given the brown colour of Mr BT's blood.

62. At 11.11pm and 11.12pm two further venous blood gas samples were completed but contaminated (because the results were taken from the arm with the intravenous cannula in place).
63. At 11.17pm a venous blood gas showed a MetHb level of 86.9 percent. This result was seen by staff at the point of care but, as above, was not available on the LIS nor were the reference ranges of the results.
64. At 11.23pm, Mr BT was transferred to theatre. At this stage, staff were still trying to work out what had caused his sudden deterioration while trying to resuscitate him.
65. At 12.22am the next morning, an arterial blood gas was completed, which showed MetHb at 88 percent. Because this was an arterial blood gas, it was available in the LIS, which gave staff access to the normal/abnormal reference ranges.
66. Identifying the abnormal level led staff to contact the poisons advice line at which time the toxicologist recommended commencing methylene blue and red cell exchange.
67. Over the following hours, staff continued to assess Mr BT's condition and liaised with his family regarding goals of care. The neurology team subsequently confirmed that Mr BT had suffered irreversible hypoxic brain injury.

Contributing factors

68. The RCA identified the following contributing factors that led to the delay in recognition of methaemoglobinaemia on venous blood gas and the missed opportunity of an earlier administration of methylene blue:
 - (a) as sodium nitrite is an unusual substance, it would require a high degree of suspicion to be identified in the emergency medicine setting;
 - (b) the printout from the point of care analyser was not configured to display reference ranges nor flag abnormal methaemoglobin; and
 - (c) the venous blood gases, including methaemoglobin, did not transmit to the LIS so that they did not display in the pathology viewer. It appears the functionality to include venous blood gases in the LIS should have occurred as part of the implementation of the LIS two years prior, but this did not occur.

Changes made at the Royal Melbourne Hospital

69. In his statement, Professor Putland acknowledged that methaemoglobinaemia is a very rare condition that is not routinely considered when managing a cardiac arrest. Since Mr BT's death, the hospital has made changes to the way it is reported on the blood gas tests, which are often taken during cardiac arrests, which will draw it to the attention of staff managing these patients.
70. The Recommendation and Monitoring Report identifies that within 24 hours of Mr BT's death, the point of care analyser was programmed to print out reference ranges and the venous blood gases are transmitted and displayed in the LIS viewer.
71. Methaemoglobin and carboxyhaemoglobin have also been added to the critical results list and an alert and escalation pathway has been implemented for abnormal results.

Conclusion regarding medical care

72. Mr BT's first blood gas showing an abnormal level of MetHb occurred at 10.37pm on 17 April 2019. The significance of the abnormal and rising MetHb was not recognised on further testing at 11.17pm. At 12.22am the next morning, the MetHb level was finally noted as abnormal because it was in the LIS (with the reference ranges).
73. The RCA noted the identification of sodium nitrite in the emergency department would have been difficult, however knowing the contributing drug was not as important as recognising the abnormal level of MetHb because when it was finally noted to be abnormal, the poisons line was contacted and provided treatment advice (before the causative drug was identified).
74. The abnormal MetHb levels should have been available to all the point of care clinicians (as print outs) given it appears there is heavy reliance on reference ranges to identify abnormalities in pathology results. None of the clinicians appeared to have recognised the abnormal or increasingly abnormal level of MetHb, especially in the circumstances of increasing deterioration and colour change in Mr BT's blood.
75. I am satisfied that the RCA recommendations and actions implemented by the hospital will decrease the likelihood that a failure to recognise an abnormal MetHb level will result in delayed appropriate treatment.

SODIUM NITRITE

76. The CPU also provided me with advice about sodium nitrite (NaNO_2), which is an inorganic compound similar in appearance to table salt: a white to slightly yellow crystalline powder which is odourless and soluble in water.
77. From an internet search, it appears that sodium nitrite is readily available to purchase online.
78. The *Australia New Zealand Food Standards Code* (Food Standards Code) permits the use of sodium nitrite as an additive to a range of food products including particularly meat, poultry, and game products. The salt inhibits bacterial growth that causes a common food poisoning known as botulism and preserves the attractive pink colour of the meat. Sodium nitrite is also used as a treatment for cyanide poisoning, as an anti-corrosive, and as a precursor in the manufacture of pharmaceuticals, dyes, and pesticides.⁸
79. In Australia, sodium nitrite is classified as a poison under Schedules 2, 5, 6 and 7 of the Commonwealth's *Standard for the Uniform Scheduling of Medicines and Poisons* (SUSMP, also known as the Poisons Standard); the concentration of sodium nitrite and its intended use determine the Schedule under which any substance containing sodium nitrite is regulated.
80. The sodium nitrite used in suicide is most often sold as a curing salt by food ingredient retailers and butcher suppliers, including online. These products have a sodium nitrite content ranging from 2 to 12 percent and are regulated under Schedule 6 of the SUSMP. Schedule 6 sodium nitrite is determined to present a moderate risk of harm; to reduce this risk, when sold for curing and pickling purposes it requires a cautionary label, which warns that its use may be dangerous.
81. As an additional safety measure to avoid accidental ingestion, curing mixes containing sodium nitrite are usually dyed pink to distinguish them from table salt, hence they are commonly known as 'pink salt'.
82. Preparations containing sodium nitrite above 40 percent concentration have a high potential to harm and are regulated as Schedule 7 poisons, which means they are only available to specialised or authorised users from chemical suppliers. These include its use in commercial,

⁸ Abdollahi M and Khaksar MR, "Sodium nitrite," in *Encyclopedia of Toxicology*, third edition, 2014, accessed via <<https://doi.org/10.1016/B978-0-12-386454-3.01206-9>>, accessed 15 December 2020.

medical, scientific and industrial settings. Domestic access and possession of Schedule 7 sodium nitrite is unlawful under the current legislation.

How sodium nitrite ingestion causes death

83. When sodium nitrite is ingested, haemoglobin (the protein in red blood cells that transports oxygen and carbon dioxide around the body) is oxidised to methaemoglobin, interfering with blood oxygen transport. This condition of elevated methaemoglobin level is called methaemoglobinaemia.
84. Clinical signs associated with elevated methaemoglobin levels are cyanotic skin discolouration and chocolate brown appearance of whole blood (present at methaemoglobin level of 10 to 20 percent in blood), headache and rapid heartbeat (20 to 30 percent), fatigue, confusion, dizziness and increasingly rapid heartbeat (30 to 50 percent); and coma, seizures, arrhythmias and acidosis (50 to 70 percent).⁹ A higher methaemoglobin level restricts oxygen to the brain, which in turn may cause central nervous system depression, hypoxia, and death.¹⁰
85. Two other important features of sodium nitrite poisoning are:
- (a) the oxidation of haemoglobin to methaemoglobin is reversed over time by protective enzymes in the human body. Therefore, a sufficiently high quantity of sodium nitrite must be ingested to result in death. The lethal dose has been estimated to be approximately three grams of sodium nitrite,¹¹ although a reliable case report from the United Kingdom identified a fatality following ingestion of only one gram;¹² and
 - (b) death by sodium nitrite has been documented to take approximately an hour between ingestion and death.¹³ A reason for this may be that humans can survive severe

⁹ Walker R, "The metabolism of dietary nitrites and nitrates," *Biochemical Society Transactions*, 24(3), 1996: 780-785.

¹⁰ Mansouri A and Lurie A, "Methemoglobinemia," *American Journal of Hematology*, 42(1), 1993: 7-12; Standefer JC and Jones AM, "Death associated with nitrite ingestion: Report of a case," *Journal of Forensic Science*, 24(4), 1979: 768-771.

¹¹ Nitschke P and Stewart F, "Lethal Inorganic Salts", in *The Peaceful Pill eHandbook*, 2017. The CPU obtained a print-out of this section of *The Peaceful Pill eHandbook* from another coronial investigation. The print-out is from 2017. The exact date is not known, but it would have been printed in September or later in the year, as this is when the chapter was added.

¹² Gowans WJ, "Fatal methaemoglobinaemia in a dental nurse. A case of sodium nitrite poisoning," *British Journal of General Practice*, 40, 1990: 470-471.

¹³ Standefer JC and Jones AM, "Death associated with nitrite ingestion: Report of a case," *Journal of Forensic Science*, 24(4), 1979: 768-771; Nishiguchi M, Nushida H, Okudaira N and Nishio H, "An autopsy case of fatal methemoglobinemia due to ingestion of sodium nitrite," *Journal of Forensic Research*, 6(1000262), 2015, doi:10.4172/2157-7145.1000262.

methaemoglobinaemia for short periods, with one case report describing a person who fully recovered from a methaemoglobin blood level of 92.7 percent.¹⁴

Sodium nitrite ingestion as a suicide method

86. Sodium nitrite ingestion has been promoted as a viable and effective suicide method by the voluntary euthanasia movement.
87. The CPU identified 20 confirmed sodium nitrite suicides between 2000 and 2020 (including Mr BT). However, I note that the VIFM is currently unable to test for the presence of nitrates and nitrites in blood; instead, this testing is done upon request by Queensland Health Forensic and Scientific Services if there is evidence to suggest it might be pertinent. This may mean that there may be cases where sodium nitrite toxicity has not been identified as a possible cause of death.
88. While there were no deaths between 2000 and 2016, since 2017 the rate has steadily increased as follows:
 - (a) one in 2017;
 - (b) three in 2018;
 - (c) eight in 2019; and
 - (d) eight in 2020 (as at 31 October 2020).
89. Of the 20 Victorian sodium nitrite suicides:
 - (a) 13 people were male (65 percent) and seven were female (35 percent);
 - (b) the highest suicide frequency by age group was the 18 to 24 range with six deaths (30 percent), followed by 35 to 45 group with four suicides (20 percent), and three suicides (15 percent) each between ages of 25 to 24, and 55 to 64;
 - (c) 16 people (80 percent) had history of mental disorder/s including depression, anxiety, schizoaffective disorder, and anorexia; and

¹⁴ Dela Cruz M, Glick J, Merker SH and Vearrier D, "Survival after severe methemoglobinemia secondary to sodium nitrate ingestion," *Toxicology Communications*, 2018, 2(1): 21-23.

(d) six people (30 percent) were diagnosed with physical ailments such as chronic pain, chronic obstructive pulmonary disease, and multiple sclerosis.

90. Post-mortem toxicological analysis detected the presence of metoclopramide or other anti-emetics in 13 people (65 percent). This detection is consistent with advice voluntary euthanasia advocates that people using sodium nitrite in suicide take an anti-emetic first to reduce the risk of the salty solution being vomited after ingestion.
91. Other pharmaceutical drugs were detected in 16 people (80 percent), including benzodiazepines, antidepressants, and opioids.

Potential prevention opportunities

92. To identify potential interventions to reduce the risk of sodium nitrite suicide, the CPU reviewed the extant literature on sodium nitrite suicide as well as relevant literature on sodium nitrite toxicity more broadly. In the review process, the CPU identified six potential areas for intervention as follows.

Education for clinicians

93. The need for clinicians to consider the possibility of methaemoglobinaemia in relevant patient presentations, and to know how to respond appropriately, was the most frequently mentioned prevention intervention in the literature. One research group suggested methaemoglobinaemia diagnosis should be considered for all patients who are:

[...] presenting after an intentional overdose with dark-appearing blood, cyanosis, hypoxia, and hemodynamic instability. Methylene blue should be administered immediately, with early repeat dosing, along with early consideration of RBC or exchange transfusions.¹⁵

94. The use of methylene blue is considered as the first-line antidote therapy in presentation of methaemoglobinaemia from suspected sodium nitrite toxicity.¹⁶ Whilst methaemoglobin levels of 70 percent and above are considered potentially lethal, methylene blue had been successful in treating a patient with an initial methaemoglobin level of 92.5 percent secondary

¹⁵ See Mudan A, Repplinger D, Lebin J, Lewis J, Vohra R and Smollin C, "Severe methemoglobinemia and death from intentional sodium nitrite ingestions," *Journal of Emergency Medicine*, 2020, 6(31): 1-4; Neth M, Love J, Horowitz Z, Shertz M, Sahni R and Daya MR, "Fatal sodium nitrite poisoning: Key considerations for prehospital providers," *Prehospital Emergency Care*, 2020, doi: 10.1080/10903127.2020.1838009.

¹⁶ Gowans WJ, "Fatal methaemoglobinaemia in a dental nurse. A case of sodium nitrite poisoning," *British Journal of General Practice*, 40, 1990: 470-471.

to ingesting sodium nitrite.¹⁷ It was subsequently noted that timely response can potentially reverse even the most extreme methaemoglobinaemia and save the patient's life.

95. There are a number of factors that favour this prevention intervention. The first is that sodium nitrite appears to be easily accessible. The second is that it is advertised as a practical form of suicide by voluntary euthanasia advocates. And the third is the increasing statistic of suicide attributed to sodium nitrite toxicity. These factors indicate that there will be an increase of cases of nitrite toxicity in future.
96. Sodium nitrite toxicity is currently uncommon in ordinary hospital practice. Most clinicians will never have to treat it during their career. As Professor Putland acknowledged, in over 20 years of clinical practice, this was the first time he had come across a case of in hospital cardiac arrest related to methaemoglobinaemia. A benefit of education is that if treating clinicians can suspect the problem early enough, then life-saving treatment may be possible.
97. For these reasons and given the difficulties in recognising the cause for Mr BT's deterioration, I will direct my finding be distributed to the Australasian College for Emergency Medicine and Safer Care Victoria for education purposes. Any reproduction of my finding or details of Mr BT's case should be deidentified before publication.

Taking down online information about sodium nitrite

98. The second most frequently mentioned intervention was to target online sources of information about sodium nitrite as a suicide method. The basis of this recommendation was that most people who intentionally self-harmed by taking sodium nitrite had learned about the method online.¹⁸ One study revealed the importance of preventing and fighting existing suicide information networks over the internet, particularly networks through which 'suicide kits' can be purchased and delivered while circumventing customs controls.¹⁹
99. While to date no Victorian coroner has considered restrictions on information about sodium nitrite suicide, the issue of controlling information about other suicide methods has been

¹⁷ Katabami K, Hayakawa M and Gando S, "Severe methemoglobinemia due to sodium nitrite poisoning," *Case Reports in Emergency Medicine*, 2016, doi: 10.1155/2016/9013816.

¹⁸ Mudan A, Replinger D, Lebin J, Lewis J, Vohra R and Smollin C, "Severe methemoglobinemia and death from intentional sodium nitrite ingestions," *Journal of Emergency Medicine*, 2020, 6(31): 1-4.

¹⁹ Durao C, Pedrosa F and Dinis-Oliveira RJ, "A fatal case by a suicide kit containing sodium nitrite ordered on the internet," *Journal of Forensic and Legal Medicine*, 2020, 73; doi: 10.1016/j.jflm. 2020.101989.

considered.²⁰ However, in both cases it was acknowledged that there was no practical method to prevent people viewing and accessing this material online.

Safe storage in the workplace

100. Sodium nitrite is used across a range of industries and therefore readily accessible on various work sites: not only food retailers but research and medical institutions, dentist surgeries, plants that produce pesticides and dye and pharmaceuticals.
101. The need to ensure sodium nitrite present in workplaces is stored safely, was mentioned in a United Kingdom case study:

*The toxicity of sodium nitrite tablets is not widely known, despite their widespread use in the medical and dental professions. If they are to be kept on surgery premises at all then secure storage must be guaranteed.*²¹

102. In Victoria, at least two people were believed to have sourced sodium nitrite from their workplace. The recommendation thus likely has limited utility in Victoria due to the low frequency of relevant deaths.

Public awareness campaigns

103. One study proposed a public awareness campaign highlighting the dangers of sodium nitrite.²² However, there was little detail about how such a campaign would be executed, and the CPU was concerned that such a campaign may further disseminate knowledge of the method (which contradicts the imperative noted above to restrict this information), while not being clear as to how public awareness might at the same time reduce risks.

Restricting access to sodium nitrite

104. One study proposed restricting access to sodium nitrite generally.²³ While this proposal is theoretically sound as means restriction is the suicide intervention with the highest level of evidence for efficacy, sodium nitrite is widely used for legitimate purposes in many different

²⁰ In COR 20074986 (unpublished) and in COR 2014 0169 Finding into death without inquest regarding WJ, dated 21 September 2015 (published).

²¹ Gowans WJ, "Fatal methaemoglobinaemia in a dental nurse. A case of sodium nitrite poisoning," *British Journal of General Practice*, 40, 1990: 470-471.

²² Mudan A, Replinger D, Lebin J, Lewis J, Vohra R and Smollin C, "Severe methemoglobinemia and death from intentional sodium nitrite ingestions," *Journal of Emergency Medicine*, 2020, 6(31): 1-4.

²³ Mudan A, Replinger D, Lebin J, Lewis J, Vohra R and Smollin C, "Severe methemoglobinemia and death from intentional sodium nitrite ingestions," *Journal of Emergency Medicine*, 2020, 6(31): 1-4.

areas, and of particular note, an alternative to sodium nitrite as a multifunctional food additive in cured meats has not been identified despite significant research effort.²⁴ Therefore, this does not appear to be a practical intervention opportunity.

Increased focus on investigation of sodium nitrite suicides

105. While not strictly a prevention intervention as such, one study suggested that death investigators should be aware of the possibility of sodium nitrite toxicity and should have processes in place to test for this as a mechanism of death.²⁵ This points to a potential route to future prevention insights.
106. At present in Victoria we have limited knowledge of where people are sourcing sodium nitrite for suicide, and in what form. If coroners prioritised establishing sodium nitrite sources in their investigations, and also establishing how people learned about the suicide method, it is possible that we might be able to develop a better evidence base for prevention recommendations in the future.
107. In a similar vein, I note the work of the Victorian Suicide Register (VSR).

VICTORIAN SUICIDE REGISTER

108. The VSR is a database containing detailed information on suicides that have been reported to and investigated by Victorian Coroners between 1 January 2000 and the present.
109. The VSR indicates the annual frequency of suicides occurring in the state of Victoria has been steadily increasing for the past decade, from 537 deaths in 2010 to 726 deaths in 2019.
110. The annual Victorian suicide rate for the period 2010 to 2019 ranged from 9.8 suicides per 100,000 people (2010) to 11.3 suicides per 100,000 people (2018).
111. The proportion of suicides by history of diagnosed or suspected mental ill health between 2009 and 2016 was 55.7 percent (for those diagnosed) and 19.8 percent (for those suspected but not diagnosed).
112. The primary purpose of gathering suicide data in the VSR is to assist Coroners with prevention-oriented aspects of their suicide death investigations. VSR data is often used to

²⁴ Alahakoon AU, Jayasena DD, Ramachandra S and Jo C, "Alternatives to nitrite in processed meat: Up to date," *Trends in Food Science & Technology*, 2015, 45(1): 37-49.

²⁵ Durao C, Pedrosa F and Dinis-Oliveira RJ, "A fatal case by a suicide kit containing sodium nitrite ordered on the internet," *Journal of Forensic and Legal Medicine*, 2020, 73; doi: 10.1016/j.jflm. 2020.101989.

contextualise an individual suicide with respect to other similar suicides; this can generate insights into broader patterns and trends and themes not immediately apparent from the individual death, which in turn can lead to recommendations to reduce the risk that further such suicides will occur in the future.

113. So much is still unknown about suicide and, given that every suicide occurs in unique circumstances to a person with a unique history and life experience, possibly there is much we will never be able to quantify and understand. But through recording information about each individual suicide in the VSR, particularly information about the health and other services with whom the person had contact, and then looking at what has happened across time and across people, we hope the VSR can at least lead us to new understandings of how people who are suicidal might better be supported in our community.

FINDINGS AND CONCLUSION

114. Pursuant to section 67(1) of the Act I make the following findings:
- (a) the identity of the deceased was BT, born 3 December 1993;
 - (b) the death occurred on 19 April 2019 at Royal Melbourne Hospital, 300 Grattan Street, Parkville, Victoria, from multiple system failure and ingestion of sodium nitrite; and
 - (c) the death occurred in the circumstances described above.
115. Having considered all of the evidence, I am satisfied that Mr BT intentionally took his own life.
116. I offer my sincere condolences to Mr BT's family for their loss.

Pursuant to section 49(2) of the Act, I direct the Registrar of Births, Deaths and Marriages to amend the cause of death to “*1(a) Multiple system failure*” and “*1(b) Ingestion of sodium nitrite*”.

Pursuant to section 73(1A) of the Act, I order that this finding be published on the Coroners Court of Victoria website in accordance with the rules.

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

MT, senior next of kin
NorthWestern Mental Health (Melbourne Health)
Royal Melbourne Hospital
Office of the Chief Psychiatrist
Safer Care Victoria
Australasian College for Emergency Medicine
Registrar of Births, Deaths and Marriages
Senior Constable Jason Barry-Bassett, Victoria Police, Coroner’s Investigator

Signature:

C. English



CAITLIN ENGLISH
DEPUTY STATE CORONER

Date: 19 March 2021

NOTE: Under section 83 of the *Coroners Act 2008* (the Act), a person with sufficient interest in an investigation may appeal to the Trial Division of the Supreme Court against the findings of a coroner in respect of a death after an investigation. An appeal must be made within six months after the day on which the determination is made, unless the Supreme Court grants leave to appeal out of time under section 86 of the Act.
