The Health and Wellbeing of Aboriginal and Torres Strait Islander Adolescents and Young People: Opportunities for Applied Epidemiology

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Originality Statement

‘I hereby declare that this submission is my own work and to the best of my knowledge it contains no materials previously published or written by another person, or substantial proportions of material which have been accepted for the award of any other degree or diploma at Australian National University or any other educational institution, except where due acknowledgement is made in the thesis. Any contribution made to the research by others, with whom I have worked is explicitly acknowledged within this thesis. I also declare that the intellectual content of this thesis is the product of my own work, except to the extent that assistance from others in the project’s design and conception or in style, presentation or linguistic expression is acknowledged’.

Signed: 

Acknowledgements

Firstly, I'd like to acknowledge the Centre for Research Excellence in Aboriginal Sexual Health and Blood-Borne Viruses, and the Fay Fuller Foundation for your support and funding of my Master of Philosophy in Applied Epidemiology (MAE).

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I dedicate this thesis to the future, Stephen John.

Abstract

My MAE was undertaken at the South Australian Health and Medical Research Institute (SAHMRI), during 2018-2019. My studies focussed on the health and wellbeing of adolescent and young Aboriginal and Torres Strait Islander peoples, with the exception of my outbreak project. My studies included:

Analysis of public health dataset – A retrospective study of South Australian adolescents aged 10-24 years utilising data from the Integrated South Australian Activity Collection dataset. The aim of the study was to assess leading causes and trends in hospital separations among adolescents in South Australia (SA) between 2006 and 2015, by sex, age groups and Aboriginal status. Counts and proportions of leading causes of separation were calculated as age-standardised rates and negative binominal regression was used to assess trend over time.

Epidemiological study – Let's Talk About It 2019, an online survey of sexual health, knowledge, behaviours and access to health services for sexually transmitted infections (STI) and bloodborne viruses (BBV), amongst young South Australians aged 16-29 years, both Aboriginal and Torres Strait Islander and non-Indigenous. Descriptive analysis, univariate and adjusted logistic regression models were used to determine whether socio-demographic characteristics and sexual risk behaviours were associated with specific behaviours.

Evaluation of a public health surveillance system – The preliminary evaluation of the ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network – a national sentinel surveillance system within Aboriginal community-controlled health services (ACCHS). The evaluation of ATLAS involved a document review, stakeholder interviews and analysis of ATLAS data using the Centers for Disease Control and Prevention (United States of America) *Updated Guidelines for Evaluating Public Health Surveillance Systems*. I assessed the following attributes: acceptability, simplicity, flexibility, data quality, representativeness, timeliness, stability, and usefulness.

Outbreak investigation – An epidemiological investigation and a retrospective case-control study of an outbreak of *Salmonella* Havana in alfalfa sprouts, in Adelaide. The outbreak was conducted during June and July 2018 with colleagues from SA Health. Investigations identified the most likely source to be alfalfa sprouts. Public health action lead to a consumer level recall of all alfalfa sprout products and public health alert.

Teaching – This chapter outlines two teaching sessions, (i) a teaching session to first year MAE scholars, on a Single Overarching Communication Outcome (SOCO) in relation to the communication of a public health message; and (ii) a Lessons From the Field to my fellow scholars, on 'Conducting research with Aboriginal and Torres Strait Islander communities'.

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Chapter 1. Introduction and overview of my Master of Philosophy in Applied Epidemiology experience

1.1. Acknowledgement

I would like to acknowledge Aboriginal and Torres Strait Islander people as the oldest continuous living culture in the world and recognise the diversity that existing among Aboriginal and Torres Strait Islander people. I would like to also acknowledge elders, past, present and future, for your knowledge and authority, and unwavering resolve for our people. Finally, Iwould like to acknowledge the Aboriginal and Torres Strait Islander people who have informed or contributed to this thesis, or who this thesis is about.

1.2. Positioning and standpoint

As a Nurrunga and Ngarrindjeri man from South Australia, I have a deep connection to this country. My sense of belonging to country and its peoples is the driving force behind what I do and what I want my mob to achieve. It is central to who I am as a person and shapes my beliefs and values and how I see the world.

My concept of health and wellbeing has been shaped by my lived experience and those of my family and community, and is articulated perfectly by the aunties and uncles who drafted the 1989 National Aboriginal Health Strategy and defined Aboriginal and Torres Strait Islander health as;

> *[N]ot just the physical wellbeing of an individual but refers to the social, emotional and cultural wellbeing of the whole Community in which each individual is able to achieve their full potential as a human being, thereby bringing about the total wellbeing of their Community. It is a whole-of-life view and includes the cyclical concept of life-death-life*. (1)

Furthermore, my concept of health and wellbeing is guided by the Universal Declaration of Human Rights and the United Nations Declaration on the Rights of Indigenous Peoples.

The Universal Declaration of Human Rights, Article 25 (1) states,

> *Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control. (2)*

The United Nations Declaration on the Rights of Indigenous Peoples, Articles 21 (1) & 24 (2) states,

Indigenous peoples have the right, without discrimination, to the improvement of their […], health….

Indigenous individuals have an equal right to the enjoyment of the highest attainable standard of physical and mental health. (3)

These documents enshrine and promote the right to a common standard of health and wellbeing that should be afforded to all humans and informs the practice of a human rights-based approach to health, which is a guiding principle in many aspects of Aboriginal and Torres Strait Islander health and wellbeing, which I support.

My motivation in pursuing the Master of Philosophy in Applied Epidemiology (MAE) builds on my innate determination to make a difference. The MAE has broadened my knowledge base and provided opportunities to utilise applied epidemiology in my pursuit to improve the health and wellbeing of Aboriginal and Torres Strait Islander people and future generations.

1.3. Aboriginal and Torres Strait Islander people

Throughout this thesis I use the terms Aboriginal and Torres Strait Islander. Within the context of South Australia (SA), I used the preferred term Aboriginal to refer to the original inhabitants of SA (Chapter 2); however, I also used the term Aboriginal and or Torres Strait Islander to refer to those individuals who have identify as such in Chapter 3. Within the national context, where appropriate I have used the term Aboriginal and Torres Strait Islander (Chapter 4).

1.4. Field placement

My MAE placement was at the Wardliparingga Aboriginal Health Equity theme at SAHMRI. Within Wardliparingga, I undertook my projects with the Sexual Health and Wellbeing, and the Population Health platforms.

The Sexual Health and Wellbeing platform is led by Professor James Ward, a descendent of the Pitjantjatjara and Nurrunga clans of Central and South Australia; whose research program aims to address disparities existing between Aboriginal and non-Aboriginal Australians across sexual health, blood borne viruses and alcohol and illicit drug use, with a focus on research engaging strength-based approaches and existing agency within communities.

The Population Health platform is led by Dr Odette Pearson, an eastern Kuku Yalanji and Torres Strait Islander women from North Queensland. The platform utilises epidemiological

monitoring and data sciences to measure health inequalities, with a focus on the use of administrative data to support Aboriginal services and government agencies to better handle and understand existing data sources, and adequately manage and curate data of relevance to Aboriginal and Torres Strait Islander health and social outcomes in a culturally appropriate manner. In addition to my time at SAHMRI, I also spent time at the Communicable Disease Control Branch, Department of Health and Aging (SA Health), SA, where I conducted my outbreak investigation project.

In addition, to the projects presented in this thesis, I had two opportunities throughout my MAE to apply epidemiology in the field. The first opportunity was as a volunteer epidemiologist at the Australian Jamboree 2019, hosted by Scouts SA and held at Tailem Bend, SA. Over the course of five days, I was immersed in the frenzy that was Jamboree. I was engaged with the medical team and the health and safety team; spent a morning with an Environmental Health Officer from the local council inspecting food outlets, food storage facilities, the pool and toilet and shower facilities at Jamboree; and assisted with the investigation of unwell participants who had experienced vomiting and diarrhoea. It was later reported that several of the unwell participants had norovirus, however, many of the others were related to heat exhaustion and dehydration.

The second opportunity for shoe-leather epidemiology was 19 days spent in Samoa, as a team leader for the Surveillance and Monitoring to Eliminate Lymphatic Filariasis and Scabies from Samoa: SaMELFS Samoa project. I was involved in the mosquito survey component of the study and was responsible for supervision of SaMELFS field members including both Australian and Samoan Red Cross team members. This included overseeing the preparation for each village visit and trap setting, collections and sorting and pooling of mosquitoes in the laboratory; data management, including checking for completeness and cleaning of data; management of finances and payments for accommodation, vehicle hire and petrol, allowances for Samoan Red Cross workers, and supplies; and reporting to project leaders, including drafting of a weekly report. It was a fantastic learning opportunity. Although I learnt a lot, I also strengthened skills that I had previously acquired from other fieldwork, research and projects. However, it was my soft skills that I developed the most. I am thankful for this experience. It is opportunities such as this that provide invaluable experiences as a MAE scholar and as an epidemiologist, it has enriched my overall MAE experience.

1.5. Thesis structure and competencies

This thesis meets the core competency of the MAE in the subsequent chapters, as listed in Table 1.1. Chapter two presents a retrospective study of South Australian adolescents aged 10-24 years using data from the Integrated South Australian Activity Collection dataset. The aim of the study was to assess leading causes and trends in hospital separations among adolescents in SA between 2006 and 2015, by sex, age groups and Aboriginal status. Counts and proportions of leading causes of separation were calculated as age-standardised rates and negative binominal regression was used to assess trend over time. This study fulfils the requirements of analysis of a public health dataset and was presented at three separate conferences.

TABLE 1.1: SUMMARY OF CORE COMPETENCIES, MASTER OF PHILOSOPHY IN APPLIED EPIDEMIOLOGY

	Chapter 2	Chapter 3	Chapter 4	Chapter 5	Chapter 6
Field projects					
Analyse a public health dataset	X				
Conduct an epidemiological study		X			
Evaluate a surveillance system			X		
Investigate an acute public health problem				X	
Additional requirements					
Complete a literature review			X		
Report to a non-scientific audience				X	
Publish a peer review journal article				X	
Complete an oral presentation	X				
Teaching					
Lessons from the field					X
Teaching to the first year MAEs					X

Chapter three explores the results of Let's Talk About It 2019. An online survey of sexual health, knowledge, behaviours and access to health services in relation to sexually transmitted infections (STI) and bloodborne viruses (BBV) amongst young South Australians aged 16-29 years, both Aboriginal and/or Torres Strait Islander and non-Indigenous. Descriptive analysis, univariate and adjusted logistic regression models were used to determine whether socio-demographic characteristics and sexual risk behaviours were associated with specific behaviours. This study fulfils the requirements of conducting an epidemiological study.

Chapter four fulfils the requirements of evaluating a surveillance system. The preliminary evaluation of the ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network – a national sentinel surveillance system within ACCHS. The evaluation of ATLAS involved a document review, stakeholder interviews and analysis of ATLAS data using the Centers for Disease Control and Prevention (United States of America) *Updated Guidelines for Evaluating Public Health Surveillance Systems*. A literature review was undertaken as part of the evaluation.

Chapter five presents the outcomes of an epidemiological investigation and a retrospective case-control study into an outbreak of *Salmonella* Havana in alfalfa sprouts, in Adelaide, South Australia. The outbreak was conducted during June and July 2018 with colleagues from SA Health. Epidemiological investigation and a retrospective case-control study identified the most likely source to be alfalfa sprouts. This project fulfils the requirements of an outbreak investigation and the requirements of a report to a non-scientific audience (ministerial brief) and was published as a peer review journal article in *Communicable Diseases Intelligence*.

Chapter six outlines two teaching sessions, which fulfil the teaching requirements of the MAE; (i) a teaching session to first year MAE scholars on a Single Overarching Communication Outcome (SOCO) in relation to the communication of a public health message; and (ii) a Lessons From the Field to my fellow scholars on 'Conducting research with Aboriginal and Torres Strait Islander communities'.

1.6. Summary of public health impact

Three of my chapters focused on the health and wellbeing of Aboriginal and Torres Strait Islander adolescents and young people. This stage of life is often considered an important period in which the foundations for later life health and wellbeing are established. Unfortunately, much of the adversity experienced by Aboriginal and Torres Strait Islander adolescents and young people during this period is the result of the ongoing effects of colonisation and intergenerational trauma. Therefore, addressing the inequalities experienced by Aboriginal and Torres Strait Islander adolescents and young people deserves attention and investment.

The data analysis project focused on the leading causes of public hospital separations among adolescents in SA between 2006-2015. Overall, there was minimal change in causes and rates of separation in adolescents during the study period. However, Aboriginal adolescents had significantly higher age-standardised rates for all separations than non-Aboriginal adolescents. The findings provide an evidence base for policy reform and program

development, and for improving health care delivery for adolescents in SA. The findings are also relevant to better understanding of drivers of morbidity and the health needs of this population nationally.

The epidemiological study explored the sexual health, knowledge, behaviours and access to health services in relation to STI and BBV amongst young South Australians, both Aboriginal and Torres Strait Islander and non-Indigenous. Overall, young South Australians are engaged in behaviours which increases their risk of acquiring STI. This evidence is important for informing public health practice and policy development, and development of STI and BBV preventative health programs – particularly those targeting young Aboriginal and/or Torres Strait Islander people.

The evaluation of a surveillance system assessed the ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network ability to provide important information and data on STI and BBV among the Aboriginal and Torres Strait population. It was agreed ATLAS is a useful addition to enhanced efforts in STI and BBV control. The utilisation of ACCHS, provides a unique opportunity to strengthen STI and BBV testing, care and management for health services, and improve surveillance, monitoring and evaluation of STI and BBV. Overall, ATLAS has the potential to enhance the current knowledge of STI and BBV among the Aboriginal and Torres Strait Islander population, by identifying where to target interventions and informing clinical guidelines and policy, ultimately reducing disease burden.

1.7. References

1. National Aboriginal Health Strategy Working Party. National Aboriginal Health Strategy. Caberra, Australia. 1989.
2. UN General Assembly. Universal Declaration of Human Rights. 1984.
3. UN General Assembly. The United Nations Declaration on the Rights of Indigenous Peoples. 2007.

Chapter 2: Leading causes of adolescent hospital separations in South Australia by Aboriginal status, 2006-2015

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Abbreviations and acronyms

ASR	Age-standardised rates
CI	Confidence intervals
ISAAC	Integrated South Australian Activity Collection
ICD-10	International Statistical Classification of Diseases and Related Health Problems 10th Revision
SA	South Australia
SA Health	South Australian Department for Health and Wellbeing

2.1. Prologue

I would like to acknowledge the adolescents whose data was provided for this project.

2.1.1. My role

My analysis of a public health dataset project involved:

- drafting a study proposal and data analysis plan
- obtaining ethics approval
- liaising with/seeking the advice of specialists regarding trend analysis
- constructing a dataset from an administrative dataset
- cleaning and recoding variables
- data analysis and interpretation
- drafting of initial and subsequent versions of the chapter
- obtaining feedback and comments on the chapter from co-investigators and supervisors
- liaising with data custodians for approval of the chapter.

2.1.2. Lessons learnt

I learnt three important lessons from this project. The first lesson: itis important to manage your data including the analysis and results. Itis a lesson I am still learning to grasp. This dataset contained 333,096 observations across several different variables. The analysis, including stratification by age, sex and Indigenous status produced 10 times more information than I started with. This has been a lot to contend with, particularly when it is the first time you have ever done quantitative analysis such as this. What helped was ensuring that every Stata do-file, dataset, MS Excel file and spreadsheet, table and graph was appropriately labelled and marked and saved in a logical structure.

Second lesson: there is such a thing as too much ANALYSIS!!! I have lost count of the number of times I have analysed and presented results from this dataset. The challenge has been undertaking this journey of discovery to understand the data and what the data is telling me. Having never used or analysed data like this before, I am grateful to have had the assistance of people who understand this dataset and population better than I do.

Finally, the third lesson: the presentation of data and results is important to the story you want to tell. Part of the challenge in telling the story is working out the best format in which the results should be presented to convey the story you want to tell. In the end I found myself asking the following questions to determine what results to present and in what format: ‘Does this answer my question?’; ‘What is the important message I am trying to relay?’; and

'Is it significant and noteworthy?'. If I couldn't answer yes to all three, it wasn't highlighted within the text or included at all.

2.1.3. Public health implications

Administrative datasets provide a wealth of knowledge about a population. Often that information is not intended to be used for research purposes. However, administrative datasets are increasingly used to answer research questions, as they provide valuable insight into a population. Also, and importantly, we must remember that data represents people; we must respect the data and honour the knowledge provided by that information, in a way that is a strength-based approach. This is critically important when that data involves Aboriginal and Torres Strait Islander (hereafter Aboriginal) people.

This study is the first analysis of public hospital separation data in South Australia (SA) to identify the leading causes of hospitalisation for Aboriginal and non-Aboriginal adolescents. Pregnancy, childbirth and the puerperium; injury, poisoning and certain other consequences of external causes; mental and behavioural disorders; and diseases of the digestive system were the leading causes of separation among all adolescents and age-standardised rates were significantly higher among Aboriginal adolescents than non-Aboriginal adolescents. The results from this study will be useful in informing policy, programs and health care delivery for adolescents in SA. The results could potentially also be applied nationally to understand drivers of morbidity and the health needs of this population across jurisdictions.

2.1.4. Acknowledgements

I would like to acknowledge my co-authors and supervisors for their support and guidance: Dr Odette Pearson, Professor James Ward, Dr Tambri Housen and Dr Peter Azzopardi. A particular mention to Ms Victoria Shtangey, whose knowledge and experience of the data was invaluable; I am forever grateful for your time and commitment; and to Dr Alice Richardson for her guidance and support with all things trend and regression analysis. Finally, I would like to acknowledge the Landscape Governance Group for its support, and the South Australian Department for Health and Wellbeing for its approval of this chapter.

2.1.5. MAE core requirements

This project fulfils the analysis of a public health dataset project component of the Master of Philosophy in Applied Epidemiology. The project was presented at the South Australian State Population Health Conference, 1 December 2018, Adelaide; Australian Association for Adolescent Health Youth Health Conference, 7-9 November 2018, Gold Coast; and Lowitja Institute International Indigenous Health and Wellbeing Conference, 18-20 June 2019,

Darwin (Appendix 2.C). A version of this chapter will also be drafted into a manuscript for publication in a peer reviewed journal.

2.2. Abstract

2.2.1. Objective

To investigate leading causes and trends in adolescent hospital separations in South Australia.

2.2.2. Design, setting and participants

A retrospective study of South Australian adolescents (aged 10-24 years) hospitalised in public hospitals, during the period 1 January 2006 – 31 December 2015. Data were extracted from the Integrated South Australian Activity Collection.

2.2.3. Outcomes measures

Methods: Leading causes of separation were defined by primary diagnosis coded according to the International Statistical Classification of Diseases and Related Health Problems, Australian modification. Counts and proportions of leading causes of separation were calculated as age-standardised rates by sex, age groups (10-14, 15-19 and 20-24 years) and by Aboriginal status. Age-standardised rates were calculated using estimated population census data relevant to the study period. Negative binominal regression was used to assess trend over time. Separations at private hospitals where Aboriginal status was unknown, and for people living in the far northern region of the state where hospital access occurs predominantly across the border in the Northern Territory, were excluded.

2.2.4. Results

Overall, our study included 333,096 separations by adolescents, comprising three percent of all hospital separations during the study period. Females had the highest proportion of separations (62%), and separations increased with each age group. Aboriginal adolescents comprised six percent of all adolescent separations. Leading causes of separation were pregnancy, childbirth and the puerperium; injury, poisoning and certain other consequences of external causes; mental and behavioural disorders; and diseases of the digestive system. Aboriginal adolescents had significantly higher age-standardised rates of separation for all causes than non-Aboriginal adolescents. Overall, there was minimal change in causes and rates of separation in adolescents during the study period.

2.2.5. Conclusion

During the study period, the leading causes of separations in South Australia were similar for all adolescents; however, significantly higher rates of separation among Aboriginal adolescents are of concern, as Aboriginal adolescent often experience inequitable outcomes. This is the first analysis of hospital separation data focusing on adolescents in South Australia, and the findings provide an evidence base for policy reform and program development, and

for improving health care delivery for adolescents in this jurisdiction. The findings are also relevant to better understanding of drivers of morbidity and the health needs of this population nationally.

2.3. Introduction

It is estimated that there are 1.8 billon adolescents aged 10-24 years old in the world today, comprising 25% of the global population (1). This is the largest cohort of adolescents in the world's history (2). Adolescence is often regarded as a period of peak health; however, for the majority of adolescents this is not the case, with 89% of the world's adolescents living in less developed countries (1). This presents significant challenges to achieving equitable health and wellbeing of adolescents when poverty and limited access to health care and education are known drivers of morbidity (2). Further, marginalised populations – including ethnic minorities, Indigenous and tribal peoples, offenders, gender and sexually diverse populations, and refugees – face far greater challenges to their health and wellbeing (2).

In Australia, adolescents generally experience relatively good health. However, Aboriginal adolescents disproportionately experience ill health and report lower levels of wellbeing in comparison to their non-Aboriginal counterparts (3). A study by Azzopardi *et al.* on the health and wellbeing of adolescents in Australia found Aboriginal adolescents 'had a mortality rate of 70 per 100,000 per year on average, more than twice that of non-Indigenous adolescents' (4, p770). In addition, mortality risk increased with age, and was most noticeable among males in mid-to-late adolescence (4). The hospital separation rates for Aboriginal adolescents for pregnancy, ischaemic heart disease, stroke and intentional self-harm were twice that of non-Aboriginal adolescents; four times higher for pneumonia; and six times higher for endocarditis and assault-related injury. Separations due to type 2 diabetes for Aboriginal adolescents were more than 10 times that for non-Aboriginal adolescents (4). Other reports have shown higher rates of morbidity attributable to injury, psychiatric disorders, and poor sexual and reproductive health outcomes among Aboriginal adolescents (3, 5-8). Similarly, disparities in health and hospital separations are experienced by Indigenous adolescents in New Zealand (9, 10), Canada (11, 12) and the United States of America (13-15).

Understanding leading causes for hospital separations can inform policy, programs and health care delivery for adolescents. In this study we assessed leading causes and trends in hospital separations among adolescents in South Australia (SA) between 2006 and 2015, by sex, age group (10-14, 15-19 and 20-24 years), and by Aboriginal status.

2.4. Methods

This study is a retrospective data analysis of adolescent (aged 10-24 years) (2, 16, 17) hospital separation data from South Australia, during the period 1 January 2006 – 31 December 2015. Data were extracted from the Integrated South Australian Activity Collection (ISAAC).

The ISAAC is a database of routinely collected hospital separation data from all public and private hospitals in SA, administered by the South Australian Department of Health and Wellbeing (SA Health), and primarily collected for funding purposes. Variables within the ISAAC dataset, and used in this analysis, were primary diagnoses coded according to the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10), Australian modification (18-20); and separation year, gender, age, and Aboriginal status. Data were de-identified, representing all hospital separations during the study period and not attributable to an individual.

Some data were excluded, including private hospital separations, observations with Aboriginal status unknown, and adolescents not resident in South Australia. Almost 90% of separations for Aboriginal people occur at public hospitals (21). Further, residents of the Anangu Pitjantjatjara Yankunytjatjara Lands were excluded, as this community generally accesses hospital care in the Northern Territory (22).

2.4.1. Statistical analysis

The outcome measure of interest was primary reason for hospital separation, reported by primary diagnosis. The number of separations was calculated for all adolescents and stratified by sex, age group and by Aboriginal status.

The primary diagnosis as listed in the data was used to identify and describe the causes and rates of hospital separations. Hospital separation data were aggregated into ICD-10 chapters. The focus of our analysis was on the leading ICD-10 chapters accounting for the greatest proportion of separations. These were further analysed by sex, Aboriginal status and three age groups (10-14, 15-19, 20-24 years).

Numbers and age-standardised rates (ASR) per 1,000 population were calculated. Population census estimates from the Australian Bureau of Statistics for 2006, 2011 and 2015, and estimates in between census years generated by Prometheus Pty Ltd (Appendix 2.A), were used to calculate direct age-standardised separation rates (23), using `distrate`, a Stata user written command (24). Incidence rate ratios were calculated to compare Aboriginal and non-Aboriginal age-standardised rates.

After assessing the distribution of data, negative binominal regression was used to assess trend over time (year-on-year), with the number of hospital separations by ICD-10 chapter as the dependent variable, time (in years) as the independent variable and population size as the offset, expressed as incidence rate ratios. Data were reported with 95% confidence intervals (CI) and the significance level was set at 0.05. Statistical analyses were performed with the statistical software Stata version 15 (25). Graphs were generated using Stata and MS Excel 2016 (26).

2.4.2. Ethics approval

This study sits within a broader project, *The Aboriginal Health Landscape: Identifying and monitoring Aboriginal health disparities in South Australia* (27). The project obtained ethics approval from the South Australian Department of Health and Wellbeing (SA Health) (HREC/14/SAH/22), the Aboriginal Human Research Ethics Committee (South Australia) (HREC 04-14-546), and the Human Research Ethics Committee of the Australian National University (HREC 2018/399).

2.5. Results

The ISAAC dataset included 498,291 (5%) hospital separations of adolescents age 10-24 years separated from all South Australian hospitals. Of these 165,195 (33%) separation observations were excluded from the dataset, including: private hospital separations (n=142,384), observations where Aboriginal status was unknown (n=14,371), separations for adolescents not resident in SA (n= 8,145), and separations for residents of the Anangu Pitjantjatjara Yankunytjatjara Lands (n=292); and an additional three (n=3) observations were excluded due to ICD-10 coding error. The final dataset for analysis included 333,096 observations representing 3% of all hospital separations in the study period.

Overall, females accounted for the majority (n=204,850, 62%) of separations and proportionately, separations increased with each five-year age group. Aboriginal adolescents comprised 20,513 (6%) of all separations and Aboriginal females comprised a larger proportion of separations in this population than non-Aboriginal female adolescents (69% vs 61%) (Table 2.1).

2.5.1. Leading causes and rates of hospital separations for all adolescents

The top four causes for separations, by ICD-10 chapter, for all adolescents were: (i) pregnancy, childbirth and the puerperium (O00-O99) (pregnancy) (n=72,818, 22%); (ii) injury, poisoning and other related external causes (S00-T98) (injury) (n=56,656, 17%); (iii) diseases

of the digestive system (K00-K93) (digestive system) (n=32,858, 10%); and (iv) mental and behavioural disorders (F00-F99) (n=25,228, 8%) (Table 2.2). These four causes accounted for 57% of all adolescent separations, with the remaining separations distributed across the remaining 16 ICD-10 chapters (Appendix 2.B).

TABLE 2.1: CHARACTERISTICS OF HOSPITAL SEPARATIONS BY ABORIGINAL STATUS, SOUTH AUSTRALIAN ADOLESCENTS 10 – 24 YEARS, 2006-2015

Characteristics	Aboriginal n *(%)*	non-Aboriginal n *(%)*	All adolescents n *(%)*
Separations	20,513	312,583	333,096
	(6.2%)	(93.8%)	(100%)
Sex			
Male	6,432	121,814	128,246
	(31.4%)	(39.0%)	(38.5%)
Female	14,081	190,769	204,850
	(68.6%)	(61.0%)	(61.5%)
Age groups			
10-14 years	3,073	58,716	61,789
	(15.0%)	(18.8%)	(18.5%)
15-19 years	6,915	108,274	115,189
	(33.7%)	(34.6%)	(34.6%)
20-24 years	10,525	145,593	156,118
	(51.3%)	(46.6%)	(46.9%)

Among females, pregnancy, and among males, injury, were the leading causes accounting for 36% and 29% of separations, respectively. Further, the ASR for injury among males was 75% higher than for females (22.5 vs 12.8 per 1000 population) and by age groups, other than pregnancy, injury was the leading cause for separation (Table 2.2).

2.5.2. Hospital separations and rates by Aboriginal status

The ASR for all causes of hospital separations among Aboriginal adolescents was 193.5 per 1,000 (CI: 190.8-196.1), almost double the ASR of 100.4 per 1,000 (CI: 100.0-100.7) for non-Aboriginal adolescents (data not shown). Pregnancy and injury were the two leading causes for separations for both Aboriginal and non-Aboriginal adolescents, followed by mental health and digestive system for Aboriginal adolescents; whereas digestive system and mental health were the third and fourth leading causes among non-Aboriginal adolescents (Table 2.2). Among Aboriginal adolescents aged 10-24 years, age-standardised incidence rate ratios for mental health, pregnancy, injury and digestive were 3.1 (CI: 2.86-3.30), 2.5 (CI: 2.43-2.62), 1.7 (CI: 1.66-1.80) and 1.2 (CI: 1.10-1.14) times higher, respectively, than non-Aboriginal

adolescents aged 10-24 years for the same causes (Table 2.2 and Figure 2.1). The ASR for all causes of hospitalisation increased with age for both Aboriginal and non-Aboriginal adolescents (Table 2.3).

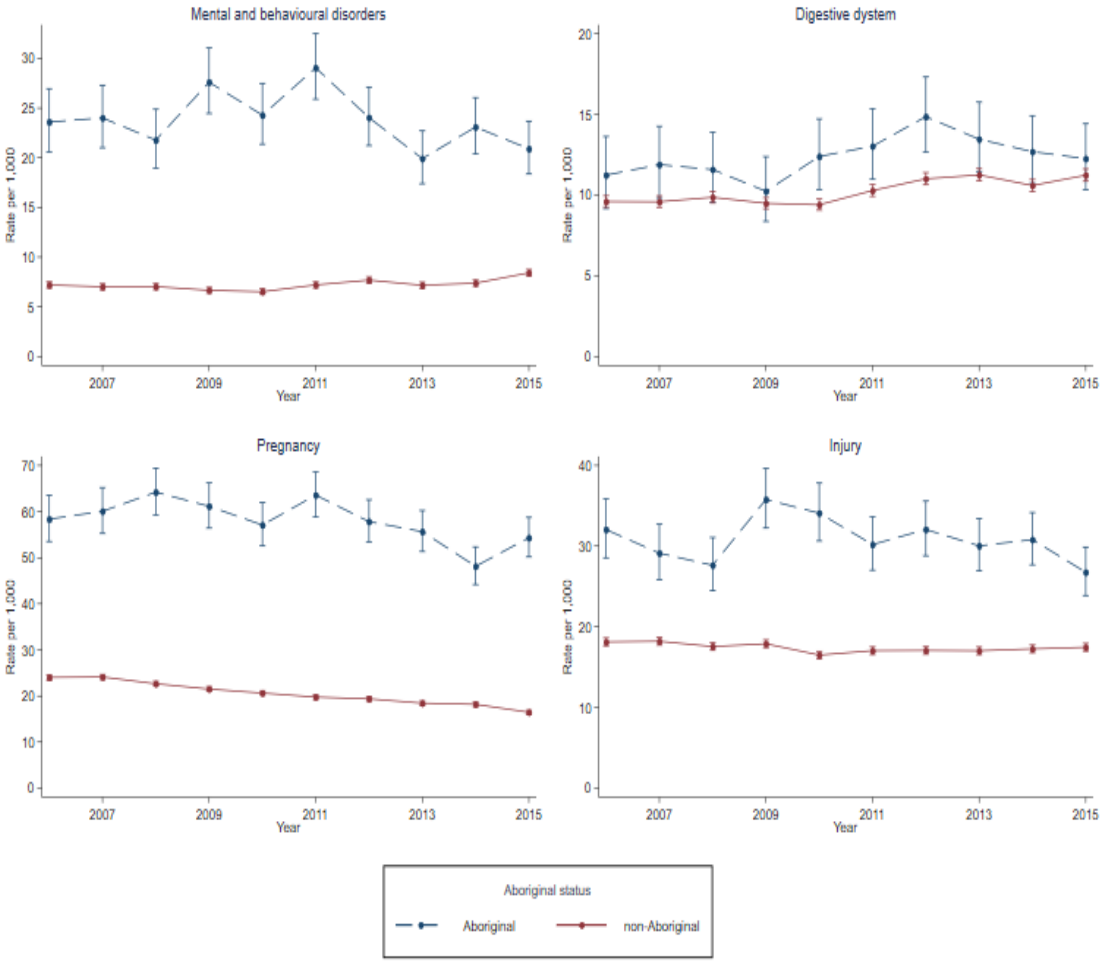
TABLE 2.2: AGE-STANDARDISED RATES AND INCIDENCE RATE RATIOS FOR LEADING CAUSES OF HOSPITAL SEPARATIONS, BY SEX AND AGE GROUP STRATIFIED BY ABORIGINAL STATUS, SOUTH AUSTRALIAN ADOLESCENTS 10 – 24 YEARS, 2006-2015

	Aboriginal		non-Aboriginal			Aboriginal		non-Aboriginal		
	n *(%)*	Rate* (CI)	n *(%)*	Rate* (CI)	IRR[α] (CI)	n *(%)*	Rate* (CI)	n *(%)*	Rate* (CI)	IRR[α] (CI)
IDC-10 chapter	**Male**					**Female**				
Pregnancy, childbirth and the puerperium (O00-O99)	-	-	-	-	-	6,018 (42.7%)	118.2 (115.21-121.20)	66,800 (35.0%)	42.1 (41.78-42.42)	2.5 (2.43-2.61
Injury, poisoning and certain other consequences of external causes (S00-T98)	1,970 (30.6%)	35.8 (34.28-37.47)	34,837 (28.6%)	22.1 (21.91-22.38)	1.5 (1.51-1.67)	1,338 (9.5%)	25.5 (24.17-26.93)	18,511 (9.7%)	12.4 (12.25-12.61)	2.0 (1.88-2.13)
Diseases of the digestive system (K00-K93)	1,201 (18.7%)	22.3 (21.09-3.94)	14,208 (11.7%)	9.1 (8.91-9.21)	1.2 (1.05-1.25)	1,303 (9.3%)	14.1 (13.19-15.25)	17,325 (9.1%)	11.4 (11.28-11.63)	1.2 (1.09-1.28)
Mental and behavioural disorders (F00-F99)	584 (9.1%)	10.6 (9.80-1.55)	10,556 (8.7%)	6.5 (6.35-6.60)	3.2 (2.96-3.43)	741 (5.3%)	25.2 (23.88-26.64)	12,168 (6.4%)	8.0 (7.87-8.15)	3.0 (2.74-3.21)
	10-14 years					**15-19 years**				
Pregnancy, childbirth and the puerperium (O00-O99)	54 (1.8%)	1.4 (1.03-1.78)	204 (0.3%)	0.2 (0.19-0.25)	6.3 (4.34-9.24)	2,149 (31.1%)	57.6 (55.26-60.16)	17,122 (15.8%)	16.9 (16.67-17.18)	3.5 (3.24-3.74)
Injury, poisoning and certain other consequences of external causes (S00-T98)	714 (23.2%)	18.0 (16.74-9.42)	13,364 (22.8%)	14.1 (13.88-14.36)	1.3 (1.18-1.39)	1,229 (17.8%)	32.9 (31.16-34.88)	20,799 (19.2%)	20.5 (20.28-20.84)	1.6 (1.51-1.71)
Diseases of the digestive system (K00-K93)	181 (5.9%)	8.2 (7.32-9.13)	7,122 (12.1%)	7.5 (7.35-7.70)	1.1 (0.94-1.22)	990 (14.3%)	10.1 (9.07-11.13)	11,789 (15.8%)	11.6 (11.44-11.86)	0.9 (0.77-0.96)
Mental and behavioural disorders (F00-F99)	324 (10.5%)	4.6 (3.93-5.39)	1,837 (3.1%)	1.9 (1.85-2.03)	2.4 (1.98-2.80)	375 (5.4%)	26.5 (24.94-28.27)	9,752 (9.0%)	9.6 (9.45-9.83)	2.8 (2.50-3.05)
	20-24 year					**10-24 years**				
Pregnancy, childbirth and the puerperium (O00-O99)	3,815 (36.2%)	57.8 (56.39-59.33)	49,474 (34.0%)	20.4 (20.35-20.66)	2.5 (2.43-2.62)	6,018 (29.3%)	116.7 (113.02-120.46)	66,800 (21.4%)	45.2 (44.88-45.68)	2.6 (2.49-2.69)

	Aboriginal		non-Aboriginal			Aboriginal		non-Aboriginal		
	n *(%)*	Rate* (CI)	n *(%)*	Rate* (CI)	IRR$^{\alpha}$ (CI)	n *(%)*	Rate* (CI)	n *(%)*	Rate* (CI)	IRR$^{\alpha}$ (CI)
Injury, poisoning and certain other consequences of external causes (S00-T98)	1,365 (13.0%)	30.7 (29.75-31.86)	19,185 (13.2%)	17.4 (17.27-17.56)	1.7 (1.66-1.80)	3,308 (16.1%)	41.7 (39.56-44.02)	53,348 (17.1%)	17.5 (17.31-17.81)	2.4 (2.23-2.55)
Diseases of the digestive system (K00-K93)	1,333 (12.7%)	12.3 (11.72-13.07)	12,622 (8.7%)	10.2 (10.1-10.3)	1.2 (1.10-1.14)	2,504 (12.2%)	19.1 (17.67-20.70)	31,533 (10.1%)	11.5 (11.35-11.75)	1.7 (1.50-1.83)
Mental and behavioural disorders (F00-F99)	626 (5.9%)	23.7 (22.84-24.71)	11,135 (7.6%)	7.2 (7.12-7.31)	3.1 (2.86-3.30)	1,325 (6.5%)	40.7 (38.61-43.02)	22,724 (7.3%)	10.1 (10.00-10.38)	4.0 (3.64-4.41)

*Rates are age-standardised rates per 1,000 adolescents calculated using population estimates generated by Prometheus Pty Ltd (Appendix 2.B). IRR$^{\alpha}$ – Incidence Rate Ratios, comparing Aboriginal and non-Aboriginal age-standardised rates. CI – Confidence Interval.

FIGURE 2.1 AGE-STANDARDISED RATE PER 1,000 ADOLESCENTS, LEADING CAUSES FOR HOSPITAL SEPARATIONS, BY ABORIGINAL STATUS, SOUTH AUSTRALIAN ADOLESCENTS AGED 10-24 YEARS, 2006-2015



N.B. Confidence intervals for non-Aboriginal adolescents have been included but are too small to clearly identify.

2.5.3. Trends in hospital separations

During the study period, among all adolescents, there were small changes in the rates for the leading causes for separation by age, gender and Aboriginal status as noted in Table 2.3 and Figure 2.1.

TABLE 2.3: TRENDS OVERTIME, COMPARING YEAR-ON-YEAR, IN HOSPITAL SEPARATIONS BY LEADING CAUSES, SOUTH AUSTRALIA ADOLESCENTS 10 – 24 YEARS, 2006-2015

	Pregnancy		Injury		Digestive system		Mental health	
	↑↓ (95% CI)	p-value	↑↓ (95% CI)	p-value	↑↓ (95% CI)	p-value	↑↓ (95% CI)	p-value
Sex								
Male	-	-	↓ (0.97-0.98)	<0.001	↑ (1.01-1.03)	<0.001	↓ (0.99-1.01)	0.459
Female	↓ (0.96-0.97)	<0.001	↓ (1.01-1.02)	<0.001	↑ (1.00-1.02)	<0.001	↑ (1.02-1.04)	<0.001
Age group								
10-14 years	↓ (0.84-0.97)	0.009	↓ (0.99-1.01)	0.518	↑ (1.02-1.05)	<0.001	↑ (0.99-1.04)	0.291
15-19 years	↓ (0.92-0.94)	<0.001	↓ (0.99-1.00)	0.087	↑ (1.02-1.04)	<0.001	↑ (1.02-1.05)	<0.001
20-24 years	↓ (0.97-0.98)	<0.001	↓ (0.97-0.99)	0.009	↑ (1.00-1.02)	0.122	↔ (0.98-1.01)	0.621
Aboriginal status								
Aboriginal	↓ (0.97-0.99)	0.027	↓ (0.98-1.01)	0.470	↑ (1.00-1.04)	0.013	↓ (0.99-1.01)	0.438
Non-Aboriginal	↓ (0.96-0.97)	<0.001	↓ (0.98-0.99)	0.024	↑ (1.01-1.02)	<0.001	↑ (1.00-1.03)	0.006
Sex & Aboriginal status								
Male & Aboriginal	-	-	↓ (0.97-1.02)	0.881	↑ (0.99-1.05)	0.202	↓ (0.95-1.00)	0.020
Male & non-Aboriginal	-	-	↓ (0.98-0.99)	<0.001	↑ (1.02-1.03)	<0.001	↓ (0.99-1.00)	0.770
Female & Aboriginal	↓ (0.97-0.99)	0.011	↓ (0.97-1.00)	0.197	↑ (0.99-1.07)	0.137	↑ (0.99-1.04)	0.396
Female & non-Aboriginal	↓ (0.96-0.97)	<0.001	↑ (1.01-1.02)	<0.001	↑ (1.01-1.03)	<0.001	↑ (1.02-1.05)	<0.001
Age group & Aboriginal status								
10-14 years & Aboriginal	↓ (0.79-0.96)	0.008	↑ (0.98-1.04)	0.556	↑ (1.06-1.17)	<0.001	↑ (0.97-1.07)	0.543

	Pregnancy		Injury		Digestive system		Mental health	
	↑↓ (95% CI)	p-value	↑↓ (95% CI)	p-value	↑↓ (95% CI)	p-value	↑↓ (95% CI)	p-value
10-14 years & non-Aboriginal	↓ (0.85-0.99)	0.028	↑ (0.99-1.01)	0.609	↑ (1.01-1.04)	<0.001	↑ (0.99-1.04)	0.370
15-19 years & Aboriginal	↓ (0.95-0.98)	<0.001	↓ (0.95-1.01)	0.154	↑ (1.01-1.09)	0.010	↓ (0.96-1.01)	0.283
15-19 years & non-Aboriginal	↓ (0.92-0.94)	<0.001	↓ (0.99-1.00)	0.100	↑ (1.02-1.04)	<0.001	↑ (1.02-1.05)	<0.001
20-24 years & Aboriginal	↓ (0.98-1.01)	0.336	↓ (0.97-1.02)	0.652	↓ (0.93-1.00)	0.073	↓ (0.96-1.02)	0.339
20-24 years & non-Aboriginal	↓ (0.97-0.98)	<0.001	↓ (0.98-1.00)	0.010	↑ (1.00-1.02)	0.079	↓ (0.98-1.01)	0.644

Trend was calculated using Negative Binomial Regression, comparing year-on-year (2006-2015) and is reported as either an increase (↑) or decrease (↓) in ASR.

2.6. Discussion

This detailed analysis of public hospital separation data for South Australian adolescents is the first of its kind with a focus on Aboriginal adolescents. Overall, pregnancy, injury, mental health, and the digestive system were the leading causes of hospital separation among all adolescents. Separations calculated as ASR were significantly higher among Aboriginal adolescents than for their non-Aboriginal peers. We found little or no change in the causes and rates of separations during the 10-year period.

Our results are consistent with national data for both Aboriginal and non-Aboriginal adolescents. A report by the Australian Institute of Health and Welfare on Aboriginal adolescent health and wellbeing (3), showed differences in separation rates for Aboriginal people. Overall separation rates for Aboriginal adolescents were higher and increased with age. A study by Azzopardi *et al.* (2018) (4), also indicated separation rates for Aboriginal adolescents were significantly higher than non-Aboriginal adolescents. These trends were consistent with overall national population separations characteristics (28, 29).

Aboriginal adolescents experience similar levels of disparity in relation to separations, illness and disease as other Indigenous adolescents across the globe (2, 30). For example, in Aotearoa (New Zealand), separations were higher among young Māori people aged 15–24 years compared to their non-Māori counterparts, and the most common reasons for separations were pregnancy, injury or poisoning, and mental health related admissions (9). Similarly, in Canada, ASR separation rates for First Nations, Métis and Inuit adolescents aged 10-19 years were considerably higher than for their non-Aboriginal counterparts, and pregnancy and injury were the leading causes of separation (11).

The high rate of separations for mental health, pregnancy and injury among Aboriginal adolescents is due to complex and diverse factors. The causes of mental health issues are multifaceted, however, several factors have been identified that contribute to poor mental health among the Aboriginal population, including among adolescents. These include the ongoing effects of colonisation and intergeneration trauma (31-33), loss of culture and identity (32, 34), death of a family member or close friend (32, 35, 36), serious illness or accident (35), alcohol or drug-related problems (32, 35, 36), racism and discrimination (36, 37), and socioeconomic disadvantage (32, 35).

It is well known that Aboriginal females give birth at a younger age compared to non-Aboriginal females (38, 39). The reasons for this are unclear, although several factors have been associated with pregnancy during adolescence, such as social attitudes and behaviours,

family history of teenage pregnancy, socioeconomic disadvantage, and a one-parent family structure (40-44). A study by Larkins et al. (43) investigated social attitudes and behaviours of young Indigenous people with regard to relationships and pregnancy. They found the most common reasons for not using or inconsistent contraception use was unplanned sex, contraception was not considered or "I don't think I/she will get pregnant" (43). Several studies indicate low socioeconomic status (access and attainment of education, employment, parental income) is a risk factor for earlier age at first sexual intercourse and increased risk of teenage pregnancy particularly among minority groups (45-48). What is clear is that adolescent mothers experience disadvantage because of their younger age. Babies born to adolescent mothers are at greater risk of being born pre-term, of low birthweight and are more likely to suffer higher morbidity and mortality throughout their life (38, 39).

Injury is one of the leading causes of morbidity and mortality among Aboriginal adolescents for all injury types (3). Limited evidence exists on the underlying risk factors for injury among Aboriginal adolescents, however, several studies have shown a relationship between risk taking, social disadvantage and living in remote communities. A study by Cercarelli and Knuiman (49) identified an increase in hospitalisation due to road traffic injury was significantly associated with being male, aged between 0–14 years and living in rural areas. Other studies found that lower socioeconomic status and remoteness was associated with an increased risk of unintentional injury (50), risk taking behaviour and being male (51, 52). A possible explanation as to why these factors are associated with higher rates of injury is that those living in remote areas tend to be more socioeconomically disadvantaged (53), and those who are disadvantaged are exposed to a wider range of hazards in their environment (54).

Unfortunately, the inequalities experienced by Aboriginal adolescents reflect those of Aboriginal peoples across the life course (4). Adolescence is often considered an important period to mitigate and reduce inequalities (30). It is a life stage in which the foundations for later life health and wellbeing are established (2, 30), and efforts to address these inequalities will have an impact on the long-term health of Aboriginal communities. The adversity experienced by Aboriginal adolescents such as the ongoing effects of colonisation and intergenerational trauma (31-33), has been associated with increased risk of mental health conditions, particularly among those whose parent or primary carer was forcibly separated from their family. Adolescence is a critical period of life and addressing the inequalities experienced by Aboriginal adolescents deserves attention and investment.

Azzopardi *et al.* suggest 'current national adolescent health policies and programmes will not be sufficient to improve the specific health needs of Indigenous adolescents' (4 p779). Further, concerns should be raised regarding the lack of inclusion of adolescents and their health in key South Australian strategic health documents such as the *SA Health Strategic Plan 2017 to 2020 (55)* and the *Health and Wellbeing Strategy 2019 to 2020* (56). Resnick and colleagues in the second *Lancet* series on adolescent health, argue that 'failure to invest in the health of the largest generation of adolescents in the world's history jeopardises earlier investments in maternal and child health, erodes future quality and length of life, and escalates suffering, inequality, and social instability' (57 p1565).

So, what can be done to address adolescent separations and ultimately adolescent health and wellbeing? While pregnancy is not an illness, it is an important stage of life. Action is required to prevent unplanned pregnancy during early adolescence and strengthen antenatal services' capacity to engage female adolescents and their families in antenatal care, to ensure they are supported and can reach full-term without complications. A review by Savage (58), found limited evidence on what works to prevent pregnancy during adolescence. Sexual and reproductive programs that are school and or community-based, linked to contraceptive services and developed in conjunction with adolescents, have had some impact on reducing pregnancy during adolescents (58).

A greater public health response is required to address the rates of injury in adolescents. Any response to injury prevention should consider that injury related separations increase with age and are more likely to occur in males. Similarly, a focus on adolescent mental health is needed particularly at the community level, on prevention and early intervention tailored for and by the community and addressing the upstream social determinants of social and emotional wellbeing, have demonstrated to be effective (32, 59). Prevention of disease of the digestive system should focus on oral health care (60-62) and nutrition (63). Additionally, any response to addressing adolescent health should include primary health care, oral health, health promotion and prevention, sexual health, the social determinants of health and education (4).

Overall, a targeted investment into adolescent health is required. The study results draw attention to where investment should be focused on in future policy and programs to reduce the leading causes of separation for adolescents in SA. One way this can be done is through the development of an adolescent health strategy for SA that incorporates all aspects of adolescent health and wellbeing and considers the social and cultural determinants of health,

including actions specifically targeting Aboriginal young people. Development of the strategy must involve adolescents themselves and be innovative and bold and reflect the diversity that exists among adolescents of today. If governments are serious about enabling a healthy ageing population and closing the gap in disparities between the Aboriginal and non-Aboriginal population, they must invest in adolescent health.

2.7. Limitations

This study is limited by its retrospective design. The data is from an administrative dataset which limits the type of analysis that can be conducted, as the primary purpose is not to explore research questions. Separation data provides insight into health end points rather than burden of disease; therefore, these results must not be interpreted as a complete picture of adolescent health. Furthermore, primary diagnosis was used to identify cause of separation, excluding additional diagnosis, thus a holistic picture of each separation cannot be considered. Additionally, a proportion of adolescent hospital separations were not included. There were 142,384 private hospital separations excluded. Other analysis of hospital separation data show that a very small proportion of Aboriginal people use private hospitals (21).With this in mind, the inclusion of private hospital separations would have slightly increased the estimates but unlikely to change the top 5 conditions for both Aboriginal and non-Aboriginal adolescents. However, the inclusion of these separations may reduce the disparity in rates of hospitalisation for particular conditions, between Aboriginal and non-Aboriginal adolescents, although not to the point of reaching equitable outcomes. The exclusion of Anangu Pitjantjatjara Yankunytjatjara Lands adolescents due to incomplete data capture is a major limitation in that the results of this study are not inclusive of South Australia's Aboriginal adolescent population. It is highly likely that the inclusion of adolescents residing in the Anangu Pitjantjatjara Yankunytjatjara Lands, is likely to have increased the Aboriginal estimates. The ABS 2016 census estimated 589 Aboriginal adolescents between the age of 10 and 24 resided in the Anangu Pitjantjatjara Yankunytjatjara Lands at this time, a proportion of whom would have been hospitalised during the study period. Lastly, the under-reporting of Aboriginal status in the dataset can result in an understatement of morbidity patterns among Aboriginal people (64), which can prevent the delivery of targeted services to Aboriginal people where need is highest. Additionally, it is unclear if under-reporting of among Aboriginal people occurs for certain conditions, this may affect estimates.

2.8. Conclusion

Hospital separation data can be used to understand causes for adolescent separations and provide insight into adolescent health needs. Pregnancy, injury, digestive system and mental health were the leading causes for adolescent contact with the hospital system in SA. Knowing this can help inform and influence policy, programs and health care delivery, by addressing the issues of most concern and where the greatest impact to improving adolescent health and wellbeing can occur.

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Appendix 2.A

South Australian population estimates by sex and age group stratified by Aboriginal Status, 2006-2015

Year	Male				Female				All adolescents
	10-14 years n	15-19 years n	20-24 years n	10-24 years n	10-14 years n	15-19 years n	20-24 years n	10-24 years n	Total n
	All adolescents								
2006	51,672	53,152	54,549	159,373	49,188	50,179	52,386	151,753	311,126
2007	51,429	53,973	55,558	160,960	48,903	50,941	53,217	153,061	314,021
2008	51,119	54,602	56,390	162,111	48,728	51,619	53,934	154,281	316,392
2009	51,093	54,608	58,032	163,733	48,690	52,044	54,872	155,606	319,339
2010	50,734	54,544	59,009	164,287	48,460	51,816	55,964	156,240	320,527
2011	50,145	54,265	59,129	163,539	48,112	51,543	55,923	155,578	319,117
2012	50,008	53,862	59,204	163,074	47,800	51,218	55,960	154,978	318,052
2013	49,750	53,542	59,206	162,498	47,589	50,887	55,718	154,194	316,692
2014	49,846	53,616	58,794	162,256	47,243	51,147	55,635	154,025	316,281
2015	49,850	52,973	58,845	161,667	47,288	50,679	55,563	153,531	315,198
	Aboriginal								
2006	1,999	1,811	1,520	5,330	1,769	1,749	1,507	5,025	10,355
2007	2,056	1,882	1,589	5,527	1,867	1,751	1,617	5,235	10,762
2008	2,078	1,940	1,645	5,663	1,960	1,781	1,659	5,400	11,063
2009	2,088	2,004	1,703	5,795	2,040	1,823	1,687	5,550	11,345
2010	2,128	2,055	1,742	5,925	2,116	1,871	1,716	5,703	11,628
2011	2,158	2,071	1,825	6,054	2,155	1,888	1,794	5,837	11,891
2012	2,156	2,117	1,888	6,161	2,131	1,975	1,793	5,899	12,060
2013	2,161	2,133	1,945	6,239	2,115	2,059	1,821	5,995	12,234
2014	2,148	2,142	2,003	6,293	2,130	2,128	1,862	6,120	12,413
2015	2,138	2,176	2,051	6,365	2,101	2,192	1,908	6,201	12,566
	Non-Aboriginal								
2006	49,673	51,341	53,029	154,043	47,419	48,430	50,879	146,728	300,771
2007	49,373	52,091	53,969	155,433	47,036	49,190	51,600	147,826	303,259
2008	49,041	52,662	54,745	156,448	46,768	49,838	52,275	148,881	305,329
2009	49,005	52,604	56,329	157,938	46,650	50,221	53,185	150,056	307,994
2010	48,606	52,489	57,267	158,362	46,344	49,945	54,248	150,537	308,899
2011	47,987	52,194	57,304	157,485	45,957	49,655	54,129	149,741	307,226
2012	47,852	51,745	57,316	156,913	45,669	49,243	54,167	149,079	305,992
2013	47,589	51,409	57,261	156,259	45,474	48,828	53,897	148,199	304,458
2014	47,698	51,474	56,791	155,963	45,113	49,019	53,773	147,905	303,868
2015	47,711	50,797	56,793	155,302	45,187	48,488	53,655	147,330	302,632

Appendix 2.B

Age-standardised rates for leading causes of hospital separations, by sex and age group stratified by Aboriginal status, South Australian adolescents, 2006-2015

IDC-10 primary diagnosis category	Male		Female		10-14 years		15-19 years		20-24 years		10-24 years	
	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)
	All adolescents											
	N=128,246		N=204,850		N=61,789		N=115,189		N=156,118		N=333,096	
Pregnancy, childbirth and the puerperium (O00-O99)	-	-	72,818 (35.5%)	44.5 (44.20-44.85)	258 (0.4%)	0.3 (0.23-0.30)	19,271 (16.7%)	18.3 (18.12-18.64)	53,289 (34.1%)	47.3 (46.96-47.77)	72,818 (21.9%)	21.6 (21.52-21.84)
Injury, poisoning and certain other consequences of external causes (S00-T98)	36,807 (28.7%)	22.5 (22.36-22.82)	19,849 (9.7%)	12.8 (12.67-13.03)	14,078 (22.8%)	14.2 (14.05-14.52)	22,028 (19.1%)	21.0 (20.73-21.28)	20,550 (13.2%)	18.2 (18.02-18.52)	56,656 (17.0%)	17.8 (17.70-18.00)
Diseases of the digestive system (K00-K93)	14,792 (11.5%)	9.1 (8.95-9.25)	18,066 (8.8%)	11.5 (11.37-11.71)	7,446 (12.1%)	7.6 (7.38-7.72)	12,164 (10.6%)	11.5 (11.39-11.81)	13,248 (8.5%)	11.7 (11.57-11.98)	32,858 (9.9%)	10.2 (10.18-10.40)
Mental and behavioural disorders (F00-F99)	11,757 (9.2%)	7.0 (6.85-7.10)	13,471 (6.6%)	8.6 (8.41-8.70)	2,018 (3.3%)	2.0 (0.95-2.13)	10,742 (9.3%)	10.2 (10.05-10.45)	12,468 (8.0%)	11.7 (10.89-11.28)	25,228 (7.6%)	7.7 (7.65-7.84)
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	8,081 (6.3%)	4.9 (4.83-5.05)	14,273 (7.0%)	9.1 (8.96-9.26)	4,612 (7.5%)	4.7 (4.54-4.81)	8,272 (7.2%)	7.9 (7.71-8.05)	9,470 (6.1%)	8.4 (8.24-8.58)	22,354 (6.7%)	7.0 (6.88-7.06)
Diseases of the respiratory system (J00-J99)	9,442 (7.4%)	5.9 (5.76-5.99)	11,643 (5.7%)	7.6 (7.45-7.73)	6,586 (10.7%)	6.7 (6.52-6.84)	8,186 (7.1%)	7.8 (7.63-7.97)	6,313 (4.0%)	5.6 (5.47-5.75)	21,085 (6.3%)	6.7 (6.62-6.80)
Factors influencing health status and contact with health services (Z00-Z99)	10,037 (7.8%)	6.1 (6.02-6.26)	9,625 (4.7%)	6.0 (5.92-6.16)	4,382 (7.1%)	4.4 (4.31-4.57)	5,426 (4.7%)	5.17 (5.03-5.31)	9,854 (6.3%)	8.8 (8.58-8.93)	19,662 (5.9%)	6.1 (6.00-6.17)

IDC-10 primary diagnosis category	Male		Female		10-14 years		15-19 years		20-24 years		10-24 years	
	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)
Diseases of the genitourinary system (N00-N99)	4,361 (3.4%)	2.7 (2.62-2.78)	10,297 (5.0%)	6.4 (6.32-6.57)	2,409 (3.9%)	2.4 (2.34-2.54)	5,011 (4.4%)	4.8 (4.64-4.91)	7,238 (4.6%)	6.4 (6.28-6.58)	14,658 (4.4%)	4.5 (4.45-4.60)
Diseases of the skin and subcutaneous tissue (L00-L99)	6,848 (5.3%)	4.2 (4.06-4.26)	5,556 (2.7%)	3.6 (3.47-3.65)	2,448 (4.0%)	2.5 (2.38-2.58)	4,799 (4.2%)	4.6 (4.44-4.70)	5,157 (3.3%)	4.6 (4.45-4.71)	12,404 (3.7%)	3.9 (3.80-3.94)
Diseases of the musculoskeletal system and connective tissue (M00-M99)	4,859 (3.8%)	3.0 (2.87-3.04)	4,060 (2.0%)	2.6 (2.54-2.70)	2,037 (3.3%)	2.1 (1.97-2.15)	3,360 (2.9%)	3.2 (3.09-3.31)	3,522 (2.3%)	3.1 (3.02-3.23)	8,919 (2.7%)	2.8 (2.73-2.85)
Certain infectious and parasitic diseases (A00-B99)	3,839 (3.0%)	2.4 (2.29-2.44)	4,847 (2.4%)	3.1 (3.04-3.21)	2,379 (3.9%)	2.4 (2.31-2.51)	3,183 (2.8%)	3.0 (2.93-3.14)	3,124 (2.0%)	2.8 (2.67-2.87)	8,686 (2.6%)	2.7 (2.68-2.79)
Neoplasms (C00-D48)	3,323 (2.6%)	2.1 (2.01-2.15)	4,582 (2.2%)	2.9 (2.86-3.03)	2,563 (4.1%)	2.6 (2.50-2.70)	2,559 (2.2%)	2.4 (2.34-2.53)	2,783 (1.8%)	2.5 (2.38-2.56)	7,905 (2.4%)	2.5 (2.44-2.56)
Endocrine, nutritional and metabolic diseases (E00-E90)	3,387 (2.6%)	2.1 (2.03-2.18)	4,320 (2.1%)	2.8 (2.74-2.90)	2,469 (4.0%)	2.5 (2.40-2.60)	3,011 (2.6%)	2.9 (2.76-2.97)	2,227 (1.4%)	2.0 (1.89-2.06)	7,707 (2.3%)	2.5 (2.40-2.51)
Diseases of the nervous system (G00-G99)	3,285 (2.6%)	2.0 (1.97-2.11)	3,849 (1.9%)	2.5 (2.40-2.56)	2,256 (3.7%)	2.3 (2.19-2.38)	2,328 (2.0%)	2.2 (2.13-2.31)	2,550 (1.6%)	2.3 (2.17-2.35)	7,134 (2.1%)	2.3 (2.20-2.31)
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89)	2,320 (1.8%)	1.5 (1.40-1.52)	2,505 (1.2%)	1.6 (1.55-1.68)	1,744 (2.8%)	1.8 (1.68-1.58)	1,589 (1.4%)	1.5 (1.44-1.59)	1,492 (1.0%)	1.3 (1.25-1.39)	4,825 (1.4%)	1.5 (1.49-1.58)
Diseases of the circulatory system (I00-I99)	1,759 (1.4%)	1.1 (1.02-1.12)	1,627 (0.8%)	1.0 (0.98-1.08)	666 (1.1%)	0.7 (0.62-0.73)	1,158 (1.0%)	1.1 (1.04-1.16)	1,562 (1.0%)	1.4 (1.32-1.45)	3,386 (1.0%)	1.1 (1.01-1.08)
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)	1,353 (1.1%)	0.9 (0.82-0.92)	1,351 (0.7%)	0.9 (0.84-0.94)	1,322 (2.1%)	1.3 (1.26-1.41)	928 (0.8%)	0.9 (0.82-0.94)	454 (0.3%)	0.4 (0.36-0.44)	2,704 (0.8%)	0.9 (0.84-0.92)

IDC-10 primary diagnosis category	Male		Female		10-14 years		15-19 years		20-24 years		10-24 years	
	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)
Diseases of the ear and mastoid process (H60-H95)	1,285 (1.0%)	0.8 (0.78-0.88)	1,335 (0.7%)	0.9 (0.84-0.94)	1,515 (2.5%)	1.5 (1.46-1.61)	691 (0.6%)	0.7 (0.61-0.71)	414 (0.3%)	0.4 (0.33-0.41)	2,620 (0.8%)	0.9 (0.82-0.89)
Diseases of the eye and adnexa (H00-H59)	711 (0.6%)	0.4 (0.41-0.48)	776 (0.4%)	0.5 (0.47-0.55)	601 (1.0%)	0.6 (0.56-0.66)	483 (0.4%)	0.5 (0.42-0.50)	403 (0.3%)	0.4 (0.32-0.39)	1,487 (0.4%)	0.5 (0.45-0.50)
Aboriginal												
	N=6,432		N=14,081		N=3,073		N=6,915		N=10,525		N=20,513	
Pregnancy, childbirth and the puerperium (O00-O99)	-	-	6,018 (42.7%)	118.2 (115.21-121.20)	54 (1.8%)	1.4 (1.03-1.78)	2,149 (31.1%)	57.6 (55.26-60.16)	3,815 (36.2%)	116.7 (113.02-120.46)	6,018 (29.3%)	57.8 (56.39-59.33)
Injury, poisoning and certain other consequences of external causes (S00-T98)	1,970 (30.6%)	35.8 (34.28-37.47)	1,338 (9.5%)	25.5 (24.17-26.93)	714 (23.2%)	18.0 (16.74-19.42)	1,229 (17.8%)	32.9 (31.16-34.88)	1,365 (13.0%)	41.7 (39.56-44.02)	3,308 (16.1%)	30.7 (29.75-31.86)
Mental and behavioural disorders (F00-F99)	1,201 (18.7%)	22.3 (21.09-23.94)	1,303 (9.3%)	25.2 (23.88-26.64)	181 (5.9%)	4.6 (3.93-5.39)	990 (14.3%)	26.5 (24.94-28.27)	1,333 (12.7%)	40.7 (38.61-43.02)	2,504 (12.2%)	23.7 (22.84-24.71)
Factors influencing health status and contact with health services (Z00-Z99)	322 (5.0%)	6.0 (5.36-6.69)	1,310 (9.3%)	25.9 (24.59-27.42)	125 (4.1%)	3.2 (2.63-3.76)	261 (3.8%)	7.0 (6.18-7.91)	1,246 (11.8%)	38.1 (36.02-40.29)	1,632 (8.0%)	15.8 (15.06-16.60)
Diseases of the digestive system (K00-K93)	584 (9.1%)	10.6 (9.80-11.55)	741 (5.3%)	14.1 (13.19-15.25)	324 (10.5%)	8.2 (7.32-9.13)	375 (5.4%)	10.1 (9.07-11.13)	626 (5.9%)	19.1 (17.67-20.70)	1,325 (6.5%)	12.3 (11.72-13.07)
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	445 (6.9%)	8.1 (7.40-8.93)	749 (5.3%)	14.3 (13.32-15.39)	224 (7.3%)	5.7 (4.95-6.45)	443 (6.4%)	11.8 (10.80-13.05)	527 (5.0%)	16.1 (14.77-17.55)	1,194 (2.8%)	11.1 (10.54-11.82)
Diseases of the respiratory system (J00-J99)	437 (6.8%)	7.7 (7.04-8.51)	548 (3.9%)	10.2 (9.41-11.14)	366 (11.9%)	9.3 (8.33-10.25)	348 (5.0%)	9.3 (8.38-10.37)	271 (2.6%)	8.3 (7.33-9.34)	985 (4.8%)	9.0 (8.41-9.54)
Diseases of the skin and subcutaneous tissue (L00-L99)	341 (5.3%)	6.2	365 (2.6%)	6.9	178 (5.8%)	4.5	260 (3.8%)	7.0	268 (2.5%)	8.2	706 (3.4%)	6.5

IDC-10 primary diagnosis category	Male		Female		10-14 years		15-19 years		20-24 years		10-24 years	
	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)
		(5.53-6.86)		(6.23-7.67)		(3.86-5.21)		(6.16-7.88)		(7.25-9.24)		(0.06-7.03)
Diseases of the genitourinary system (N00-N99)	121 (1.9%)	2.2 (1.79-2.57)	552 (3.9%)	10.6 (9.80-11.59)	122 (4.0%)	3.1 (2.56-3.68)	220 (3.2%)	5.9 (5.15-6.74)	331 (3.1%)	10.1 (9.06-11.27)	673 (3.3%)	6.3 (5.85-6.82)
Diseases of the musculoskeletal system and connective tissue (M00-M99)	191 (3.0%)	3.5 (2.99-4.00)	193 (1.4%)	3.6 (3.13-4.18)	109 (3.5%)	2.8 (2.26-3.32)	130 (1.9%)	3.5 (2.92-4.14)	145 (1.4%)	4.4 (3.74-5.22)	384 (1.9%)	3.5 (3.20-3.92)
Diseases of the nervous system (G00-G99)	207 (3.2%)	3.7 (3.23-4.26)	159 (1.1%)	3.0 (2.57-3.52)	112 (3.6%)	2.8 (2.33-3.41)	118 (1.7%)	3.2 (2.62-3.79)	136 (1.3%)	4.2 (3.49-4.92)	366 (1.8%)	3.4 (3.03-3.74)
Certain infectious and parasitic diseases (A00-B99)	132 (2.1%)	2.3 (1.96-2.78)	217 (1.5%)	4.1 (3.56-4.66)	122 (4.0%)	3.1 (2.56-3.68)	117 (1.7%)	3.1 (2.60-3.76)	110 (1.0%)	3.4 (2.77-4.06)	349 (1.7%)	3.2 (2.86-3.54)
Endocrine, nutritional and metabolic diseases (E00-E90)	148 (2.3%)	2.6 (2.24-3.11)	99 (0.7%)	1.9 (1.54-2.30)	89 (2.9%)	2.2 (1.81-2.79)	61 (0.9%)	1.6 (1.25-2.10)	97 (0.9%)	3.0 (2.41-3.62)	247 (1.2%)	2.3 (2.00-2.57)
Neoplasms (C00-D48)	86 (1.3%)	1.5 (1.24-1.91)	147 (1.0%)	2.8 (2.37-3.30)	82 (2.7%)	2.1 (1.65-2.57)	45 (0.7%)	1.2 (0.88-1.62)	106 (1.0%)	3.2 (2.65-3.92)	233 (1.1%)	2.2 (1.89-2.45)
Diseases of the ear and mastoid process (H60-H95)	107 (1.7%)	1.9 (1.52-2.24)	128 (0.9%)	2.3 (1.93-2.75)	149 (4.8%)	3.8 (3.19-4.42)	59 (0.9%)	1.6 (1.21-2.04)	27 (0.3%)	0.8 (0.54-1.20)	235 (1.1%)	2.1 (1.81-2.35)
Diseases of the circulatory system (I00-I99)	65 (1.0%)	1.2 (0.91-1.50)	63 (0.4%)	1.2 (0.92-1.54)	33 (1.1%)	0.8 (0.57-1.17)	42 (0.6%)	1.1 (0.81-1.52)	53 (0.5%)	1.6 (1.21-2.12)	128 (0.6%)	1.2 (0.99-1.41)
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89)	18 (0.3%)	0.3 (0.19-0.52)	93 (0.7%)	1.8 (1.42-2.15)	38 (1.2%)	1.0 (0.68-1.32)	27 (0.4%)	0.7 (0.48-1.05)	46 (0.4%)	1.4 (1.03-1.88)	111 (0.5%)	1.0 (0.84-1.23)

IDC-10 primary diagnosis category	Male		Female		10-14 years		15-19 years		20-24 years		10-24 years	
	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)	35 (0.5%)	0.6 (0.42-0.84)	28 (0.2%)	0.5 (0.34-0.75)	31 (1.0%)	0.8 (0.53-1.12)	24 (0.3%)	0.6 (0.41-0.96)	8 (0.1%)	0.2 (0.11-0.48)	63 (0.3%)	0.6 (0.43-0.72)
Diseases of the eye and adnexa (H00-H59)	22 (0.3%)	0.4 (0.24-0.59)	30 (0.2%)	0.6 (0.39-0.80)	20 (0.7%)	0.5 (0.31-0.78)	17 (0.2%)	0.5 (0.27-0.73)	15 (0.1%)	0.5 (0.26-0.76)	52 (0.3%)	0.5 (0.35-0.61)
						non-Aboriginal						
	N=121,814		N=190,769		N=58,716		N=108,274		N=145,593		N=312,583	
Pregnancy, childbirth and the puerperium (O00-O99)	-	-	66,800 (35.0%)	42.1 (41.78-42.42)	204 (0.3%)	0.2 (0.19-0.25)	17,122 (15.8%)	16.9 (16.67-17.18)	49,474 (34.0%)	45.2 (44.88-45.68)	66,800 (21.4%)	20.4 (20.35-20.66)
Injury, poisoning and certain other consequences of external causes (S00-T98)	34,837 (28.6%)	22.1 (21.91-22.38)	18,511 (9.7%)	12.4 (12.25-12.61)	13,364 (22.8%)	14.1 (13.88-14.36)	20,799 (19.2%)	20.5 (20.28-20.84)	19,185 (13.2%)	17.5 (17.31-17.81)	53,348 (17.1%)	17.4 (17.27-17.56)
Diseases of the digestive system (K00-K93)	14,208 (11.7%)	9.1 (8.91-9.21)	17,325 (9.1%)	11.4 (11.28-11.63)	7,122 (12.1%)	7.5 (7.35-7.70)	11,789 (15.8%)	11.6 (11.44-11.86)	12,622 (8.7%)	11.5 (11.35-11.75)	31,533 (10.1%)	10.2 (10.1-10.3)
Mental and behavioural disorders (F00-F99)	10,556 (8.7%)	6.5 (6.35-6.60)	12,168 (6.4%)	8.0 (7.87-8.15)	1,837 (3.1%)	1.9 (1.85-2.03)	9,752 (9.0%)	9.6 (9.45-9.83)	11,135 (7.6%)	10.1 (10.00-10.38)	22,724 (7.3%)	7.2 (7.12-7.31)
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00-R99)	7,636 (6.3%)	4.8 (4.73-4.95)	13,524 (7.1%)	8.9 (8.79-9.09)	4,388 (7.5%)	4.6 (4.50-4.78)	7,829 (7.2%)	7.7 (7.57-7.91)	8,943 (6.1%)	8.2 (8.02-8.36)	21,160 (6.8%)	6.8 (6.74-6.93)
Diseases of the respiratory system (J00-J99)	9,005 (7.4%)	5.8 (5.69-5.93)	11,095 (5.8%)	7.5 (7.36-7.64)	6,220 (10.6%)	6.6 (6.41-6.74)	7,838 (7.2%)	7.7 (7.58)	6,042 (4.1%)	5.5 (5.39-5.67)	20,100 (6.4%)	6.6 (6.53-6.72)
Factors influencing health status and contact with health services (Z00-Z99)	9,715 (8.0%)	6.2 (6.04-6.28)	8,315 (4.4%)	5.4 (5.33-5.55)	4,257 (7.3%)	4.5 (4.37-4.64)	5,165 (4.8%)	5.1 (4.98-5.28)	8,608 (5.9%)	7.9 (7.71-8.05)	18,030 (5.8%)	5.8 (5.17-5.88)
Diseases of the genitourinary system (N00-N99)	4,240 (3.5%)	2.7	9,745 (5.1%)	6.3	2,287 (3.9%)	2.4	4,791 (4.4%)	4.7	6,907 (4.7%)	6.3	13,985 (4.5%)	4.5

IDC-10 primary diagnosis category	Male		Female		10-14 years		15-19 years		20-24 years		10-24 years	
	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)
		(2.64-2.81)		(6.18-6.43)		(2.32-2.52)		(4.60-4.87)		(6.17-6.47)		(4.39-4.54)
Diseases of the skin and subcutaneous tissue (L00-L99)	6,507 (5.3%)	4.1 (3.99-4.19)	5,191 (2.7%)	3.4 (3.35-3.554)	2,270 (3.9%)	2.4 (2.30-2.50)	4,539 (4.4%)	4.5 (4.36-4.62)	4,889 (3.4%)	4.5 (4.35-4.60)	11,698 (3.7%)	3.8 (3.71-3.84)
Diseases of the musculoskeletal system and connective tissue (M00-M99)	4,668 (3.8%)	2.9 (2.86-3.03)	3,867 (2.0%)	2.6 (2.50-2.67)	1,928 (3.3%)	2.0 (1.95-2.13)	3,230 (3.0%)	3.2 (3.08-3.31)	3,377 (2.3%)	3.1 (2.99-3.20)	8,535 (2.7%)	2.8 (2.71-2.82)
Certain infectious and parasitic diseases (A00-B99)	3,707 (3.0%)	2.4 (2.30-2.45)	4,630 (2.4%)	3.1 (3.01-3.19)	2,257 (3.8%)	2.4 (2.29-2.49)	3,066 (2.8%)	3.0 (2.92-3.14)	3,014 (2.1%)	2.8 (2.66-2.86)	8,337 (2.7%)	2.7 (2.66-2.78)
Neoplasms (C00-D48)	3,237 (2.7%)	2.1 (2.03-2.18)	4,435 (2.3%)	3.0 (2.87-3.05)	2,481 (4.2%)	2.6 (2.52-2.73)	2,514 (2.3%)	2.5 (2.39-2.58)	2,677 (1.8%)	2.5 (2.36-2.55)	7,672 (2.5%)	2.5 (2.46-2.57)
Endocrine, nutritional and metabolic diseases (E00-E90)	3,239 (2.7%)	2.1 (2.02-2.16)	4,221 (2.2%)	2.9 (2.78-2.95)	2,380 (4.1%)	2.5 (2.42-2.62)	2,950 (2.7%)	2.9 (2.81-3.02)	2,130 (1.5%)	1.9 (1.87-2.03)	7,460 (2.4%)	2.5 (2.41-2.52)
Diseases of the nervous system (G00-G99)	3,078 (2.5%)	2.0 (1.91-2.06)	3,690 (1.9%)	2.5 (2.39-2.55)	2,144 (3.7%)	2.3 (2.17-2.36)	2,210 (2.0%)	2.2 (2.09-2.28)	2,414 (1.5%)	2.2 (2.12-2.30)	6,768 (2.2%)	2.2 (2.16-2.27)
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89)	2,302 (1.9%)	1.5 (1.44-1.57)	2,412 (1.3%)	1.6 (1.55-1.69)	1,706 (2.9%)	1.8 (1.72-1.89)	1,562 (1.4%)	1.5 (1.47-1.62)	1,446 (1.0%)	1.3 (1.26-1.39)	4,714 (1.5%)	1.6 (1.51-1.60)
Diseases of the circulatory system (I00-I99)	1,694 (1.4%)	1.1 (1.02-1.12)	1,564 (0.8%)	1.0 (0.98-1.08)	633 (1.1%)	0.7 (0.32-0.72)	1,116 (1.0%)	1.1 (1.04-1.17)	1,509 (1.0%)	1.4 (1.31-1.45)	3,258 (1.0%)	1.0 (1.01-1.08)
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)	1,318 (1.1%)	0.9 (0.83-0.93)	1,323 (0.7%)	0.9 (0.86-0.96)	1,291 (2.2%)	1.4 (1.29-1.44)	904 (0.8%)	0.9 (0.84-0.95)	446 (0.3%)	0.4 (0.37-0.45)	2,641 (0.8%)	0.9 (0.86-0.93)

IDC-10 primary diagnosis category	Male		Female		10-14 years		15-19 years		20-24 years		10-24 years	
	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)	n (%)	Rate* (CI)
Diseases of the ear and mastoid process (H60-H95)	1,178 (1.0%)	0.8 (0.74-0.84)	1,207 (0.6%)	0.8 (0.79-0.89)	1,366 (2.3%)	1.4 (1.37-1.52)	632 (0.6%)	0.6 (0.58-0.68)	387 (0.3%)	0.4 (0.32-0.39)	2,385 (0.8%)	0.8 (0.78-0.85)
Diseases of the eye and adnexa (H00-H59)	689 (0.6%)	0.4 (0.42-0.48)	746 (0.4%)	0.5 (0.47-0.55)	581 (1.0%)	0.6 (0.57-0.67)	466 (0.4%)	0.5 (0.42-0.50)	388 (0.3%)	0.4 (0.32-0.39)	1,435 (0.5%)	0.5 (0.45-0.50)

	Aboriginal											
	Male		**Female**		**10-14**		**15-19**		**20-24**		**All adolescents**	
IDC-10 primary diagnosis category	n *(%)*	Rate*	n *(%)*	Rate*	n *(%)*	Rate*	n *(%)*	Rate*	n *(%)*	Rate*	n *(%)*	Rate*
Pregnancy, childbirth and the puerperium	-	-	6,018 (42.7%)	118.2	54 (1.8%)	1.4	2,149 (31.1%)	57.6	3,815 (36.2%)	116	6,018 (29.3%)	57.8
Injury, poisoning and certain other consequences of external causes	1,970 (30.6%)	35.8	1,338 (9.5%)	25.5	714 (23.2%)	18.0	1,229 (17.8%)	32.9	1,365 (13.0%)	41.7	3,308 (16.1%)	30.7
Mental and behavioural disorders	1,201 (18.7%)	22.3	1,303 (9.3%)	25.2	181 (5.9%)	4.6	990 (14.3%)	26.5	1,333 (12.7%)	40.7	2,504 (12.2%)	23.7
Factors influencing health status and contact with health services	322 (5.0%)	6	1,310 (9.3%)	25.9	125 (4.1%)	3.2	261 (3.8%)	7.0	1,246 (11.8%)	38.1	1,632 (8.0%)	15.8
Diseases of the digestive system	584 (9.1%)	10.6	741 (5.3%)	14.1	324 (10.5%)	8.2	375 (5.4%)	10.1	626 (5.9%)	19.1	1,325 (6.5%)	12.3
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	445 (6.9%)	8.1	749 (5.3%)	14.3	224 (7.3%)	5.7	443 (6.4%)	11.8	527 (5.0%)	16.1	1,194 (2.8%)	11.1
Diseases of the respiratory system	437 (6.8%)	7.7	548 (3.9%)	10.2	366 (11.9%)	9.3	348 (5.0%)	9.3	271 (2.6%)	8.3	985 (4.8%)	9.0
Diseases of the skin and subcutaneous tissue	341 (5.3%)	6.2	365 (2.6%)	6.9	178 (5.8%)	4.5	260 (3.8%)	7.0	268 (2.5%)	8.2	706 (3.4%)	6.5
Diseases of the genitourinary system	121 (1.9%)	2.2	552 (3.9%)	10.6	122 (4.0%)	3.1	220 (3.2%)	5.9	331 (3.1%)	10.1	673 (3.3%)	6.3
Diseases of the musculoskeletal system and connective tissue	191 (3.0%)	3.5	193 (1.4%)	3.6	109 (3.5%)	2.8	130 (1.9%)	3.5	145 (1.4%)	4.4	384 (1.9%)	3.5
Diseases of the nervous system	207 (3.2%)	3.7	159 (1.1%)	3.0	112 (3.6%)	2.8	118 (1.7%)	3.2	136 (1.3%)	4.2	366 (1.8%)	3.4
Certain infectious and parasitic diseases	132 (2.1%)	2.3	217 (1.5%)	4.1	122 (4.0%)	3.1	117 (1.7%)	3.1	110 (1.0%)	3.4	349 (1.7%)	3.2

Endocrine, nutritional and metabolic diseases	148 (2.3%)	2.6	99 (0.7%)	1.9	89 (2.9%)	2.2	61 (0.9%)	1.6	97 (0.9%)	3.0	247 (1.2%)	2.3
Neoplasms	86 (1.3%)	1.5	147 (1.0%)	2.8	82 (2.7%)	2.1	45 (0.7%)	1.2	106 (1.0%)	3.2	233 (1.1%)	2.2
Diseases of the ear and mastoid process	107 (1.7%)	1.9	128 (0.9%)	2.3	149 (4.8%)	3.8	59 (0.9%)	1.6	27 (0.3%)	0.8	235 (1.1%)	2.1
Diseases of the circulatory system	65 (1.0%)	1.2	63 (0.4%)	1.2	33 (1.1%)	0.8	42 (0.6%)	1.1	53 (0.5%)	1.6	128 (0.6%)	1.2
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	18 (0.3%)	0.3	93 (0.7%)	1.8	38 (1.2%)	1.0	27 (0.4%)	0.7	46 (0.4%)	1.4	111 (0.5%)	1.0
Congenital malformations, deformations and chromosomal abnormalities	35 (0.5%)	0.6	28 (0.2%)	0.5	31 (1.0%)	0.8	24 (0.3%)	0.6	8 (0.1%)	0.2	63 (0.3%)	0.6
Diseases of the eye and adnexa	22 (0.3%)	0.4	30 (0.2%)	0.6	20 (0.7%)	0.5	17 (0.2%)	0.5	15 (0.1%)	0.5	52 (0.3%)	0.5

	non-Aboriginal											
	Male		**Female**		**10-14**		**15-19**		**20-24**		**All adolescents**	
IDC-10 primary diagnosis category	n (%)	Rate*	n (%)	Rate*	n (%)	Rate*	n (%)	Rate*	n (%)	Rate*	n (%)	Rate*
Pregnancy, childbirth and the puerperium	-	-	66,800 (35.0%)	42.1	204 (0.3%)	0.2	17,122 (15.8%)	16.9	49,474 (34.0%)	45.2	66,800 (21.4%)	20.4
Injury, poisoning and certain other consequences of external causes	34,837 (28.6%)	22.1	18,511 (9.7%)	12.4	13,364 (22.8%)	14.1	20,799 (19.2%)	20.5	19,185 (13.2%)	17.5	53,348 (17.1%)	17.4
Diseases of the digestive system	14,208 (11.7%)	9.1	17,325 (9.1%)	11.4	7,122 (12.1%)	7.5	11,789 (15.8%)	11.6	12,622 (8.7%)	11.5	31,533 (10.1%)	10.2
Mental and behavioural disorders	10,556 (8.7%)	6.5	12,168 (6.4%)	8.0	1,837 (3.1%)	1.9	9,752 (9.0%)	9.6	11,135 (7.6%)	10.1	22,724 (7.3%)	7.2
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	7,636 (6.3%)	4.8	13,524 (7.1%)	8.9	4,388 (7.5%)	4.6	7,829 (7.2%)	7.7	8,943 (6.1%)	8.2	21,160 (6.8%)	6.8
Diseases of the respiratory system	9,005 (7.4%)	5.8	11,095 (5.8%)	7.5	6,220 (10.6%)	6.6	7,838 (7.2%)	7.7	6,042 (4.1%)	5.5	20,100 (6.4%)	6.6
Factors influencing health status and contact with health services	9,715 (8.0%)	6.2	8,315 (4.4%)	5.4	4,257 (7.3%)	4.5	5,165 (4.8%)	5.1	8,608 (5.9%)	7.9	18,030 (5.8%)	5.8
Diseases of the genitourinary system	4,240 (3.5%)	2.7	9,745 (5.1%)	6.3	2,287 (3.9%)	2.4	4,791 (4.4%)	4.7	6,907 (4.7%)	6.3	13,985 (4.5%)	4.5
Diseases of the skin and subcutaneous tissue	6,507 (5.3%)	4.1	5,191 (2.7%)	3.4	2,270 (3.9%)	2.4	4,539 (4.4%)	4.5	4,889 (3.4%)	4.5	11,698 (3.7%)	3.8
Diseases of the musculoskeletal system and connective tissue	4,668 (3.8%)	2.9	3,867 (2.0%)	2.6	1,928 (3.3%)	2.0	3,230 (3.0%)	3.2	3,377 (2.3%)	3.1	8,535 (2.7%)	2.8
Certain infectious and parasitic diseases	3,707 (3.0%)	2.8	4,630 (2.4%)	3.1	2,257 (3.8%)	2.4	3,066 (2.8%)	3.0	3,014 (2.1%)	2.8	8,337 (2.7%)	2.7
Neoplasms	3,237 (2.7%)	2.1	4,435 (2.3%)	3.0	2,481 (4.2%)	2.6	2,514 (2.3%)	2.5	2,677 (1.8%)	2.5	7,672 (2.5%)	2.5

Endocrine, nutritional and metabolic diseases	3,239 (2.7%)	2.1	4,221 (2.2%)	2.9	2,380 (4.1%)	2.5	2,950 (2.7%)	2.9	2,130 (1.5%)	1.9	7,460 (2.4%)	2.5
Diseases of the nervous system	3,078 (2.5%)	2.0	3,690 (1.9%)	2.5	2,144 (3.7%)	2.3	2,210 (2.0%)	2.2	2,414 (1.5%)	2.2	6,768 (2.2%)	2.2
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	2,302 (1.9%)	1.5	2,412 (1.3%)	1.6	1,706 (2.9%)	1.8	1,562 (1.4%)	1.5	1,446 (1.0%)	1.3	4,714 (1.5%)	1.6
Diseases of the circulatory system	1,694 (1.4%)	1.1	1,564 (0.8%)	1.0	633 (1.1%)	0.7	1,116 (1.0%)	1.1	1,509 (1.0%)	1.4	3,258 (1.0%)	1.0
Congenital malformations, deformations and chromosomal abnormalities	1,318 (1.1%)	0.9	1,323 (0.7%)	0.9	1,291 (2.2%)	1.4	904 (0.8%)	0.9	446 (0.3%)	0.4	2,641 (0.8%)	0.9
Diseases of the ear and mastoid process	1,178 (1.0%)	0.8	1,207 (0.6%)	0.8	1,366 (2.3%)	1.4	632 (0.6%)	0.6	387 (0.3%)	0.4	2,385 (0.8%)	0.8
Diseases of the eye and adnexa	689 (0.6%)	0.4	746 (0.4%)	0.5	581 (1.0%)	0.6	466 (0.4%)	0.5	388 (0.3%)	0.4	1,435 (0.5%)	0.5

Appendix 2.C

Abstract – Lowitja Institute International Indigenous Health and Wellbeing Conference, 18 – 20 June 2019, Darwin, Australia

Title: Trends in Aboriginal adolescent hospitalisations in South Australia, 2006-2015

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Abstract

Aboriginal and Torres Strait Islander Australians are a relatively young population. In 2016, the median age was 23 years and over 30 percent were aged 10-24. Understanding reasons for and rates of hospitalisation of Aboriginal and Torres Strait Islander adolescents will help identify priority health needs to inform service delivery and policy. This study aims to understand if there has been a change in adolescent hospitalisations in South Australia between 2006-2015.

Using public hospital separation data from the Integrated South Australian Activity Collection, SA Department for Health and Wellbeing, a retrospective study of adolescent hospitalisations in South Australia was conducted. For 2006-2015, the reason and rate of hospitalisation was calculated per 1,000 adolescent population by Aboriginal status, sex, age group (10-14, 15-19 and 20-24 years) and remoteness. Reason for hospitalisation was defined by International Classification of Disease (ICD-10AM) and presented by ICD chapter and service related group.

There was a total of 333,096 adolescent separations in South Australian public hospitals from 2006 to 2015 inclusive. Females had a higher proportion of hospitalisations (62%) than males over the ten-year period. Of all hospitalisations, 6% were by Aboriginal adolescents. For Aboriginal adolescents, the top four reasons for hospitalisation were pregnancy, childbirth and the puerperium, injury, poisoning and other related external causes, mental and

behavioural disorders and disease of the digestive system. The findings show that the rates for hospitalisation varied over the ten-year period by Aboriginal status, sex, age group and remoteness.

Presentation – 2019 Lowitja Institute International Indigenous Health and Wellbeing Conference

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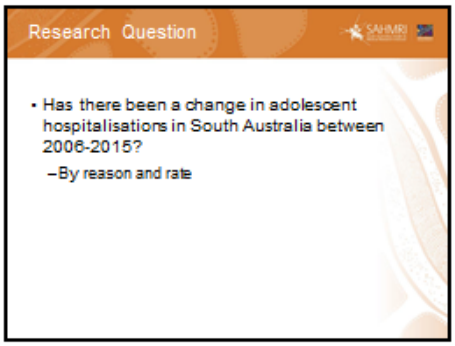

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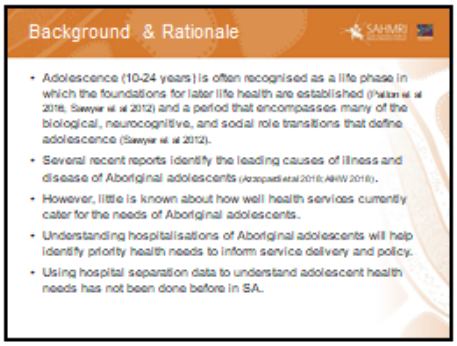

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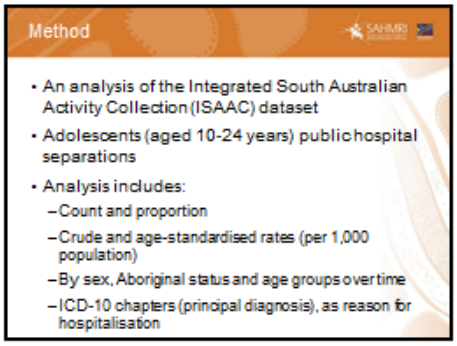

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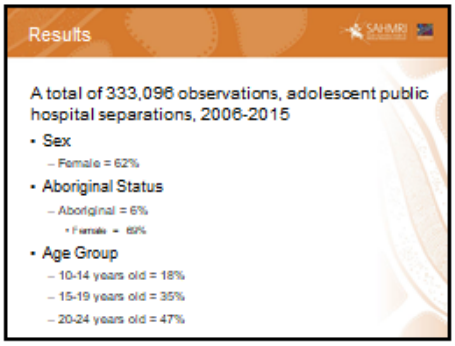

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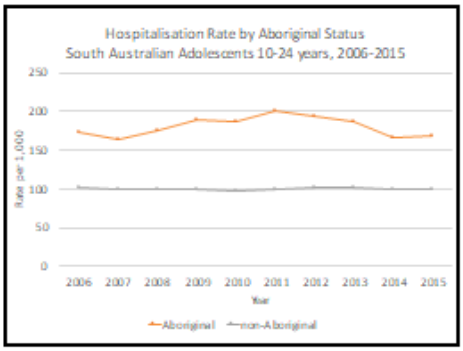
Hospitalisation Rate by Aboriginal Status
South Australian Adolescents 10-24 years, 2006-2015
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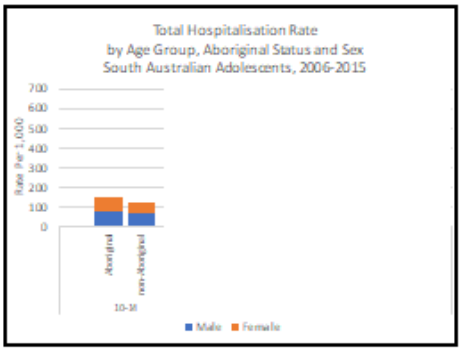
Total Hospitalisation Rate
by Age Group, Aboriginal Status and Sex
South Australian Adolescents, 2006-2015
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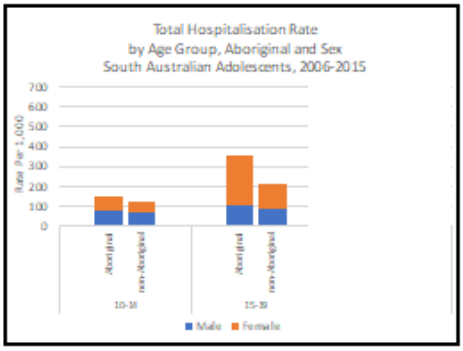
Total Hospitalisation Rate
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South Australian Adolescents, 2006-2015
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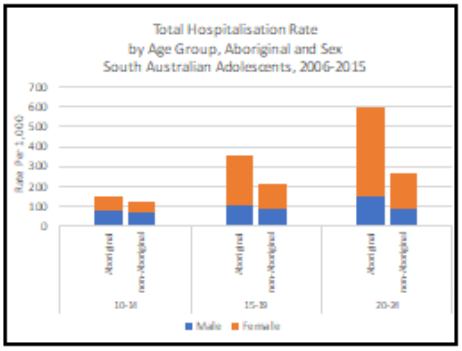
Total Hospitalisation Rate
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South Australian Adolescents, 2006-2015
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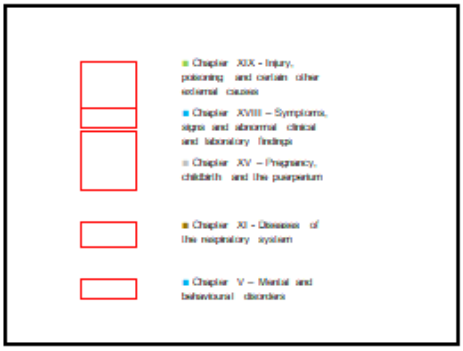
Chapter XIX - Injury, poisoning and certain other external causes
Chapter XVIII – Symptoms, signs and abnormal clinical and laboratory findings
Chapter XV – Pregnancy, childbirth and the puerperium
Chapter XI - Diseases of the respiratory system
Chapter V – Mental and behavioural disorders

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Proportion of Hospitalisations by ICD-10 Chapters, by Aboriginal status,
South Australian Adolescents 10-24 Years, 2006-2015
Chapter XIX - Injury, poisoning and certain other external causes
Chapter XV – Pregnancy, childbirth and the puerperium
Chapter XI - Diseases of the respiratory system
Chapter V – Mental and behavioural disorders

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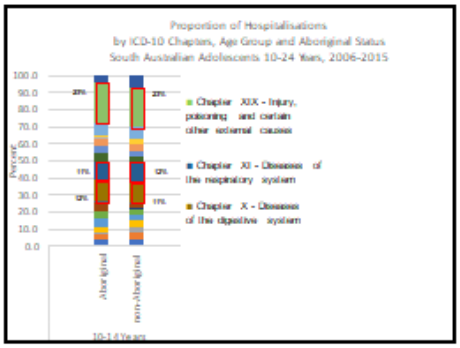

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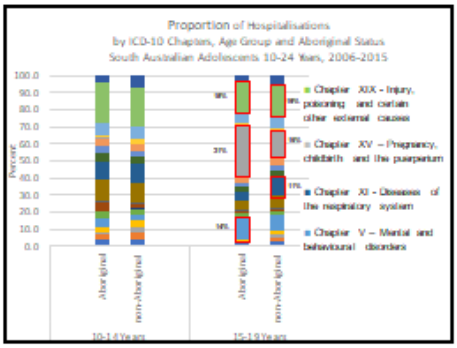

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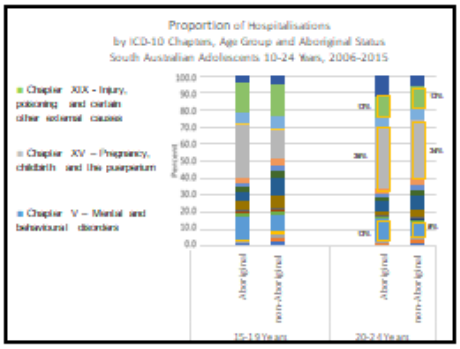

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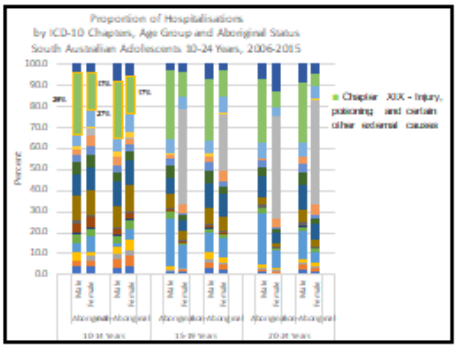

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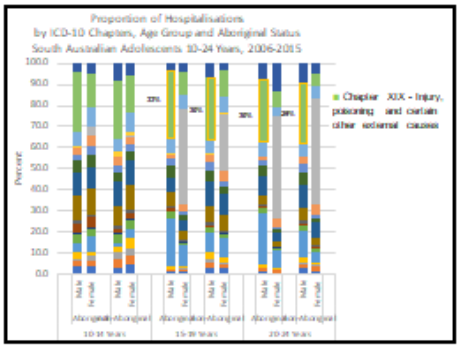

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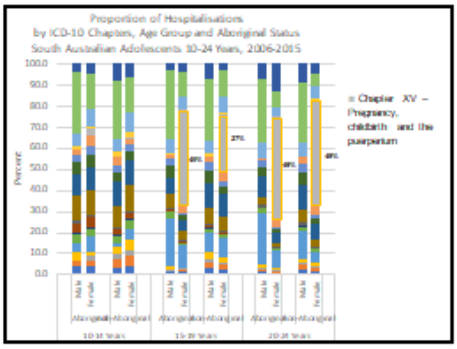

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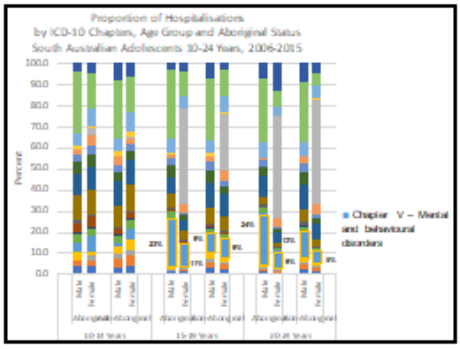

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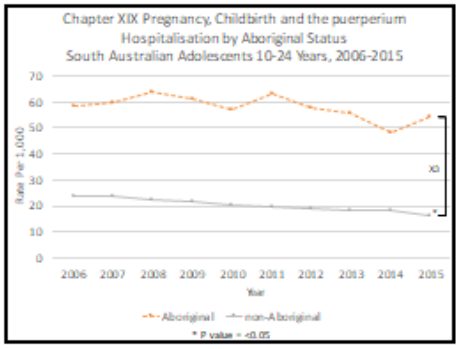

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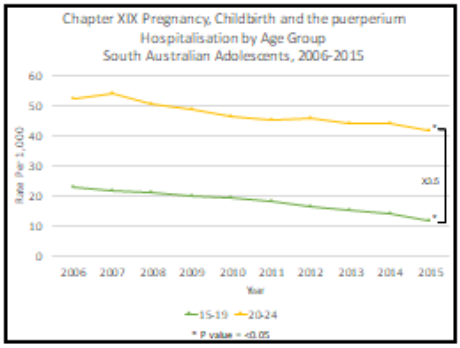

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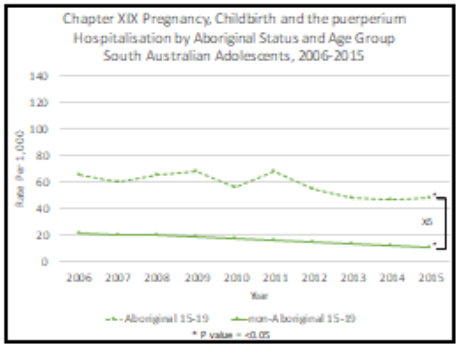

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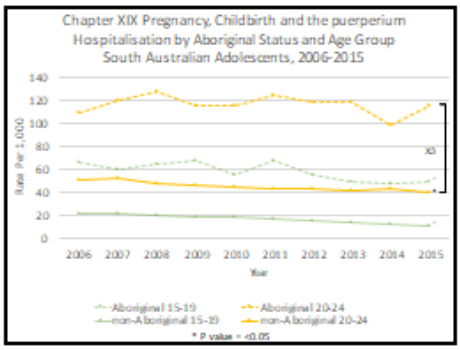

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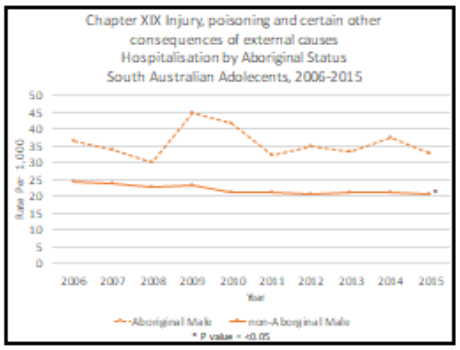

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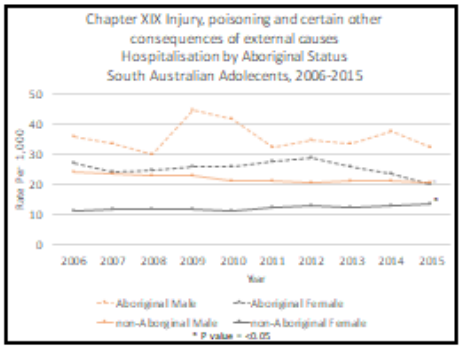

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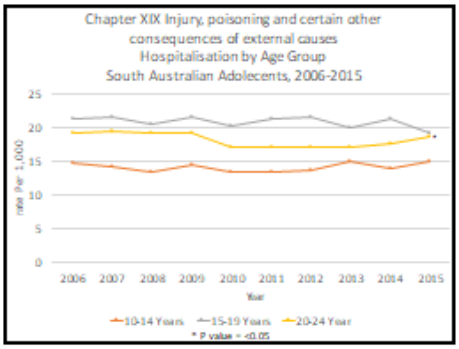

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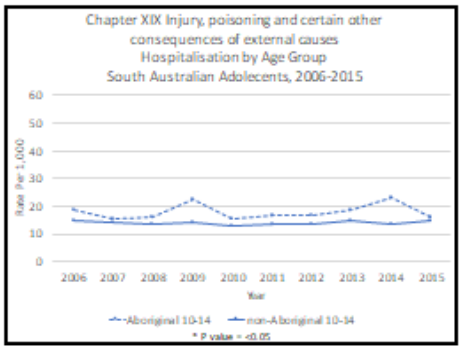

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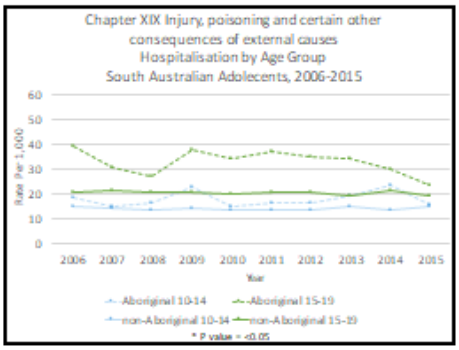

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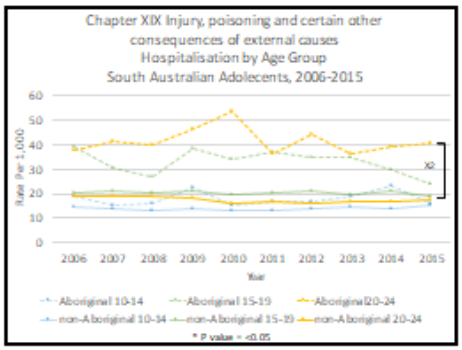

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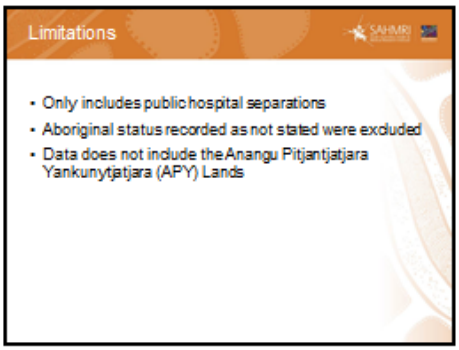

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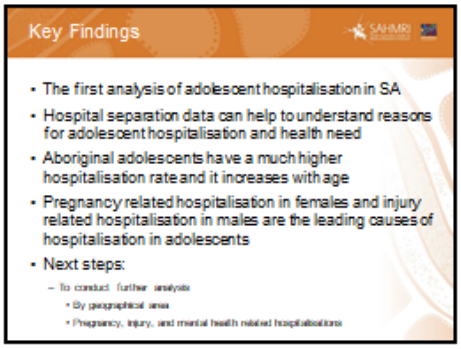
Key Findings
SAHMRI
• The first analysis of adolescent hospitalisation in SA
• Hospital separation data can help to understand reasons for adolescent hospitalisation and health need
• Aboriginal adolescents have a much higher hospitalisation rate and it increases with age
• Pregnancy related hospitalisation in females and injury related hospitalisation in males are the leading causes of hospitalisation in adolescents
• Next steps:
– To conduct further analysis
• By geographical area
• Pregnancy, injury, and mental health related hospitalisations

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Thank you!
Australian National University
SAHMRI

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Chapter 3: Let's Talk About It – An online pilot survey of sexual health, knowledge and behaviour of young South Australians

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Abbreviations and acronyms

aOR	Adjusted odds ratios
BBV	Bloodborne viruses
CI	Confidence intervals
IQR	Interquartile range
SDRR	Sex, Drugs, and Rock'n'Roll
STI	Sexually transmitted infections
SA	South Australia
SA Health	Department of Health and Wellbeing, South Australia

3.1. Prologue

Rates of sexually transmitted infections (STI) have been rising among young Australians and disproportionately affect the Aboriginal and Torres Strait Islander population. However, limited evidence exists to provide insight into the social and behavioural factors of young Australians. One approach to collecting such information is via cross-sectional surveys of a broadly representative population group at a point in time. Previous surveys have provided some evidence on the topic, yet none to date have been collected at the state level in South Australia. Additionally, despite the over-representation of STI among Aboriginal and Torres Strait Islander peoples, very few studies have included a sufficient number of Aboriginal and Torres Strait Islander people to enable direct comparisons between Indigenous and non-Indigenous population groups. This chapter describes the piloting of *Let's Talk About It 2019*, an online survey of South Australian young people aged 16-29 years.

3.1.1. My role

My epidemiological study involved:

- drafting a study proposal and data analysis plan
- obtaining ethics approval
- engaging with an advisory group comprised of Aboriginal and non-Indigenous young people aged 16-29 years
- reviewing the survey questions
- engaging with a communication and marketing specialist regarding the promotion and management of the survey on social media
- cleaning and recoding variables
- data analysis and interpretation
- presentation of results
- drafting of initial and subsequent versions of the chapter
- obtaining feedback and comments on the chapter from co-investigators and supervisors.

3.1.2. Lessons learnt

This is the first project I have conducted that uses a survey as the main method and only form of data collection. This method of data collection is typically used in epidemiology, as it is easier to undertake and less costly than many other study designs, and surveys can provide valuable insight into a population at a particular point in time but also over time to assess trends if repeated.

This is what was achieved with *Let's Talk About It 2019*:

- In total 2,380 young South Australians over a 6-week period provided information on their current sexual health, knowledge, behaviours and access to health services in relation to sexually transmitted infections (STI) and bloodborne viruses (BBV).
- We collected a significant amount of information and compared data obtained from Aboriginal and/or Torres Strait Islander respondents with data from non-Indigenous respondents. We examined socio-demographic factors, behaviours, sexual health knowledge and health service access including STI and BBV testing for associations.
- I learnt about developing and conducting adjusted logistic regression analysis and models and worked with a biostatistician to ensure my approach was appropriate.
- Another lesson I learnt is how to best present data and results. Deciding between whether to present results in a table or as a graph is ultimately dependent on the type of data being presented. First and foremost, regardless of how data is presented, whether it is in a table or graph, it should be self-explanatory; the reader should be able to understand the table or graph without the need to read the text that refers to it. Tables can be ideal where a lot of information needs to be included. For example, demographic data which is categorical can be presented by distribution with counts (n) and percentages (%) and include the denominator (N). This is particularly important when the denominator might be different for each category being presented and are not comparable across categories.
- It is not always possible to effectively communicate data on a table, particularly when multiple categories are being presented. Graphs can be a simple way to communicate results and can often have a greater impact than tables, as similarities and differences can be seen without requiring too much interpretation.
- Finally, when you are immersed in and working with the data, you become aware of how you might change or restructure future surveys and how to code these for ease of analysis. These are only small changes but ultimately it is about ensuring the data is user-friendly, so there is less cleaning and recoding of variables and values required.

3.1.3. Public health implications

Most STI in Australia occur in young people aged 15-29 years and disproportionately affect the Aboriginal and Torres Strait Islander population in the same age group. STI are easy to detect and treat but can lead to serious sexual and reproductive health consequences if left untreated. It is important to understand key clinical, social and behavioural factors

underlying STI notification data to allow trends to be interpreted and assist in the development and design of public health interventions aimed at addressing STI among young Australians.

This study is the first to describe current sexual health, knowledge, behaviours and access to health services for STI and BBV and related issues amongst young South Australians, both Aboriginal and/or Torres Strait Islander and non-Indigenous.

We found similar proportions of Aboriginal and/or Torres Strait Islander and non-Indigenous participants reporting behaviours such as: being sexually active; having a sexual partner at the same time as a regular partner (concurrency); and multiple sexual partners in the past 12 months. Each group equally used internet/mobile applications (apps) to meet partners.

Aboriginal and or Torres Strait Islander participants initiated sexual activity marginally earlier; were more likely to report being 'drunk' or 'high' during their last sexual encounter; were less likely to use a condom with a casual sexual partner; were more likely to report having ever or recently tested for an STI; and were more likely to have been diagnosed with an STI than non-Indigenous participants.

Overall, young South Australians are engaged in behaviours which increases their risk of acquiring STI. This evidence is important for informing public health practice and policy development, and development of STI and BBV preventative health programs – particularly those targeting young Aboriginal and/or Torres Strait Islander people. As a result of this survey the South Australian Government have initiated social media campaigns to promote condom awareness and use in this population group. We propose that consideration be given to conducting surveys on an ongoing basis to health shape future public health policy and programs within the state of South Australia.

3.1.4. Acknowledgements

Firstly, I would like to acknowledge and thank the young people who participated in *Let's Talk About It 2019*. Additionally, I would like to acknowledge and thank the investigator team, Dr Salenna Elliot and Professor James Ward for their guidance, support and leadership, and Dr Handan Wand for her statistical data analysis support.

3.1.5. MAE core requirements

This project fulfils the 'conducting an epidemiological study' component of the Master of Applied Epidemiology. Summary results were made available to participants through social media and the South Australian Health and Medical Research Institute website.

3.2. Abstract

3.2.1. Objective

The aim of this study was to 1) to conduct a sexual health survey of young South Australians; 2) to include Aboriginal and/or Torres Strait Islander and non-Indigenous young people in the same survey to allow for comparisons; and 3) to assess the acceptability and feasibility of collecting STI and BBV data in an online format with a view to delivering future surveys utilising the same format.

3.2.2. Methods

This study was an online cross-sectional survey, completed by participants aged between 16-29 years, and residents of South Australia. Descriptive analysis, univariate and adjusted logistic regression models were used to assess association, whether socio-demographic characteristics and sexual risk behaviours were associated with specific behaviours.

3.2.3. Results

Between July and August 2019, 2,380 young South Australians participated in *Let's Talk About It 2019,* an online survey of South Australian young people aged 16-29 years. Participants provided information on their current sexual health, knowledge, behaviours and access to health services in relation to sexually transmissible infections and blood-borne viruses. Over half (52%) of participants were female; the median age was 20 years; 72% identified as straight (heterosexual) and as 17% bisexual; 78% were from the urban Adelaide area; and 10% identified as Aboriginal and/or Torres Strait Islander.

Similar proportions of Aboriginal and/or Torres Strait Islander and non-Indigenous participants reported: being sexually active (81% vs 78%); having two sexual partners at the same time (concurrency) (13% vs 12%); and multiple sexual partners in past 12 months. Both population groups reported the same rate for using the internet or mobile applications to meet partners (30%). However, Aboriginal and/or Torres Strait Islander participants reported an earlier age of sexual debut (vaginal - 16.0 years of age vs 16.7 years of age); were more likely to report being 'drunk' or 'high' when they last had sex (28% vs 17%); were less likely to always use a condom with a casual sexual partner (25% vs 36%); were more likely to report having ever tested for an STI (69% vs 46%) or recently tested for an STI (46% vs 27%); and were more likely to have tested positive for an STI (30% vs 21%) than non-Indigenous participants.

3.2.4. Conclusion

Let's Talk About It 2019 is the first study to describe current sexual health, knowledge, behaviours and access to health services for sexually transmissible infections and blood-

borne viruses and related issues amongst young South Australians. This evidence is important for informing both public health practice and policy, and the development of sexually transmissible infections and blood-borne viruses preventative health programs. We propose that consideration be given to conducting surveys on an ongoing basis to help shape future public health policy and programs within the state of South Australia.

3.3. Introduction

Rates of sexually transmitted infections (STI), particularly *Chlamydia trachomatis* (chlamydia), and *Neisseria gonorrhoeae* (gonorrhoea), have been rising among young Australians. In 2017, chlamydia was the most notified STI in Australia; almost three-quarters of notifications were among young people aged 15-29 years, and rates were higher among females than males (441.8 vs 394.9 per 100 000) (1). Gonorrhoea was the second most notified STI in Australia in 2017, increasing by 16% from 2016 (1). Over half of the notifications for gonorrhoea were among people aged 15-29 years and most notifications were among males (74%) (1). These and other STI disproportionately affect the Aboriginal and Torres Strait Islander population. In 2017, diagnosis rates of chlamydia and gonorrhoea were 2.8 and 6.6 times higher respectively than non-Indigenous rates (1, 2).

Similarly, in South Australia (SA), STI notifications are increasing. Notification rates for chlamydia increased by 8% between 2016 and 2017 (340.7 and 367.9 per 100,000 respectively), gonorrhoea increased by 15% and there was an 80% increase in infectious syphilis over the same period (1). Young South Australians aged 15-29 accounted for most of the notifications and Aboriginal and Torres Strait Islanders people experienced higher STI rates compared to their non-Indigenous peers (1, 3).

Sexually transmissible infections are easy to detect and treat but can lead to serious sexual and reproductive health consequences if left untreated (4-6). It is important to understand key clinical, social and behavioural factors underlying these notification data to allow trends to be interpreted and assist in the development and design of public health interventions aimed at addressing STI among young Australians. However, there has been limited evidence to date which provides insight into the social and behavioural factors of young Australians. One approach to building an evidence base is to collect such information via cross-sectional surveys of a broadly representative population group at a point in time. If these types of surveys are collected regularly using similar methods, they also enable an assessment of trends over time.

Previous surveys have provided some evidence on the topic, yet none to date have been collected at the state level in SA. Additionally, despite the over representation of STI among Aboriginal and Torres Strait Islander peoples, very few studies have included both non-Indigenous participants and a sufficient number of Aboriginal and/or Torres Strait Islander people to enable direct comparisons between the two population groups.

Established surveys such as the annual 'Sex, Drugs, and Rock'n'Roll' survey (Big Day Out Study) (SDRR) conducted in Victoria (Australia) among people aged 16-29 years, commenced in 2005, initially collected at music festivals and with online data collection since 2015 (7). The SDRR covers sexual behaviour, and alcohol and other drug use. Every year SDRR includes an additional set of questions about a specific topic, for example in 2019, it was pornography, the two years prior it was sexting, pornography and sexual harassment (8, 9). The proportion of Aboriginal and Torres Strait Islander SDRR participants has been approximately 2% or less in each survey (accounting for <50 participants in each survey) (10), making this difficult to conduct further analysis to assess for differences between populations.

The 'It's Your Love Life' survey is an online survey on sexuality, relationships and sexual health of young people aged 15 to 29 living in New South Wales and the Australian Capital Territory (11, 12). The first 'It's Your Love Life' survey was conducted between December 2015 and March 2016 and again in May and July 2017. Around 2% (n=56 and n=60) of participants in each survey identified as Aboriginal and/or Torres Strait Islander; however, no results were presented by Indigenous status (11, 12). Another survey of young people, the 'Debrief Survey', a national behavioural online survey on sexual health among young people aged 15–29 years in Australia, was conducted over a four-month period from December 2017 to April 2018. It recruited 2,303 participants through social media (13). Preliminary results indicate 3% (n=58) of participants identified as Aboriginal and/or Torres Strait Islander and similarly to 'It's Your Love Life', results were not disaggregated by Indigenous status. This is a major limitation of such surveys.

The GOANNA survey was collected at 40 Aboriginal and Torres Strait Islander community events across Australia between 2011-13 using personal digital assistant devices. It was the first study to gather data on social and behavioural factors relating to sexual health from a large sample (n=2877) of Aboriginal and/or Torres Strait Islander young people (14). The GOANNA Survey 2 is now in progress and has been underway since 2017, and thus far has collected surveys from 1200 participants. This mode of survey data collection has strengths and weaknesses; the yield and representativeness of survey participants is broadly

representative but there are various logistical challenges in conducting the survey at a national level because surveys are collected at community events with relative higher financial costs and logistical efforts required than for an online survey. Therefore, an online survey format may be more appropriate for regular surveillance and may also achieve a sample of participants that is equally representative of the broader population.

This chapter describes the piloting of an online version of an adapted GOANNA survey, named *Let's Talk About It 2019*, a survey of South Australian young people aged 16-29 years. *Let's Talk About It 2019* has three goals: 1) to conduct a sexual health survey of young South Australians; 2) to include Aboriginal and/or Torres Strait Islander and non-Indigenous young people in the same survey to allow for comparisons; and 3) to pilot an online survey with a view to delivering the GOANNA survey via this format in the future enabling an assessment of trends over time. The aim of this study is to describe current sexual health, knowledge, protective/risk behaviours and access to health services for STI and blood-borne viruses (BBV) and related issues amongst young South Australians aged 16-29 years, both Aboriginal and or Torres Strait Islander and non-Indigenous.

3.4. Methods

3.4.1. Study design and setting

This study was a cross-sectional survey, completed by participants aged between 16-29 years, and residents of South Australia. The survey was completed online via a survey website. The survey was a pilot study to assess the acceptability and feasibility of collecting this data from young people with a view of collecting on an ongoing basis. The survey was conducted over a six-week period between July and August 2019.

3.4.2. Study governance

A study advisory group for the survey was established to oversee the project. The advisory group comprised of Aboriginal and/or Torres Strait Islander and non-Indigenous young people aged 16-29 years, including members of each gender. The role of the committee was to provide input from the perspective of young people on appropriateness of survey questions and on marketing of the survey to various groups within this population, such as to people living in regional and remote areas, people from a culturally and linguistically diverse background, Aboriginal peoples, university students, and employed/unemployed people.

3.4.3. Participants and recruitment

To be eligible, participants needed to be 16-29 years old, residents of South Australia and able to provide informed consent. There were no specified exclusion criteria. Participants were recruited online via marketing of the survey on social media (Facebook and Instagram) and via email networks. The marketing was reviewed on a regular basis and altered to target underrepresented populations completing the survey. The marketing of the survey utilised emojis representing intimacy, male and female genitals and the Aboriginal and Torres Strait Islander flags. Two images were created using the emojis and were used during the period the survey was open (Figure 3.1).

The advertisement was linked to the survey webpage which included a downloadable participant information statement. Potential participants then proceeded to the survey by selecting 'Start Survey', where they were presented with eligibility and consent questions. Eligibility criteria included; 'Do you live in South Australia?', 'Are you 16-29 years old?', and 'Do you consent?'. Participants were excluded if they selected 'No' or 'Disagree' for any of these questions and were exited from the survey. Otherwise participants were directed to the survey.

The advertisement advised that participants had the opportunity to win 1 of 10 $100 gift vouchers, as an incentive. At completion of the survey, participants were invited to submit their email address to enter the prize draw. This component was not linked to the survey and could not be linked to an individual's survey response. Email addresses were deleted after completion of the prize draw.

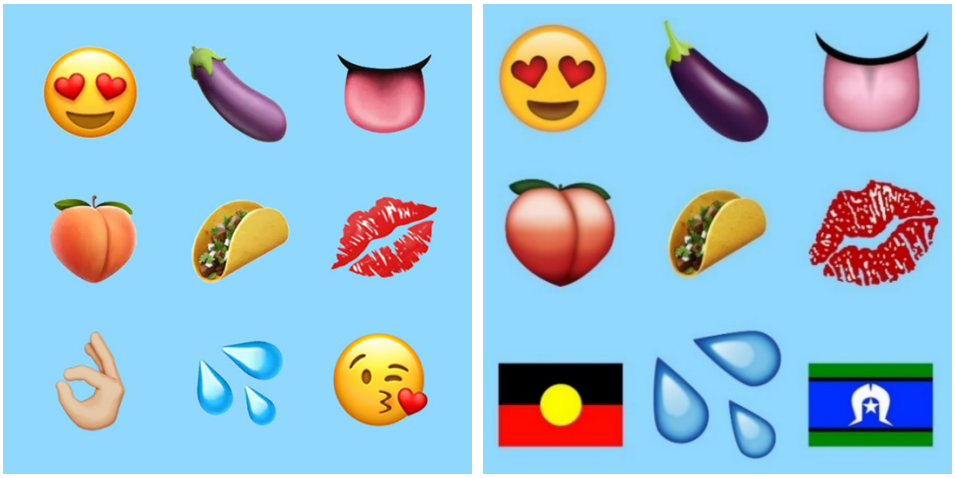

FIGURE 3.1: IMAGES USED FOR ADVERTISING OF THE SURVEY ON SOCIAL MEDIA, JUL-AUG 2019, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

3.4.4. Sample size

The aim was to recruit at least 150 Aboriginal and/or Torres Strait Islander and 300 non-Indigenous young people aged between 16-29 years old. With this sample size, the study would have 80% power to detect a 10% difference in proportions between the two groups (significance level 5%). This sample size would allow us to estimate prevalence of several characteristics with acceptable precision among the groups (±6% absolute width (for non-Indigenous participants) and ±13% absolute width (for Aboriginal participants) for 95% CIs).

3.4.5. Survey

The online survey was a modified version of the one used for the GOANNA Survey 2, to make it suitable for both Aboriginal and/or Torres Strait Islander and non-Indigenous participants (Appendix 3.A). The survey questions sought information on demographic characteristics, knowledge of STI and BBV, previous experience of testing and diagnosis of an STI or BBV, risk behaviours associated with acquisition of STI and BBV, experience of use of health services for sexual health, and a section on how participants felt about the survey. None of the questions were mandatory and some questions were conditional questions, e.g. 'Are you currently studying' and 'Where are you studying?' or 'Have you ever tested positive for an STI?' and 'Which STI(s) [have you tested positive for]?'. The survey was administered online using REDCap, a secure web application for building and managing online surveys and databases.

3.4.6. Data analysis

We compared and examined socio-demographic factors, behaviours, sexual health knowledge, health service access for STI and BBV, and associations between self-reported STI/BBV diagnosis among Aboriginal and/or Torres Strait Islander and non-Indigenous young people. Data were compiled into a single dataset, cleaned and analysed using Stata version 15 (15). Data analyses included descriptive analysis; calculation of proportions, means and medians, as appropriate. Missing data (e.g. not reported by participants) were included in calculations of proportions and reported in tables, where appropriate. Counts less than 5 are reported as <5, also counts less than 10 are reported without a percentage. Chi-squared, Fishers exact and Kruskal Wallis tests were used to test differences among variables comparing Indigenous status; the significance level was set at <0.05.

Univariate and adjusted logistic regression models were used to determine whether socio-demographic characteristics and sexual risk behaviours were associated with specific behaviours; ever been tested for an STI; and ever tested positive. Adjusted odds ratios (aOR) and 95 % Confidence Intervals (CI) are presented for all participants and by Indigenous status.

The fitness of models was tested using the Hosmere-Lemeshow criteria (16) and multi collinearity was also assessed using the variance inflation factor. The socio-demographic characteristics and sexual risk behaviours used in logistic regression analysis were included based on existing literature (17-28) and public health importance: Indigenous status, gender, age group, sexuality, remoteness, marital status, education level, employment status, concurrency, number of sexual partners, use of internet and mobile apps, condom use, alcohol and illicit drug use, and drug score. A 'drug score' for each participant was created by assigning a score of '1' (if yes, illicit drugs were reported as being used) and '0' (if no, illicit drugs were reported as being used); scores were added for each drug used by a participant, and re-categorised according to their final drug score: (0: no drug, 1: one drug only, 2: two or more drugs).

3.4.7. Ethics approval

Ethics approval was obtained from the Aboriginal Human Research Ethics Committee (South Australia) (04-18-797), Flinders University Social and Behavioural Research Ethics Committee (OH-00202) and the Australian National University Human Research Ethics Committee (2019/311).

3.5. Results

3.5.1. Participant recruitment and eligibility

To assess the acceptability and feasibility of this survey among our target population we assessed the participation rate and broad demographics of the survey over time. Within the first four days of the survey being advertised on social media, over 400 young people had accessed the survey. Over two-thirds were female, the median age was 18 years (interquartile range, IQR:17-23 years) and only two participants were Aboriginal and/or Torres Strait Islander. The initial target sample size was 450 young people; however, given that the survey was overrepresented in this early phase by younger age groups and females, and very few Aboriginal and Torres Strait Islander participants the investigator team chose to keep the survey open. During the six-week period the survey was open the marketing strategy and emoji image was altered to attract underrepresented populations. Specifically, targeting via social media among males, young people from rural and remote areas and those with an interest in Aboriginal and Torres Strait Islander culture, history, language, National Aborigines and Islanders Day Observance Committee (NAIDOC) and reconciliation were trialled during the remaining weeks of the survey. To enhance the appeal to males the background of the original image was changed to a navy-blue colour and used specifically for targeting of the survey to males only (Figure 3.2).

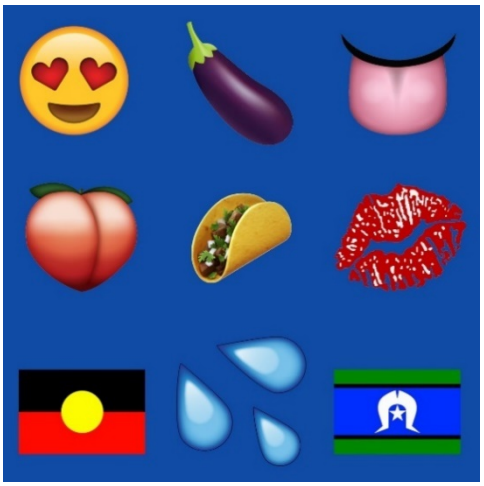

FIGURE 3.2: MODIFIED IMAGES USED FOR ADVERTISING OF THE SURVEY ON SOCIAL MEDIA WITH NAVY BLUE BACKGROUND, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

In total 2,724 people accessed the survey during the six-week period. Figure 3.3 provides details on the number of people who accessed the survey by gender and Figure 3.4 by Indigenous status. Of those who accessed the survey, 2,528 were eligible, having met the three survey eligibility questions. However, 141 were excluded based on not completing basic demographic information or any other part of the survey. A further six participants were excluded: five provided postcodes not from SA and one was under the age of 16 (despite agreeing to the eligibility questions about age and residence in SA). In total 2,380 survey participants were included in the analysis.

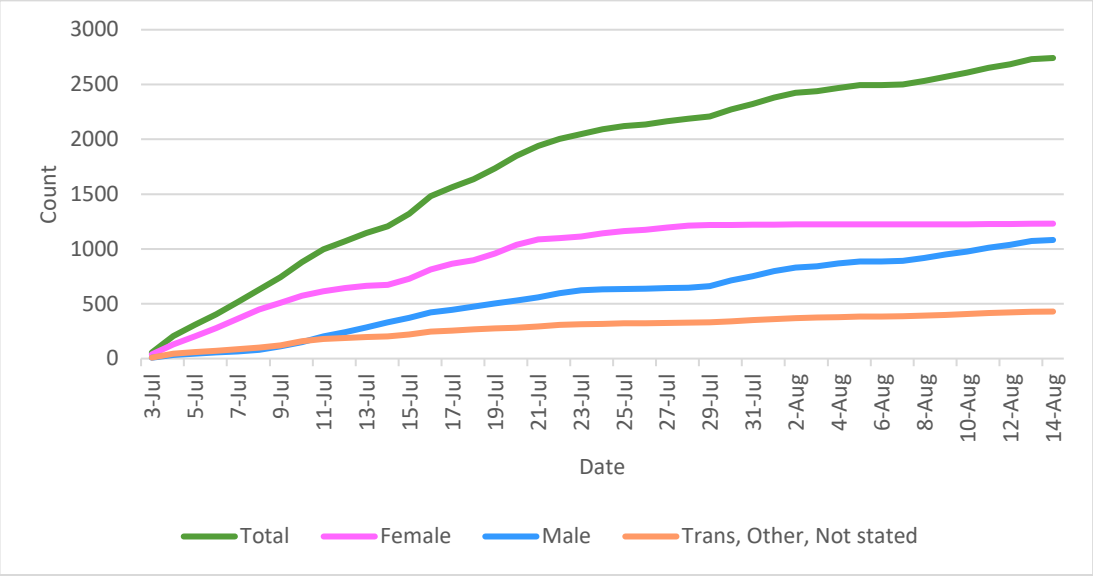

FIGURE 3.3: YOUNG PEOPLE WHO ACCESSED THE SURVEY, BY GENDER, JUL-AUG 2019, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

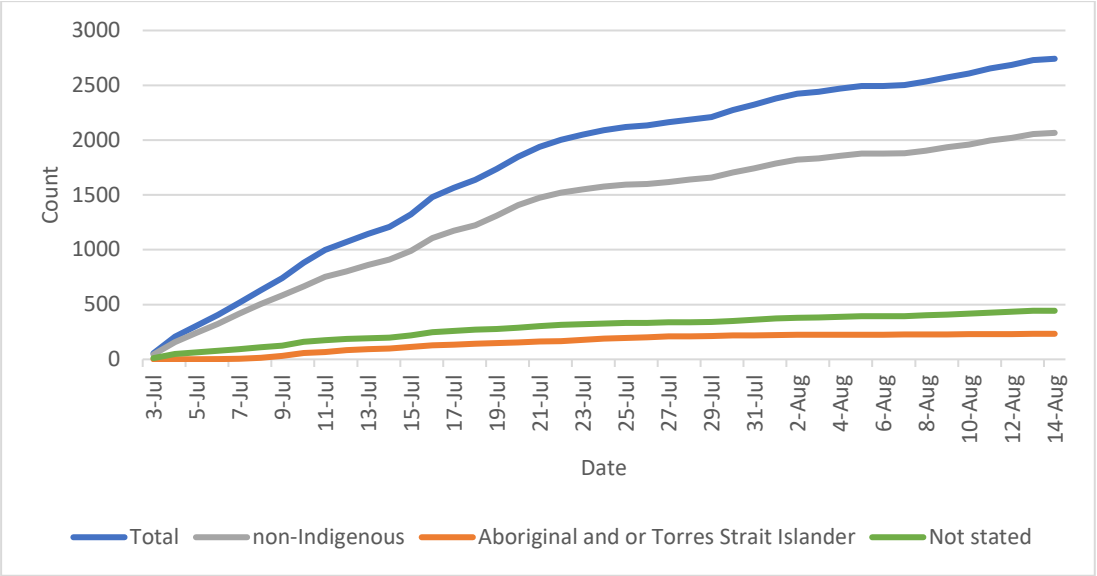

FIGURE 3.4: YOUNG PEOPLE WHO ACCESSED THE SURVEY, BY INDIGENOUS STATUS, JUL-AUG 2019, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

3.5.2. Participant characteristics

Table 3.1 presents the characteristics of survey participants by Indigenous status. Overall there were more females (52%, n=1,228) than males (45%, n=1,078); the overall median age was 20 years (IQR:17-24 years); less than half (44%, n=1,039) of participants were aged 16-19 years; almost three-quarters (72%, n=1,706) of participants identified as straight (heterosexual) followed by bisexual (17%, n=404), gay (4%, n=92), lesbian (2%, n=42), (identifying their sexuality as) other (2%, n=44), and unsure (3% , n=82); and over three-quarters (78%, n=1,861) were from the Adelaide urban area.

Most participants were not married (77%, n=1,828) and over half (61%, n=1,445) lived with their parents. Almost two-thirds (62%, n=1,469) of participants were currently engaged in study, at high school (43%, n=637) and university – undergraduate level (38%, n=552); and over one-third (37%, n=871) of participants had completed secondary education compared to tertiary education (university) (17%, n=401). Over half (51%, n=1,204) were engaged in part-time/casual employment.

Ten percent (n=231) of participants identified as Aboriginal and or Torres Strait Islander; most (73%, n=168) were female and the median age for Aboriginal and or Torres Strait Islander participants was 22 years (IQR:18-26 years). In comparison, less than half (49%, n=1,019) of non-Indigenous participants were female and the median age for all non-Indigenous participants was 21 years (IQR:17-24 years) (Table 3.1). From here on results are presented by Indigenous status.

TABLE 3.1: SURVEY PARTICIPANT CHARACTERISTICS BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	Indigenous status		
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)
Participants (n)	2,380	231	2,062	87
Gender				
Female	1,228 (52%)	168 (73%)	1,019 (49%)	41 (47%)
Male	1,078 (45%)	55 (24%)	980 (48%)	43 (49%)
Transgender	35 (1%)	<5	30 (1%)	<5
Other	29 (1%)	<5	27 (1%)	0
Not reported	10 (<1%)	<5	6	<5
Sexual identity				
Straight	1,706 (72%)	156 (68%)	1,484 (72%)	66 (76%)
Gay	92 (4%)	7	84 (4%)	<5
Lesbian	42 (2%)	<5	37 (2%)	<5
Bisexual	404 (17%)	49 (21%)	342 (17%)	13 (15%)
Unsure	82 (3%)	9	71 (3%)	<5
Other	44 (2%)	5	38 (2%)	<5
Not reported	10 (<1%)	<5	6	<5
Age group				
16-19 years	1,039 (44%)	76 (33%)	924 (45%)	39 (45%)
20-24 years	819 (34%)	85 (37%)	716 (35%)	18 (21%)
25-29 years	492 (21%)	66 (29%)	404 (20%)	22 (25%)
Not reported	30 (1%)	<5	18 (1%)	8
Residential status				
Urban	1,861 (78%)	172 (74%)	1,631 (79%)	58 (67%)
Rural	385 (16%)	38 (16%)	332 (16%)	15 (17%)
Remote	55 (2%)	12 (5%)	41 (2%)	<5
Not reported	79 (3%)	9	58 (3%)	12 (14%)
Relationship status				
Married	104 (4%)	11 (5%)	88 (4%)	5
De-facto	427 (18%)	53 (23%)	360 (17%)	14 (16%)
Not married	1,828 (77%)	164 (71%)	1,599 (78%)	65 (75%)
Not reported	21 (1%)	<5	15 (1%)	<5
Living arrangements[#]				
With parents	1,445 (61%)	91 (39%)	1,293 (63%)	61 (70%)
With partner	535 (22%)	60 (26%)	456 (22%)	19 (22%)
With children	142 (6%)	37 (16%)	103 (5%)	<5
Other family	480 (20%)	42 (18%)	415 (20%)	23 (26%)
Friends/housemate	313 (13%)	31 (13%)	277 (13%)	5
Alone	129 (5%)	24 (10%)	103 (5%)	<5
Currently studying				
Yes	1,469 (62%)	115 (50%)	1,299 (63%)	55 (63%)
No	900 (38%)	114 (49%)	756 (37%)	30 (34%)
Not reported	11 (<1%)	<5	7	<5
Study location				
High school	637 (43%)	39 (34%)	570 (44%)	28 (51%)
TAFE/college	144 (10%)	30 (26%)	107 (8%)	7
University – undergraduate	552 (38%)	33 (29%)	503 (39%)	133 (29%)
University – postgraduate	102 (7%)	6	93 (7%)	<5
Other	30 (2%)	7	23 (2%)	0
Not reported	<5	0	<5	<5
Highest level of education				
Primary school	37 (2%)	<5	33 (2%)	<5
Before year 10	30 (1%)	12 (5%)	17 (1%)	<5
Completed year 10	665 (28%)	60 (26%)	577 (28%)	28 (32%)

	Total	Indigenous status		
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)
Completed year 12	871 (37%)	82 (36%)	771 (37%)	18 (21%)
TAFE/college	355 (15%)	52 (23%)	293 (14%)	10 (11%)
University – undergraduate	333 (14%)	16 (7%)	294 (14%)	23 (26%)
University – postgraduate	68 (3%)	<5	63 (3%)	<5
Not reported	21 (1%)	<5	14 (1%)	<5
Employment status				
Yes, part-time/casual	1,204 (51%)	73 (32%)	1,084 (53%)	47 (54%)
Yes, full-time	531 (22%)	54 (23%)	459 (22%)	18 (21%)
No	636 (27%)	102 (44%)	514 (25%)	20 (23%)
Not reported	9	<5	<5	<5

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Participants were able to select all options that applied; therefore, the denominator is not the same.

3.5.3. Knowledge of sexually transmitted infections and bloodborne viruses

Participants' knowledge of STI and BBV was assessed using the following 10 questions.

1. If a woman with HIV is pregnant, can her baby become infected with HIV?
2. Does a person with a STI always have symptoms?
3. Are people who have injected drugs at risk for hepatitis C?
4. Does the pill (birth control) protect a woman from HIV infection?
5. Can chlamydia make a woman unable to have a baby?
6. If condoms are used during sex, does this help to protect people from getting HIV?
7. Is there medicine that can cure hepatitis C?
8. Could someone who looks healthy pass on HIV infection?
9. Can hepatitis B be passed on by sex?
10. Can chlamydia be easily treated with antibiotics?

The questions which received the highest proportion of correct answers by all participants were questions two (88%), four (89%), six (86%), and eight (86%). The questions that received the lowest proportion of correct answers were questions five (43%), seven (18%), and nine (43%). Both Aboriginal and/or Torres Strait Islander and non-Indigenous participants provided similar proportions of correct answers for each question. Appendix 3.B provides further detail on count and proportion for each question by Indigenous status.

Participants' scores on each question were aggregated to form a composite knowledge scale with scores ranging from 0-10. Over 75% of participants responded correctly to at least six or

more questions. Aboriginal and/or Torres Strait Islander and non-Indigenous participants both scored an average of seven. Table 3.2 presents participants' knowledge of STI and BBV average scores by Indigenous status. There was no difference in knowledge of STI and BBV average scores by Indigenous status (p-value=0.206).

TABLE 3.2 SEXUALLY TRANSMITTED INFECTIONS AND BLOODBORNE VIRUSES KNOWLEDGE QUESTIONS AVERAGE SCORE BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	Indigenous status			
	All participants N=2,205	**Aboriginal and or Torres Strait Islander** N=220	**Non-Indigenous** N=1,985	**Not stated** N=78	**p-value**
Lowest (score 0-5) n (%)	540 (24%)	43 (20%)	483 (24%)	14 (18%)	
Average (score 6-7) n (%)	853 (37%)	91 (41%)	752 (37%)	37 (47%)	0.206*
Highest (score 8-10) n (%)	890 (39%)	86 (39%)	777 (39%)	27 (35%)	

N.B. Counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and knowledge question average score, Pearson Chi-square test*.

3.5.4. Sexual behaviour

Overall, 1,867 (78%) participants reported ever being sexually active (oral, vaginal or anal sex). Eighty-one percent of Aboriginal and or Torres Strait Islander and 78% (n=1,618) of non-Indigenous participants, reported ever being sexually active and 97% (n=180) and 94% (n=1,516) respectively, of those sexually active had ever had sexual intercourse (penetrative vaginal or anal sex); there were statistically significant differences in sexually active and sexual intercourse by Indigenous status (p-value=0.028 and p-value=0.006, respectively) (Appendix 3.C).

Participants were asked about their age of sexual debut for oral, vaginal and anal sex. Overall, the median age at sexual debut among participants who reported having had oral sex was 16.5 years (IQR:15-17 years), for vaginal sex 16.6 years (IQR:15-18 years), and for anal sex 18.9 years (IQR:17-21 years) (Appendix 3.C). Figure 3.5 presents the median age of sexual debut of participants by Indigenous status. Generally, Aboriginal and or Torres Strait Islander participants reported their age of sexual debut for oral, vaginal and anal sex to be marginally earlier than non-Indigenous participants, a difference of 0.5 years for oral sex, 0.7 years for vaginal sex, and 0.4 years for anal sex. There were statistically significant differences in median age of sexual debut for oral sex and vaginal sexual debut by Indigenous status (p-

value=0.013 and p-value=<0.001, respectively); however no difference in median age of sexual debut for anal sex by Indigenous status (p-value=0.177).

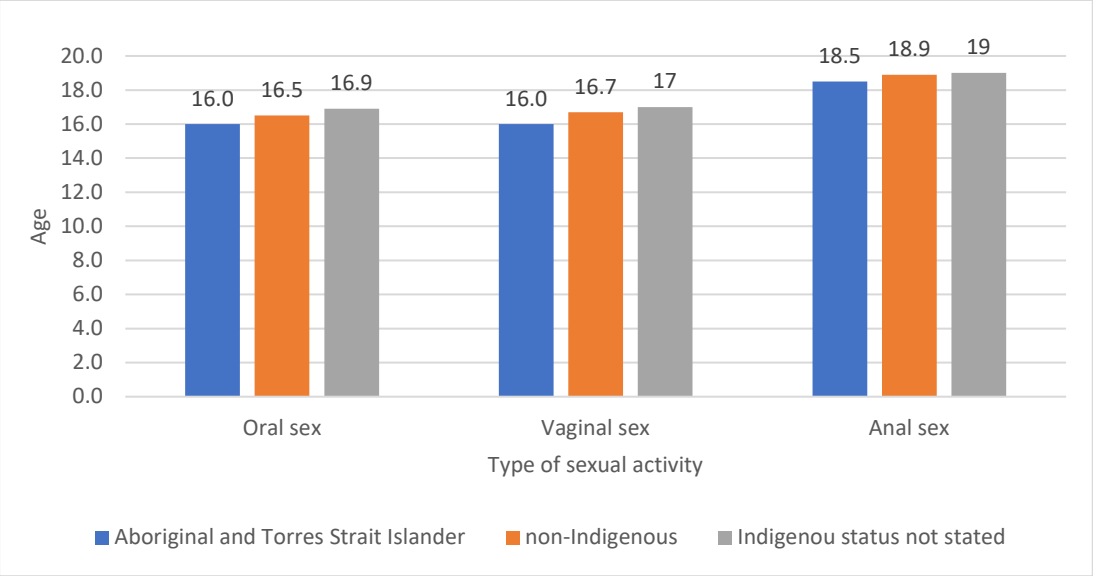

FIGURE 3.5: PARTICIPANTS SEXUAL DEBUT BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

3.5.4.1. Sexual partners and concurrency

Sexual concurrency is defined as "overlapping sexual partnerships where sexual intercourse with one partner occurs between two acts of intercourse with another partner" (29), and is an important risk factor for STI transmission and acquisition. Overall, 71% (n=1,320) of participants who were sexually active reported they had a regular sexual partner (someone they have an ongoing sexual relationship with). Almost two-thirds, 65% (n=120) of Aboriginal and or Torres Strait Islander participants reported having a regular sexual partner compared to 71% (n=1,156) of non-Indigenous participants and both groups reported similar sexual partner concurrency (1 & 2) of between 10-13%; there was no difference in reported regular sexual partner and concurrency by Indigenous status (p-value=0.539, p-value=0.639, and p-value=0.248, respectively) (Table 3.3).

3.5.4.2. Last sexual partner

Of participants who reported being sexually active, 1,183 (63%) participants reported their last sexual partner was their current partner. Both Aboriginal and or Torres Strait Islander and non-Indigenous participants were more likely to report their last sexual partner being their current partner (58%, n=108 and 64%, n=1,036, respectively) than someone they had known for a while, but not current partner or (35%, n=66 and 25%, n=408, respectively) or someone they had just met for the first time (6%, n=12 and 10%, n=162, respectively); there

were statistically significant differences in relationship with last sexual partner by Indigenous status (p-value=0.008).

3.5.4.3. Number of sexual partners

The majority of both Aboriginal and or Torres Strait Islander (53%) and non-Indigenous (58%) participants reported one sexual partner and similar proportions of two or more partners in the past 12 months; there was no difference in number of sexual partners in the past 12 months by Indigenous status (p-value=0.151) (Table 3.4).

3.5.4.4. Internet and mobile apps

Overall, 30% (n=713) of participants reported using the internet/mobile apps to meet partners in the last year. Aboriginal and/or Torres Strait Islander and non-Indigenous participants were equally likely to use internet/mobile apps to meet partners; there was no difference in use of internet/mobile apps to meet partners by Indigenous status (p-value=0.767) (Table 3.5).

TABLE 3.3: SEXUAL PARTNER CONCURRENCY, BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	Indigenous status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Regular sexual partner (n)	1,867	186	1,618	63	
Yes	1,320 (71%)	120 (65%)	1,156 (71%)	44 (70%)	0.539*
No	543 (29%)	66 (35%)	458 (28%)	19 (30%)	
Not reported	<5	0	<5	0	
Only have sex with your partner, concurrency 1 (n)	1,320	120	1,156	44	
Yes	1,160 (88%)	104 (87%)	1,017 (88%)	39 (89%)	0.639*
No	158 (12%)	16 (13%)	137 (12%)	5	
Not reported	<5	0	<5	0	
Partner only has sex with you, concurrency 2 (n)	1,320	120	1,156	44	
Yes	1,182 (90%)	104 (87%)	1,039 (90%)	39 (89%)	0.248*
No	136 (10%)	16 (13%)	115 (10%)	5	
Not reported	<5	0	<5	0	

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and sexual partner concurrency, Pearson Chi-square test*.

TABLE 3.4: PARTICIPANTS RELATIONSHIP WITH LAST SEXUAL PARTNER AND NUMBER OF SEXUAL PARTNERS IN PAST 12 MONTHS, BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	Indigenous status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Relationship with last sexual partner (n)	1,867	186	1,618	63	
Current partner	1,183 (63%)	108 (58%)	1,036 (64%)	39 (62%)	
Just met for the first time	181 (10%)	12 (6%)	162 (10%)	7	0.008*
Known for a while, not current partner	491 (26%)	66 (35%)	408 (25%)	17 (27%)	
Not reported	12 (1%)	0	12 (1%)	0	
Number of sexual partners in the last year (n)	1,755	180	1,516	59	
None	63 (4%)	11 (6%)	50 (3%)	<5	
1	1,008 (57%)	96 (53%)	877 (58%)	35 (59%)	0.151*
2-4 people	468 (27%)	46 (26%)	405 (27%)	17 (29%)	
5 or more people	215 (12%)	27 (15%)	183 (12%)	5	
Not reported	<5	0	<5	0	

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and relationship of last sexual partner and number of sexual partners in past 12 months, Pearson Chi-square test*.

TABLE 3.5: PARTICIPANTS USE OF INTERNET/MOBILE PHONE APPS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	Indigenous status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Used the internet/mobile phone apps to meet partners (n)	2,380	231	2,062	87	
Yes	713 (30%)	69 (30%)	618 (30%)	26 (30%)	0.767*
No	1,437 (60%)	134 (58%)	1,257 (61%)	46 (53%)	
Not reported	230 (10%)	28 (12%)	187 (9%)	15 (17%)	

N.B. Counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and participant use of internet/mobile phone apps, Pearson Chi-square test*.

3.5.4.5. Behaviour at last sexual encounter

Eighteen percent (n=342) of all participants reported being 'drunk' or 'high' during their last sexual encounter. Aboriginal participants were more like to report being drunk' or 'high' at their last sexual encounter than non-Indigenous participants, 28% (n=52) and 17% (n=283) respectively; there were statistically significant differences in being 'drunk' or 'high' during their last sexual encounter by Indigenous status (p-value=0.001).

3.5.5. Behavioural factors influencing risk of sexually transmitted infection or bloodborne virus

3.5.5.1. Contraception

Overall, condoms were reported as the most frequent form of contraception used at last sexual encounter by all participants (49%, n=767) and by Indigenous status. After condoms, the pill (n=651, 43%), the withdrawal method (23%, n=343) and implant (14%, n=205) were the most common forms of contraception used by all participants, regardless of Indigenous status (Appendix 3.D).

3.5.5.2. Condom use

Of those participants who reported having a regular partner, 21% (n=265) reported always using a condom with their regular partner in the past 12 months, 36% (n=455) sometimes, and 42% (n=534) never. Aboriginal and or Torres Strait Islander participants were half as likely (n=12, 10%) to use a condom with a regular partner than non-Indigenous participants (n=245, 22%); there were statistically significant differences in condom use with their regular partner by Indigenous status (p-value=0.005) (Table 3.6).

Among participants who reported having a casual sexual partner, 36% (n=352) reported always using a condom in the past 12 months, 39% (n=384) sometimes, and 25% (n=247) never (Table 3.6). Non-Indigenous participants were more likely to report always using a condom with a casual partner (37%, n=309) than Aboriginal and/or Torres Strait Islander participants (25%, n=31). There were statistically significant differences in condom use with casual sexual partners by Indigenous status (p-value=<0.001).

Participants were more likely to get their condoms from a shop/chemist than any other source (74%, n=1,290), while 9% (n=156) reported their sexual partner provided the condoms (Table 3.7). There were statistically significant differences in 'Where do you usually get condoms from?' by Indigenous status (p-value=<0.001).

3.5.5.3. Alcohol, tobacco and other drugs

3.5.5.3.1. Alcohol

Eighty percent (n=1,904) of all participants reported drinking alcohol in the past 12 months. Drinking alcohol once a week or more was reported by 38% (n=726) of all participants, followed by 'about once a month' 32% (n=600), 'every few months' 19% (n=369), 'once or twice a year' 9% (n=170), and 'every day' 2% (n=38). Of participants who reported drinking alcohol in the past 12 months, 60% (n=1,142) reported drinking 1-4 drinks on each occasion, compared to 40% (n=759) of participants who reported drinking 5 or more drinks on each occasion - which is considered risky drinking behaviour (30). There were statistically

significant differences in frequency of alcohol consumption by Indigenous status (p-value=<0.001).

Table 3.8 presents frequency of alcohol consumption and number of drinks on each occasion by Indigenous status. Non-Indigenous participants consumed alcohol more frequently than Aboriginal and or Torres Strait Islander participants; however, over half, 56% (n=100) of Aboriginal and or Torres Strait Islander participants reported drinking 5 or more drinks on each occasion, more than non-Indigenous participants (38%, n=636). There were statistically significant differences in number of drinks on each occasion by Indigenous status (p-value=<0.001).

TABLE 3.6: HEATMAP OF PARTICIPANT CONDOM USE WITH REGULAR AND CASUAL SEXUAL PARTNER IN THE PAST 12 MONTHS, BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	**Indigenous status**			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Condom use with regular partner (n)	1,254	115	1,097	42	
Always	265 (21%)	12 (10%)	245 (22%)	8	
Sometimes	455 (36%)	40 (35%)	400 (36%)	15 (36%)	0.005†
Never	534 (43%)	63 (55%)	452 (41%)	19 (45%)	
Exclusions					
Not reported or no regular partner and/or not sexually active	1,126	116	965	45	
Condom use with casual sexual partner (n)	983	122	829	32	
Always	352 (36%)	31 (25%)	309 (37%)	12 (38%)	
Sometimes	384 (39%)	47 (39%)	321 (39%)	16 (50%)	<0.001*
Never	247 (25%)	44 (36%)	199 (24%)	<5	
Exclusions					
Not reported or no casual sexual partner and/or not sexually active	1,397	109	1,233	55	

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and condom use with regular partner, and by Indigenous status and condom use with casual sexual partner, Pearson Chi-square test* and Fishers exact test†.

TABLE 3.7: WHERE PARTICIPANTS REPORTED GETTING THEIR CONDOMS FROM, BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	Indigenous status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Where do you usually get condoms from (n)	1,755	178	1,475	59	
Shop/chemist	1,290 (75%)	121 (68%)	1,126 (76%)	43 (73%)	
Medical clinic/GP	21 (1%)	7	14 (1%)	0	
Aboriginal medical service	10 (1%)	9	<5	0	
Friends	16 (1%)	<5	12 (1%)	<5	<0.001†
Family member	11 (1%)	0	11 (1%)	0	
Sexual partner	156 (9%)	12 (7%)	137 (9%)	7	
Other	23 (1%)	<5	21 (1%)	0	
Never use condoms	185 (11%)	25 (14%)	153 (10%)	7	
Exclusions Not reported	625	53	587	28	

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and where participants reported getting condom from, Fishers exact test†.

3.5.5.3.2. Tobacco

Thirteen percent (n=318) of participants reported they smoked cigarettes. Aboriginal and Torres Strait Islander participants were almost twice as likely (23%, n=54) to report smoking cigarettes than non-Indigenous participants (12%, n=253). There were statistically significant differences in reported cigarette smoked by Indigenous status (p-value=<0.001). Regardless of Indigenous status, most participants reported smoking between 1-10 cigarettes per day - 63% (n=34) Aboriginal and/or Torres Strait Islander, and 58% (n=146) non-Indigenous participants; there was no difference in number of cigarette smoked per day by Indigenous status (p-value=1.000).

TABLE 3.8: FREQUENCY OF ALCOHOL CONSUMPTION AND NUMBER OF DRINKS PER OCCASION BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	Aboriginal status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Drink alcohol (n= 2,380)	2,380	231	2,062	67	
Yes	1,904 (80%)	180 (78%)	1,663 (81%)	61 (70%)	0.793*
No	211 (9%)	21 (9%)	182 (9%)	8	
Not reported	265 (11%)	30 (13%)	217 (11%)	18 (21%)	

	Total	Aboriginal status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Frequency of alcohol consumption (n=1,904)	1,904	180	1,663	61	
Everyday	38 (2%)	<5	35 (2%)	<5	
Once a week or more	726 (38%)	55 (31%)	649 (39%)	22 (36%)	
About once a month	600 (32%)	38 (21%)	538 (32%)	24 (39%)	<0.001*
Every few months	369 (19%)	59 (33%)	301 (18%)	9	
Once of twice a year	170 (9%)	27 (15%)	139 (8%)	<5	
Not reported	<5	0	<5	0	
Number of drinks on each occasion (n=1,904)	1,904	180	1,663	61	
1-4 drinks	1,142 (60%)	80 (44%)	1,024 (62%)	38 (62%)	<0.001*
5 or more drinks	759 (40%)	100 (56%)	636 (38%)	23 (38%)	
Not reported	<5	0	<5	0	

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and frequency of alcohol consumption and number of drinks per occasion, Pearson Chi-square test*.

3.5.5.3.3. Illicit drugs

Over a third (36%, n=863) of participants reported using marijuana in the past 12 months. Among Aboriginal and/or Torres Strait Islander participants, 45% (n=103) reported using marijuana, compared to 36% (n=740) of non-Indigenous participants. Frequency of marijuana use by Indigenous status is presented in Table 3.9. Aboriginal and/or Torres Strait Islander participants were three times more likely (33%, n=34) to report using marijuana everyday than non-Indigenous participants (10%, n=72). There were statistically significant differences in reported use and frequency of marijuana by Indigenous status (p-value=0.002 and p-value=<0.001, respectively).

Forty-eight (2%) participants reported using meth/amphetamine in the past 12 months, seven of those were Aboriginal and/or Torres Strait Islander and 39 (2%) were non-Indigenous. Table 3.9 presents frequency of meth/amphetamine use by Indigenous status. There was no difference in reported use and frequency of meth/amphetamine by Indigenous status (p-value=0.214 and p-value=0.353, respectively). Ice or crystal (73%, n=35) was the most common form of meth/amphetamine used by participants, followed by speed (23%, n=11) and base (n=2). Inhaling/smoking (60%, n=29) was reported as the most common method for taking meth/amphetamine, followed by snorting (n=9), swallowing (n=8) and injecting (n=2).

Fifteen percent (n=348) of participants reported using ecstasy in the past 12 months. Similar proportions of Aboriginal and or Torres Strait Islander (17%, n=40) and non-Indigenous (14%,

n=298) participants reported using ecstasy in the past 12 months. Frequency of ecstasy use by Indigenous status is presented in Table 3.9. There was no difference in reported use and frequency of ecstasy by Indigenous status (p-value=0.174 and p-value=0.574, respectively).

TABLE 3.9: FREQUENCY OF MARIJUANA, METH/AMPHETAMINE AND ECSTASY USE, BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	Aboriginal status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Used marijuana (n)	2,380	231	2,062	87	
Yes	863 (36%)	103 (45%)	740 (36%)	20 (23%)	0.002*
No	1,249 (52%)	98 (42%)	1,102 (53%)	49 (56%)	
Not reported	268 (11%)	30 (13%)	220 (11%)	18 (21%)	
Frequency of marijuana use (n)	863	103	740	20	
Everyday	107 (12%)	34 (33%)	72 (10%)	<5	
Once a week or more	128 (15%)	18 (17%)	110 (15%)	0	
Once a month	109 (13%)	12 (12%)	94 (13%)	<5	<0.001*
Every few months	198 (23%)	17 (17%)	173 (23%)	8	
Once or twice a year	321 (37%)	22 (21%)	291 (39%)	8	
Used meth/amphetamine (n)	2,380	231	2,062	87	
Yes	48 (2%)	7	39 (2%)	<5	0.214*
No	2,066 (87%)	194 (84%)	1,805 (88%)	67 (77%)	
Not reported	266 (11%)	30 (13%)	218 (11%)	18 (21%)	
Frequency of meth/amphetamine use (n)	48	7	39	<5	
Everyday	11 (23%)	0	11 (28%)	0	
Once a week or more	<5	<5	<5	0	
Once a month	6	<5	5	0	0.353†
Every few months	9	<5	7	<5	
Once or twice a year	19 (40%)	<5	14 (36%)	<5	
Used ecstasy (n=2,380)	2,380	231	2,062	87	
Yes	348 (15%)	40 (17%)	298 (14%)	10 (11%)	0.174*
No	1,767 (72%)	161 (70%)	1,547 (75%)	59 (68%)	
Not reported	265 (11%)	30 (13%)	217 (11%)	18 (21%)	
Frequency of ecstasy use (n=348)	348	40	298	10	
Everyday	<5	0	<5	0	
Once a week or more	11 (3%)	<5	8	0	
Once a month	60 (70%)	7	51 (17%)	<5	0.574†
Every few months	101 (29%)	11 (28%)	86 (29%)	<5	
Once or twice a year	173 (50%)	19 (48%)	150 (50%)	4	

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and frequency of marijuana, meth/amphetamine and ecstasy use, Pearson Chi-square test* and Fisher's exact test†.

3.5.5.3.4. Other drugs

Cocaine was the most common type of other drug used (11%, n=254) by all participants, followed by LSD/acid/mushrooms (6%, n=135), benzodiazepines (2%, n=48), ketamine (2%, n=44) and other (5%, n=128) (Appendix 3.E). Ten percent (n=23) of Aboriginal and or Torres

Strait Islander and 11% (n=221) of non-Indigenous participants reported using cocaine. Use of LSD/acid/mushrooms was higher among non-Indigenous participants (6%, n=122) than Aboriginal and or Torres Strait Islander participants (3%, n=8).

3.5.6. Previous diagnosis of a sexually transmitted infection or bloodborne virus

3.5.6.1. Tested for a sexually transmitted infection

Of sexually active participants, almost half, 48% (n=898) of participants reported ever being tested for an STI. Aboriginal and or Torres Strait Islander participants were more likely to have ever been tested for an STI (69%, n=128) than non-Indigenous participants (46%, n=746). Almost a third (29%, n=539) of participants reported having been tested in the past 12 months (Appendix 3.F). There were statistically significant differences in ever been tested for an STI by Indigenous status (p-value=<0.001).

Of those who had ever been tested for an STI, participants reported the medical clinic/general practice was the most common place where an STI test was likely to been performed (70%, n=627), followed by family planning/sexual health clinic (25%, n=228), Aboriginal Medical Service (3%, n=30) and other (2%, n=14). Similarly, the medical clinic/general practice was the most common place where an STI test was likely to been performed regardless of Indigenous status (Appendix 3.F).

Adjusted logistic regression models suggested that among Aboriginal and Torres Strait Islander participants, ever having been tested for an STI was significantly associated with female gender, older age groups (20-24 and 25-29), having completed TAFE/university, and not using a condom during last sex or with casual sexual partners. Among non-Indigenous participants, ever having been tested for an STI was significantly associated with female gender, older age groups (20-24 and 25-29), participants whose partner had sex with other people, having had 2-4 or 5 of more sexual partners in the past 12 months, not using a condom during last sex, drinking 1-4 drinks alcoholic drinks per occasion, using marijuana, and having a drug score of 1 or 2 or more (Table 3.10). Results of univariate analysis can be found in Appendix 3.G.

TABLE 3.10: ADJUSTED LOGISTIC REGRESSION ANALYSIS[#] – EVER TESTED FOR A SEXUALLY TRANSMITTED INFECTION AMONG SEXUALLY ACTIVE PARTICIPANTS, BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	All participants N= 1,805		Aboriginal and or Torres Strait Islander N=182		Non-Indigenous N= 1,564	
	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Indigenous status						

	All participants N= 1,805		Aboriginal and or Torres Strait Islander N=182		Non-Indigenous N= 1,564	
	aOR (95% CI)	**p-value**	**aOR (95% CI)**	**p-value**	**aOR (95% CI)**	**p-value**
Non-Indigenous	Reference					
Aboriginal and or Torres Strait Islander	**2.16 (1.29-3.91)**	**0.011**				
Gender						
Male	Reference		Reference		Reference	
Female	**3.06 (2.22-4.22)**	**<0.001**	2.41 (1.07-3.51)	0.034	**3.03 (2.17-4.23)**	**<0.001**
Age group						
16-19	Reference		Reference		Reference	
20-24	**3.12 (2.07-4.70)**	**<0.001**	3.34 (1.41-7.29)	0.006	**3.16 (2.04-4.87)**	**<0.001**
25-29	**7.89 (4.62-13.48)**	**<0.001**	6.47 (2.40-17.41)	0.000	**8.38 (4.76-14.76)**	**<0.001**
Sexuality						
Straight/heterosexual	Reference		Reference		Reference	
LGBTI/homosexual	1.40 (1.00-1.97)	0.052	1.29 (0.61-2.74)	0.502	1.42 (1.00-2.01)	0.051
Remoteness						
Rural and remote	Reference		Reference		Reference	
Urban	1.18 (0.80-1.73)	0.387	1.13 (0.45-2.85)	0.792	1.12 (0.75-1.67)	0.584
Marital status						
Not married	Reference		Reference		Reference	
Married/De-facto	0.98 (0.70-1.38)	0.909	1.76 (0.81-3.83)	0.154	1.06 (0.75-1.51)	0.729
Education level						
Completed less than year 12	Reference		Reference		Reference	
Completed year 12	**0.94 (0.61-1.46)**	**0.795**	1.72 (0.75-3.95)	0.203	0.95 (.061-1.49)	0.832
TAFE/University	**1.56 (0.97-2.51)**	**0.067**	2.80 (1.17-6.70)	0.021	1.57 (0.97-2.57)	0.069
Employed						
No	Reference		Reference		Reference	
Yes	1.00 (0.69-1.46)	0.997	1.80 (0.91-3.57)	0.092	1.00 (0.67-1.48)	0.981
Concurrency - partner only has sex with you						
Yes	Reference		Reference		Reference	
No	**1.92 (1.04-3.57)**	**0.037**	1.20 (0.22-6.56)	0.835	**2.00 (1.06-3.81)**	**0.033**
No. of sexual partners in past 12 months						
1	Reference		Reference		Reference	
2-4	**1.74 (1.10-2.75)**	**0.017**	0.61 (0.26-1.41)	0.244	**2.00 (1.24-3.25)**	**0.004**
5 or more	**4.89 (2.40-9.98)**	**<0.001**	7.60 (0.95-60.98)	0.056	**4.80 (2.28-10.08)**	**<0.001**
Used internet/mobile apps to meet partners						
No	Reference		Reference		Reference	
Yes	1.08 (0.71-1.65)	0.707	0.75 (0.35-1.59)	0.454	1.04 (0.67-1.61)	0.853
Used a condom last time had sex						
Yes	Reference		Reference		Reference	
No	**1.76 (1.27-2.45)**	**0.001**	2.33 (1.03-5.29)	0.043	**1.62 (1.15-2.27)**	**0.005**
Used a condom with casual sexual partner						

	All participants N= 1,805		Aboriginal and or Torres Strait Islander N=182		Non-Indigenous N= 1,564	
	aOR (95% CI)	**p-value**	**aOR (95% CI)**	**p-value**	**aOR (95% CI)**	**p-value**
Yes	Reference		Reference		Reference	
No	0.96 (0.64-1.43)	0.833	**7.63 (1.31-44.46)**	**0.024**	1.14 (0.75-1.73)	0.535
Drunk or high last sexual encounter						
No	Reference		Reference		Reference	
Yes	1.14 (0.72-1.79)	0.580	0.53 (0.25-1.11)	0.095	1.09 (0.68-1.76)	0.724
No. alcohol drinks per session						
5 or more	Reference		Reference		Reference	
1-4	**1.57 (1.12-2.21)**	**0.009**	1.43 (0.69-2.97)	0.333	**1.65 (1.16-2.37)**	**0.006**
Used marijuana						
No	Reference		Reference		Reference	
Yes	**0.35 (1.07-1.55)**	**0.017**	0.95 (0.48-1.87)	0.872	**0.37 (0.15-0.88)**	**0.025**
Used meth/amphetamine						
No	Reference		Reference		Reference	
Yes	2.21 (0.64-7.57)	0.208	0.69 (0.12-3.88)	0.671	2.64 (0.70-10.40)	0.165
Used ecstasy						
No	Reference		Reference		Reference	
Yes	0.68 (0.35-1.33)	0.262	0.69 (0.31-1.55)	0.375	0.71 (0.36-1.40)	0.321
Used cocaine						
No	Reference		Reference		Reference	
Yes	1.10 (0.60-2.00)	0.759	0.83 (0.29-2.35)	0.728	1.29 (0.69-2.41)	0.420
Drug score						
0	Reference		Reference		Reference	
1	**3.10 (1.31-7.35)**	**0.010**	1.43 (0.62-3.30)	0.402	**2.91 (1.12-6.97)**	**0.017**
2 or more	**7.25 (2.16-24.17)**	**0.001**	0.79 (0.35-1.80)	0.579	**6.86 (1.98-23.77)**	**0.002**

[#] Independent variables used in adjusted logistic regression analysis are highlighted in bold and have been accounted for in the analysis.
aOR – Adjusted odds ratio; CI – Confidence interval.
63 participants were not included as their indigenous status was not stated.

3.5.6.2. Tested positive for a sexually transmitted infection

Of sexually active participants who had even been tested for an STI, 23% (n=201) reported ever testing positive for an STI. Testing positive for an STI was higher among Aboriginal and/or Torres Strait Islander participants (n=38, 30%) than among non-Indigenous participants (21%, n=158) (Appendix 3.F). There were statistically significant differences in ever tested positive for an STI by Indigenous status (p-value=0.034). Chlamydia was the most commonly diagnosed STI among all participants to had ever been tested for an STI (16%, n=145), regardless of Indigenous status (Table 3.11).

Adjusted logistic regression models suggested that among Aboriginal and Torres Strait Islander participants, ever testing positive for an STI was significantly associated with having

completed year 12, and having 2-4 sexual partners in the past 12 months. Among non-Indigenous participants, ever testing positive for an STI was significantly associated with older age groups (20-24 and 25-29), having 2-4 or 5 or more sexual partners, and using cocaine (Table 3.12). Results of univariate analysis can be found in Appendix 3.H.

TABLE 3.11: POSITIVE SEXUAL TRANSMITTED INFECTION AMONG PARTICIPANTS EVER TESTED#, BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	Indigenous status			
	All participants n (%) N=2,380	**Aboriginal and or Torres Strait Islander** n (%) N=231	**Non-Indigenous** n (%) N=2,062	**Not stated** n (%) N=87	**p-value**
Chlamydia	145 (16%)	30 (23%)	113 (15%)	<5	0.019*
Gonorrhoea	21 (2%)	6	15 (2%)	0	0.068*
Syphilis	5	<5	<5	0	0.548†
Trichomoniasis	<5	<5	<5	0	0.379†
Genital Herpes	35 (4%)	5	29 (4%)	<5	1.000†
Genital Warts	10 (1%)	<5	7	<5	0.627†
Other	25 (3%)	<5	19 (3%)	<5	0.763†

Participants were able to select all options that applied.
N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and positive sexual transmitted infection among participants ever tested, Pearson Chi-square test* and Fisher's exact test†.

TABLE 3.12: ADJUSTED LOGISTIC REGRESSION ANALYSIS[#] – EVER TESTED POSITIVE FOR A SEXUALLY TRANSMITTED INFECTION AMONG SEXUALLY ACTIVE PARTICIPANTS, BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	All participants N=847		Aboriginal and or Torres Strait Islander N=122		Non-Indigenous N=717	
	aOR (95% CI)	p-value	aOR (95% CI)	p-value	aOR (95% CI)	p-value
Indigenous status						
Non-Indigenous	Reference					
Aboriginal and or Torres Strait Islander	1.52 (0.97-2.37)	0.065				
Gender						
Male	Reference		Reference		Reference	
Female	1.47 (1.01-2.13)	0.044	2.27 (0.72-7.13)	0.159	1.24 (0.83-1.84)	0.296
Age group						
16-19	Reference		Reference		Reference	
20-24	**2.12 (1.02-4.41)**	**0.044**	1.58 (0.45-5.55)	0.474	2.14 (1.21-3.78)	0.009
25-29	**2.40 (1.06-5.44)**	**0.036**	3.58 (0.96-13.41)	0.058	2.09 (1.15-3.79)	0.015
Sexuality						
Straight/heterosexual	Reference		Reference		Reference	
LGBTI/homosexual	1.00 (0.71-1.41)	0.987	0.55 (0.22-1.39)	0.206	1.06 (0.73-1.54)	0.766
Remoteness						
Rural and remote	Reference		Reference		Reference	
Urban	0.80 (0.51-1.27)	0.348	0.52 (0.16-1.69)	0.276	0.87 (0.53-1.44)	0.587
Marital status						
Not married	Reference		Reference		Reference	
Married/De-facto	1.40 (0.95-2.06)	0.085	1.91 (0.72-5.08)	0.196	1.42 (0.94-2.14)	0.095
Education level						
Completed less than year 12	Reference		Reference		Reference	
Completed year 12	0.66 (0.40-1.10)	0.114	0.20 (0.06-0.67)	0.010	1.20 (0.69-2.10)	0.525
TAFE/University	0.58 (0.35-0.98)	0.041	0.74 (0.27-2.01)	0.557	1.57 (0.64-1.88)	0.733
Employed						
No	Reference		Reference		Reference	
Yes	0.84 (0.56-1.26)	0.396	0.42 (0.17-1.03)	0.058	1.18 (0.73-1.90)	0.496
Concurrency - partner only has sex with you						
Yes	Reference		Reference		Reference	
No	1.06 (0.61-1.84)	0.846	0.32 (0.08-1.34)	0.120	1.22 (0.67-2.25)	0.507
No. of sexual partners in past 12 months						
1	Reference		Reference		Reference	
2-4	**1.59 (0.83-3.02)**	**0.160**	**60.67 (1.43-2569.72)**	**0.032**	**1.37 (0.67-7.45)**	**0.392**
5 or more	**2.77 (1.30-5.87)**	**0.008**	**4.86 (0.07-339.42)**	**0.465**	**3.13 (1.31-7.45)**	**0.010**
Used internet/mobile apps to meet partners						
No	Reference		Reference		Reference	

	All participants N=847		Aboriginal and or Torres Strait Islander N=122		Non-Indigenous N=717	
	aOR (95% CI)	**p-value**	**aOR (95% CI)**	**p-value**	**aOR (95% CI)**	**p-value**
Yes	1.15 (0.76-1.73)	0.516	1.33 (0.49-3.64)	0.577	1.27 (0.81-2.00)	0.305
Used a condom last time had sex						
Yes	Reference		Reference		Reference	
No	1.33 (0.92-1.91)	0.129	1.46 (0.59-3.61)	0.413	1.45 (0.97-2.16)	0.067
Used a condom with casual sexual partner						
Yes	Reference		Reference		Reference	
No	1.01 (0.67-1.52)	0.948	0.73 (0.29-1.87)	0.517	1.10 (0.67-1.74)	0.698
Drunk or high last sexual encounter						
No	Reference		Reference		Reference	
Yes	1.36 (0.85-2.18)	0.196	1.03 (0.40-2.65)	0.950	1.11 (0.70-1.77)	0.644
No. alcohol drinks per session						
5 or more	Reference		Reference		Reference	
1-4	0.93 (0.64-1.34)	0.680	0.50 (0.20-1.29)	0.152	1.10 (0.73-1.64)	0.657
Used marijuana						
No	Reference		Reference		Reference	
Yes	1.76 (0.79-3.96)	0.169	0.758 (0.36-2.09)	0.758	1.23 (0.86-1.78)	0.251
Used meth/amphetamine						
No	Reference		Reference		Reference	
Yes	1.28 (0.92-1.82)	0.166	2.75 (0.32-23.54)	0.356	1.78 (0.73-4.33)	0.206
Used ecstasy						
No	Reference		Reference		Reference	
Yes	1.10 (0.72-1.67)	0.650	1.64 (0.63-4.30)	0.311	1.38 (0.92-2.07)	0.123
Used cocaine						
No	Reference		Reference		Reference	
Yes	**2.14 (1.01-4.54)**	**0.049**	1.23 (0.40-3.83)	0.712	1.75 (1.15-2.67)	0.009
Drug score						
0	Reference		Reference		Reference	
1	1.06 (0.69-1.61)	0.799	1.00 (0.36-2.81)	0.988	0.95 (0.59-1.51)	0.815
2 or more	1.29 (0.77-2.16)	0.342	1.34 (0.47-3.81)	0.581	1.32 (0.87-2.01)	0.193

[#] Independent variables used in adjusted logistic regression analysis highlighted in bold and have been accounted for in the analysis.

aOR – Adjusted odds ratio; CI – Confidence interval.

24 participants were not included as their indigenous status was not stated.

3.5.6.3. Tested for a bloodborne virus

Around a quarter of all participants reported ever being tested for HIV (28%, n=520) and hepatitis C (24%, n=449). Aboriginal and or Torres Strait Islander participants were more likely to have ever been tested for HIV (41%, n=77) and hepatitis C (40%, n=75) than non-Indigenous participants (26%, n=432; and 22%, n=363, respectively) (Appendix 3.I). There were statistically significant differences in ever tested for HIV and hepatitis C by Indigenous status (p-value=<0.001 and p-value=<0.001, respectively). The medical clinic/general practice was the most common place where a test for HIV or hepatitis C was likely to been performed regardless of Indigenous status.

3.5.7. Health service access – health check

Over a third (34%, n=813) of participants reported having a full health check-up in the past 12 months; 94% of check-ups were completed at the medical clinic/general practice; and less than half of participants were offered an STI test (43%, n=350). Aboriginal and or Torres Strait Islander participants were more likely to report having had a full health check-up in the past 12 months (45%, n=104) than non-Indigenous participants (33%, n=680). Almost a third of full health check-ups among Aboriginal and or Torres Strait Islander participants were completed at the Aboriginal medical service. Aboriginal and or Torres Strait Islander participants were more likely to be offered an STI test than non-Indigenous participants (Table 3.13). There were statistically significant differences in having a full health check-up in the past 12 months, location of health check-up and offered an STI test by Indigenous status (p-value=<0.001, p-value=<0.001 and p-value=<0.001, respectively).

TABLE 3.13: HEALTH SERVICE ACCESS – HAD A HEALTH CHECK, LOCATION OF HEALTH CHECK AND WHETHER A TEST FOR SEXUALLY TRANSMITTED INFECTION WAS OFFERED, BY INDIGENOUS STATUS, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

	Total	Indigenous status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Health check past 12 months (n)	2,380	231	2,062	87	
Yes	813 (34%)	104 (45%)	680 (33%)	29 (33%)	<0.001*
No	1,261 (53%)	95 (41%)	1,127 (55%)	39 (45%)	
Not reported	306 (13%)	32 (14%)	255 (12%)	19 (22%)	
Location of health check (n)	813	104	680	29	
Medical clinic/General Practice	765 (94%)	71 (68%)	665 (98%)	29 (100%)	
Aboriginal Medical Service	35 (4%)	32 (31%)	<5	0	<0.001†
Other	13 (2%)	<5	12 (2%)	0	
Offered a STI test (n)	813	104	680	29	
Yes	350 (43%)	65 (63%)	274 (40%)	11 (38%)	<0.001*
No	463 (57%)	39 (38%)	406 (60%)	18 (62%)	

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and health service access, Pearson Chi-square test* and Fisher's exact test†.

3.5.8. Survey satisfaction

At the end of the survey two questions were asked regarding participant survey satisfaction and preference. The first question was '*Did you find this survey easy to complete?'*. Of participants who responded to this question, 99% (n=2,029) responded with 'Yes' (or 85% of all participants). Those who responded 'No' (1%, n=19), were asked to provide a reason as to why they found it difficult (Table 3.14).

TABLE 3.14: PARTICIPANT SURVEY SATISFACTION – SURVEY ISSUES, SOUTH AUSTRALIA, LET'S TALK ABOUT IT 2019

Survey issues	**All participants** n
Too long	<5
Words I didn't understand	<5
Questions were confusing	5
Embarrassing	5
Other	<5
No response	<5

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage.

The second question was '*What is your preferred way to complete a survey?'.* The majority of respondents, 95% (n=1939) preferred online, followed by in-person/face-to-face (3%, n=56), telephone/mobile (2%, n=40), and mail (1%, n=12).

3.6. Discussion

Let's Talk About It 2019 is the first study to describe current sexual health knowledge, behaviours and access to health services in relation to STI and BBV amongst young South Australians. It achieved its three goals; conducting a sexual health survey of young South Australians; collecting surveys from both Aboriginal and non-Indigenous young people in the same survey to allow for comparisons; and piloting this collection via an online survey with an outcome of ascertaining whether this format could be completed on an ongoing basis.

In total 2,380 young South Australians participated in *Let's Talk About It 2019* over a six-week period. Participants provided information on their current sexual health, knowledge, behaviours and access to health services for STI and BBV. This is the first time a comprehensive set of data has been collected regarding these issues from young people residing in SA. The sample represents around (1%) of the total SA population in this age group (31). Overall there were almost equal numbers of males and females who participated in the survey and the age distribution was almost equivalent to the entire SA population in this age group (31); however, the survey was not meant to be representative. There was under-representation of some groups within this population, including; people from culturally and linguistically diverse backgrounds, people resident in regional and remote SA, and Aboriginal and Torres Strait Islander males. This should be a focus of future survey recruitment should they continue.

Let's Talk About It 2019 was able to achieve a participation rate of 10% Aboriginal and or Torres Strait Islander young people (equivalent to 2% of the SA Aboriginal and Torres Strait Islander population in this age group (31)), of which almost 75% were female. This is higher than any other survey on sexual health and wellbeing of young people in Australia apart from the GOANNA survey which exclusively surveyed Aboriginal and Torres Strait Islander people. All other surveys have averaged a participation rate of Aboriginal and Torres Strait Islander people between 2-3% or less (10-13, 32-34). These data are often too small and can present several issues with representativeness, data analysis and interpretation. The genuine inclusion of Aboriginal and Torres Strait Islander people in the conceptualisation and design of research projects which utilise surveys as their main form of data collection may address this issue. Finally, small numbers of Aboriginal and Torres Strait Islander peoples in these

surveys often result in outcomes not being published by Indigenous status or available to inform policy and programming nor for shaping future research questions. This is a challenge that needs further consideration.

In relation to risk behaviours for STI and BBV there were a few differences reported between the two populations, including age of sexual debut for oral, vaginal and anal sex; more likely to report being drunk' or 'high' during their last time sexual encounter; and less likely to use a condom with a casual sexual partner. However, Aboriginal and/or Torres Strait Islander participants were more likely to report having ever been tested for an STI and more likely to have tested positive for an STI than non-Indigenous participants. Early age of first sex has been associated with a range of sexual risk behaviours and increased risk of STI (18, 23, 24, 26, 28), as has sexual partner concurrency and multiple sexual partners (19-23, 25, 28), and risky drinking behaviour and use of illicit drugs (17, 25, 27, 28). Higher rates of STI testing among Aboriginal and or Torres Strait Islander participants may be because of ongoing health promotion campaigns that have been implemented by the Aboriginal Health Council of South Australia (35) and the Young Deadly Free initiative coordinated through the South Australian Health and Medical Research Institute (36). Both initiatives target clinicians and communities to encourage STI and BBV testing, particularly in this age group.

These data also highlight the multiple issues that require addressing in STI and BBV control in relation to risk behaviours, STI and BBV knowledge, alcohol and other drug use, and health care access. It is important that the broader public health messaging and health promotion and prevention work around STI and BBV are inclusive of this new and existing evidence on the sexual health, knowledge, behaviours of young people.

Overall only a third of all participants reported using a condom with a new casual sex partner. Low condom use, particularly with casual sexual partners, mixed with alcohol and illicit drug use has been associated with increased risk of STI (27, 37-39). Condoms are the most effective form of contraception to prevent STI and BBV and unwanted pregnancy. The low rate of condom use reported by young people is concerning - effective strategies to encourage an increase in condom use are required.

The use of internet or mobile apps to find (sexual) partners has increased (40) and has been linked to an increase in STI. A review on geosocial networking apps and risk of STI by Wang *et al.* (41) found that among men who have sex with men, app-users were more likely to acquire an STI than non-app users. Additionally, use of apps has been linked to having previously had an STI (40, 42, 43). Mobile apps are increasingly used for STI and HIV

prevention and health promotion (44-46). Greater use of apps in STI prevention and testing campaigns should be considered, in addition to more traditional STI and HIV prevention and health promotion methods (47).

Any effort to address STI and BBV must include actions to engage Aboriginal and Torres Strait Islander people. The over-representation of STI and BBV among this population demonstrates that a targeted approach is required to minimise the socio-demographic and behavioural factors that influence the risk of acquiring STI and BBV. Any approach should align with the National Aboriginal and Torres Strait Islander Blood Borne Viruses and Sexually Transmissible Infections Strategy (48).

Let's Talk About It 2019, was a pilot to test the feasibility of delivering a modified version of the GOANNA survey online. The online survey format was a successful approach for engaging young people, particularly Aboriginal and Torres Strait Islander people. Overwhelmingly, most participants found the survey easy to complete and preferred an online format to collect such questionnaires. For a survey such as *Let's Talk About It 2019*, which ask questions of a sensitive nature, young people may be more willing to disclose sensitive information due to the anonymity of the online method. Other studies have indicated online self-completion questionnaires are preferred to paper self-completion questionnaires (49, 50). *Let's Talk About It 2019* data were collected over a relatively short time period (six-weeks) but yielded a substantial number of participants, demonstrating the strength of this data collection method.

3.7. Limitations

The study had several limitations, including:

- Participants self-selected to participate in *Let's Talk About It 2019*, and as such, may not be representative of the South Australian population aged 16-29. The marketing of *Let's Talk About It 2019* on social media indicated that the survey was about young people's sexual health, knowledge and behaviours – and it may be that as a result, young people who either were not sexually active or not willing to disclose this information about themselves decided not to participate.
- It is unclear how representative Aboriginal and/or Torres Strait Islander participants were of the Aboriginal and Torres Strait Islander population aged 16-29 years, as most Aboriginal and/or Torres Strait Islander participants were female, higher than the 2016 Census data for South Australia (31). However, females are most often overrepresented in the collection of such information.

- The marketing of *Let's Talk About It 2019* on social media, mainly Facebook, determines that only young people with a Facebook account and active users had access to participating in *Let's Talk About It 2019*; however, most young people have a Facebook profile and access it daily (51), thus potentially minimise sampling bias.
- None of *Let's Talk About It 2019* questions were compulsory, and therefore responses may have been affected by declaration bias and some participants may have only responded to questions which they felt comfortable to declare.

3.8. Conclusion

Let's Talk About It 2019 is the first study to describe current sexual health, knowledge, behaviours and access to health services for STI and BBV and related issues amongst young South Australians, both Aboriginal and Torres Strait Islander and non-Indigenous. It is evident that young South Australians are engaged in behaviours which increase the risk of acquiring STI. This evidence is important for informing development of public health practice and policies, and the development of STI and BBV preventative health programs, particularly those that target young Aboriginal and Torres Strait Islander people.

From here there will be ongoing discussions with the Department of Health and Wellbeing, SA (SA Health) to investigate whether this pilot project could be adopted annually or every few years to assess trends and assess the impact of interventions. The preliminary results of this survey have been posted to the same social media applications we recruited from to give participants a snapshot of the results in an infographic format. In response to *Let's Talk About It 2019*, SA Health has commenced an online health promotion campaign regarding condom use among this age demographic using their own social media platforms. This swift action demonstrates the power of such data and the potential to translate these data at a population level.

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Appendix 3.A

Let's Talk About It Survey 2019

Let's Talk About It!

Please complete the survey below.

Thank you!

Participant Information
Let's Talk About It: An online survey of sexual health, knowledge and behaviour in South Australian young people.

About the study...
You are invited to take part in a survey about sexual health, alcohol and other drug use being led by the South Australian Health and Medical Research Institute (SAHMRI). The survey is only for South Australian young people aged 16-29 years. We hope to learn about what young people know about sexually transmitted infections and related diseases, what the risks are and how easy or difficult it is to get medical help for these diseases. This project has been approved by the Aboriginal Health Research Ethics Committee (AHREC Protocol #:04-18-798) and Flinders University Social and Behavioural Ethics Committee (Flinders SBREC Project #OH-00202).

Do I have to do the survey?
No, it is your choice - you don't need to do it and you can stop at any time. This will not disadvantage you in any way.

What will happen if I do the survey?
This survey is anonymous: we will not collect any of your personal contact details such as your name, phone number and address.

The survey will take about 10-15 minutes. Some questions are very personal and might be embarrassing or upsetting for some people. It is recommended you complete the survey in a private place.

Questions include topics like:
Visits that you've made to doctors, nurses or health workers about your sexual health
Drugs that you might have used in the past
Your experiences with sex
How you've been feeling in the past four weeks.
We want you to do the survey even if you've never used drugs or had sex.

Following completion of the survey you may submit your email to go into a prize draw to win one of 10 gift vouchers valued at $100 each. Emails will be stored separately from survey submissions and cannot be traced back to your answers.

What if I have questions or feel upset?
You can stop the survey at any time. If you have any further questions, concerns or feel upset and need support, please contact your local GP/health service or one of the organisations listed below.

Will anyone else see or know about my answers?
No one will see your answers except the researchers. All information that is collected in this study is anonymous. Your answers will not be identifiable in any report or publication that results from this survey.

What will happen with my answers?
All completed surveys will be stored on computers at SAHMRI with password protection. All people's surveys will be combined, and we will publish the results in a report on our website and in research papers. We will keep all the results for at least seven years in case we repeat the survey later and want to compare to see how answers have changed.

What if I have a complaint or concern about the research?
Complaints and concerns may be directed to the researchers (see details below), or the Senior Research and Ethics Officer, Aboriginal Health Council of South Australia (AHCSA), Dr Gokhan Ayturk (Ph: 08 8273 7200, email: Gokhan.Ayturk@ahcsa.org.au) or Flinders SBREC Executive Officer (Ph: 08 8201 3116).

How can I find out about the survey results?
The results of the survey can be downloaded from our Young Deadly Free website (http://youngdeadlyfree.org.au) from 2020.

How do I get more information?
If you have any questions, Associate Professor James Ward (Ph: 08 8128 4270, email: james.ward@sahmri.com) or Dr Salenna Elliott (Ph: 08 8128 4073, email: salenna.elliott@sahmri.com) from SAHMRI will be happy to answer them.
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Support services and resources
Adelaide Sexual Health Centre
1/275 North Terrace, Adelaide SA 5000
(08) 7117 2800
https://www.sahealth.sa.gov.au/adelaidesexualhealthcentre

Shine SA
(Sexual health and relationships)
ph 1300 794 584 (general inquiries)
ph 1300 883 793 (sexual healthline)
https://www.shinesa.org.au

Nunkuwarrin Yunti
(Aboriginal community controlled health service)
182 - 190 Wakefield Street
Adelaide SA 5000
Phone: (08) 8406 1600

Or

28-30 Brady street
Elizabeth Downs SA 5113
Phone: (08) 8254 5300

Beyond Blue
(Mental health support)
Ph 1300 22 4636
https://www.beyondblue.org.au

Lifeline
(Crisis support and suicide prevention)
Ph 13 11 14 (24hrs a day)
https://www.lifeline.org.au

1800RESPECT
(National sexual assault, domestic family violence counselling service)
Ph 1800 737 732
https://www.1800respect.org.au

PRIVATE AND CONFIDENTIAL

Do you live in South Australia?	◯ Yes ◯ No
Are you 16 to 29 years old?	◯ Yes ◯ No

BEFORE YOU START:

This means you can say No.

â€¢ I have read the Participant Information statement. I understand the aims of the survey and what I will be asked to do.
â€¢ I understand that I can stop at any stage without giving a reason and without any consequence.
â€¢ I understand that I may not directly benefit from taking part.
â€¢ I understand that all answers are anonymous and I will not be identified in any way in reports of the results.
â€¢ I freely agree to take part in the survey.

◯ Agree
◯ Disagree

How old are you (in years)?	_____
Are you Aboriginal or Torres Strait Islander?	◯ No ◯ Yes, Aboriginal ◯ Yes, Torres Strait Islander ◯ Yes both Aboriginal and Torres Strait Islander
Were you born in Australia?	◯ Yes ◯ No
Where were you born?	_____
How long have you lived in Australia?	◯ One year or less ◯ 2-5 years ◯ 5-10 years ◯ More than 10 years
Is English your first language?	◯ Yes ◯ No
Postcode or town where you currently live	_____
Who do you currently live with? Check all that apply.	☐ Parents ☐ Partner ☐ Children ☐ Other family member(s) ☐ Friends/housemates ☐ Alone
Are you currently...	◯ Married ◯ In a defacto relationship (Living with a partner but not married) ◯ Not married
Are you currently studying?	◯ Yes ◯ No
Where are you studying?	◯ High school ◯ TAFE/college ◯ University - undergraduate ◯ University - post-graduate ◯ Other
What is the highest level of education you have completed?	◯ I completed primary school only ◯ I left high school before finishing Year 10 ◯ I completed Year 10 ◯ I completed Year 12 ◯ I completed a TAFE/college course ◯ I completed a university degree ◯ I completed a post-graduate qualification (eg. Masters, PhD)

Are you currently employed?	◯ No ◯ Yes, partâ˜time/casual ◯ Yes, fullâ˜time
Do you identify as...	◯ Female ◯ Male ◯ Transgender female (trans woman, sistergirl) ◯ Transgender male (trans man, brotherboy) ◯ Other
At the moment do you think of yourself as...	◯ Straight/Heterosexual ◯ Gay/Homosexual ◯ Lesbian/Homosexual ◯ Bisexual ◯ I don't know/unsure ◯ Other

These questions check what you know about sex diseases (sexually transmissible infections - STIs eg. chlamydia, gonorrhoea), HIV (the virus that causes AIDS) and hepatitis.

If a woman with HIV is pregnant, can her baby become infected with HIV?	◯ Yes ◯ No ◯ Don't know
Does a person with a STI always have symptoms?	◯ Yes ◯ No ◯ Don't know
Are people who have injected drugs at risk for Hepatitis C?	◯ Yes ◯ No ◯ Don't know
Does the pill (birth control) protect a woman from HIV infection?	◯ Yes ◯ No ◯ Don't know
Can Chlamydia make a woman unable to have a baby?	◯ Yes ◯ No ◯ Don't know
If condoms are used during sex, does this help to protect people from getting HIV?	◯ Yes ◯ No ◯ Don't know
Is there medicine that can cure hepatitis C?	◯ Yes ◯ No ◯ Don't know
Could someone who looks healthy pass on HIV infection?	◯ Yes ◯ No ◯ Don't know
Can Hepatitis B be passed on by sex?	◯ Yes ◯ No ◯ Don't know
Can Chlamydia be easily treated with antibiotics?	◯ Yes ◯ No ◯ Don't know

This section asks you about your own personal experiences with sex. Some people have had sex and others have not.

25% Complete - keep going!

Have you had oral sex (mouth on genitals) before?	◯ Yes ◯ No
How old were you when you first had oral sex?	_____
Have you had vaginal sex (penis in vagina) before?	◯ Yes ◯ No
How old were you when you first had vaginal sex?	_____
Have you had anal sex (penis in anus) before?	◯ Yes ◯ No
How old were you when you first had anal sex?	_____
In the last year how many people have you had sex with (vaginal or anal)?	◯ None ◯ 1 person ◯ 2 people ◯ 3 people ◯ 4 people ◯ 5 to 10 people ◯ 11 or more people
Was the last person you had sex with...	◯ Your current partner ◯ Someone you met for the first time ◯ Someone you had known for a while, but not your current partner
Was the last person you had sex with...	◯ Aboriginal or Torres Strait Islander ◯ Not Aboriginal or Torres Strait Islander ◯ I'm not sure
Was the last person you had sex with...	◯ Female ◯ Male ◯ Transgender female (trans woman, sistergirl) ◯ Transgender male (trans man, brotherboy) ◯ Other
How old was the last person you had sex with?	◯ Under 16 years old ◯ 16-17 years old ◯ 18-19 years old ◯ 20-24 years old ◯ 25-29 years old ◯ 30 years of age or older ◯ I'm not sure
In the last year, have you used the internet/mobile phone apps to meet partners?	◯ Yes ◯ No

Do you currently have a regular sexual partner (someone you have an ongoing sexual relationship with)?	◯ Yes ◯ No
In this relationship, do you only have sex with your partner?	◯ Yes ◯ No
In this relationship, does your partner have sex only with you?	◯ Yes ◯ No
The last time you had sex (vaginal or anal), what contraception did you or the person you had sex with use? (Tick all that apply)	☐ Condom ☐ Oral contraception (the pill) ☐ Emergency/morning after pill ☐ Withdrawal/pulling out ☐ Safe period/natural family planning ☐ Tubal ligation/vascectomy ☐ Implant (Implanon) ☐ Injection (Depoâ€•Provera or Ralovera) ☐ Nuva-Ring ☐ Diaphragm/cervical cap ☐ Other ☐ None
When you had sex (vaginal or anal) with a regular partner in the last year, how often were condoms used?	◯ Always used condoms ◯ Sometimes used condoms ◯ Never used condoms ◯ N/A: no regular partner in the last year
When you had sex (vaginal or anal) with a casual partner in the last year, how often were condoms used?	◯ Always used condoms ◯ Sometimes used condoms ◯ Never used condoms ◯ N/A: No casual partner in the last year
If you use condoms, where do you usually get them from?	◯ Shop/local store/chemist ◯ Medical clinic/General Practice ◯ Aboriginal Medical Service ◯ Never use condoms ◯ Friends ◯ Family member(s) ◯ My sexual partner(s) ◯ Other (eg. vending machine, condom tree)
Were you drunk or high last time you had sex?	◯ Yes ◯ No
The last time you had sex did you want to have sex?	◯ Yes ◯ No

This section asks about your personal experiences with cigarette smoking, alcohol and other drug use.

50% Complete - half way!

Do you smoke cigarettes?	◯ Yes ◯ No
How many cigarettes a day do you smoke?	_____
Have you drunk alcohol (beer, wine, spirits) in the past 12 months?	◯ Yes ◯ No
In the last 12 months, how often did you have an alcoholic drink of any kind?	◯ Every day ◯ Once a week or more ◯ About once a month ◯ Every few months ◯ Once or twice a year
On the days that you have an alcoholic drink, how many alcoholic drinks do you usually have?	◯ 1 to 2 drinks ◯ 3 to 4 drinks ◯ 5 to 6 drinks ◯ 7 or more drinks
Have you used marijuana (yarndi, gunga, grass, dope, pot, cannabis) in the last 12 months?	◯ Yes ◯ No
In the last 12 months, how often did you use marijuana (yarndi, gunga, grass, dope, pot, cannabis)?	◯ Every day ◯ Once a week or more ◯ About once a month ◯ Every few months ◯ Once or twice a year
Have you used meth/amphetamine (speed, ice, go-e, base, gas, crystal) in the last 12 months?	◯ Yes ◯ No
In the last 12 months, how often did you use meth/amphetamine (speed, ice, go-e, base, gas, crystal)?	◯ Every day ◯ Once a week or more ◯ About once a month ◯ Every few months ◯ Once or twice a year
When you used meth/amphetamine in the last 12 months, what kind did you usually use?	◯ Ice or crystal (white crystal) ◯ Base (brown paste or toffee-like) ◯ Speed (powder, tablet or capsule)
When you used meth/amphetamine in the last 12 months, how did you usually take it?	◯ Inhaling/smoking (inhaling vapours "chasing" or smoking a pipe) ◯ Swallowing ◯ Snorting ◯ Injection
Have you used ecstasy (E's, eccies, Molly, MDMA, XTC, Ex) in the last 12 months?	◯ Yes ◯ No

In the last 12 months, how often did you use ecstasy (E, eccies, MDMA, XTC, Ex)?	◯ Every day ◯ Once a week or more ◯ About once a month ◯ Every few months ◯ Once or twice a year
Have you used any other drugs in the last 12 months? Tick all the ones you used.	☐ No other drugs ☐ Cocaine ☐ Heroin ☐ Petrol / paint / glue ☐ Fantasy/ GHB / GBH / G ☐ Benzos / Rholies ☐ Ketamine ☐ LSD/Acid/Mushrooms ☐ Other
In the last 12 months, have you injected any drugs?	◯ Yes ◯ No
What drug(s) have you injected in the last 12 months? Tick all the ones you injected.	☐ Meth/amphetamine (ice, go-e, speed, gas, crystal, base) ☐ Heroin ☐ Methadone ☐ Morphine, pethidine, oxycodone, oxycontin, MS contin ☐ Performance-enhancing drugs ☐ Cocaine ☐ LSD or other hallucinogens ☐ Benzodiazepines ☐ Other drugs
In the last 12 months, did you use any of the following for injecting a drug after someone else used it (even if it was cleaned)? Tick all those you used.	☐ None of these ☐ Needle/Syringe ☐ Tourniquet ☐ Spoon ☐ Filter ☐ Swab
What do you think is the best way for a person to get help for alcohol and/or drug use?	◯ Medical clinic/General Practice ◯ Aboriginal Medical Service ◯ Drug and alcohol service ◯ Hospital ◯ Get help from friends or family ◯ Internet ◯ Other
Do you have any tattoo(s)?	◯ Yes ◯ No
Where did you get the tattoo(s)? Tick all the places where they were done.	☐ Professional parlour ☐ In my community (home, park) ☐ Prison /jail/ juvenile justice centre ☐ Other
Have you ever been in prison/jail or a juvenile justice centre for more than 24 hours?	◯ No ◯ Yes, in the last 12 months ◯ Yes, more than 12 months ago

This section has questions about getting advice, testing and treatment for sexually transmissible infections (STIs eg. chlamydia, gonorrhoea), HIV (the virus that causes AIDS) and hepatitis.

What is the main way you get information about sex and STIs, including HIV?

- ◯ Medical clinic/General Practice
- ◯ Family planning / Sexual health clinic
- ◯ Aboriginal Medical Service
- ◯ School /TAFE/ university
- ◯ Boyfriend / girlfriend / friends
- ◯ Family member(s)
- ◯ Internet
- ◯ Magazines
- ◯ Never look for information
- ◯ Other

Have you ever been tested for an STI?

- ◯ Yes. In the last year
- ◯ Yes. More than a year ago
- ◯ I don't know
- ◯ Never tested

Where did you get your last STI test?

- ◯ Medical clinic/General Practice
- ◯ Aboriginal Medical Service
- ◯ Family planning clinic / Sexual health clinic
- ◯ Other

Have you ever tested positive for an STI?

- ◯ Yes, in the last year
- ◯ Yes, more than a year ago
- ◯ No

Which STI(s)? Tick all those that apply.

- ☐ Chlamydia
- ☐ Gonorrhea
- ☐ Syphilis
- ☐ Trichomoniasis (Trich/"trike")
- ☐ Genital Herpes
- ☐ Genital Warts
- ☐ Other

Have you ever been tested for HIV?

- ◯ Yes, in the last year
- ◯ Yes, more than a year ago
- ◯ I don't know
- ◯ Never tested

Where did you get your last HIV test?

- ◯ Medical clinic/General Practice
- ◯ Aboriginal Medical Service
- ◯ Sexual Health Clinic/Family Planning Clinic
- ◯ Hospital
- ◯ Prison/jail or juvenile justice centre
- ◯ Other

Are you HIV positive?

- ◯ Yes
- ◯ No

Are you on treatment for HIV?

- ◯ Yes
- ◯ No

75% Complete - nearly done!

Have you been tested for hepatitis C?	◯ Yes, in the last year ◯ Yes, more than a year ago ◯ Never tested ◯ I don't know
Where did you get your last hepatitis C test?	◯ Medical clinic/General Practice ◯ Aboriginal Medical Service ◯ Sexual Health Clinic/Family Planning Clinic ◯ Hospital ◯ Prison/jail or juvenile justice centre ◯ Other
Are you hepatitis C positive?	◯ Yes ◯ No
Are you having, or have you had, treatment for hepatitis C?	☐ No ☐ Yes I had treatment in 2015 or earlier ☐ Yes I had treatment in 2016 or later
Have you had a full health check up in the last year?	◯ Yes ◯ No
Where did you have your health check?	◯ Medical clinic/General Practice ◯ Aboriginal Medical Service ◯ Other
Were you offered a check for STIs?	◯ Yes ◯ No

This section asks questions about how you have been feeling in the past 4 weeks.

In the past 4 weeks, about how often did you feel nervous?	◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time
In the past 4 weeks, about how often did you feel so sad that nothing could cheer you up ?	◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time
In the past 4 weeks, about how often did you feel restless or jumpy?	◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time
In the past 4 weeks, about how often did you feel without hope?	◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time
In the past 4 weeks, about how often did you feel that everything was an effort?	◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time
In the past 4 weeks, about how often did you feel calm and peaceful?	◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time
In the past 4 weeks, about how often have you been a happy person?	◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time
In the past 4 weeks, about how often did you feel full of life?	◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time
In the past 4 weeks, about how often did you have a lot of energy?	◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time

In the past 4 weeks, about how often did you feel worthless?	◯ All of the time ◯ Most of the time ◯ Some of the time ◯ A little of the time ◯ None of the time
What is your preferred way to complete a survey?	◯ In person/face-to-face ◯ Online ◯ Telephone/mobile ◯ Mail
How did you hear about this survey?	◯ Facebook ◯ Instagram ◯ Snapchat ◯ Email ◯ QR code ◯ Other
Did you find this survey easy to complete?	◯ Yes ◯ No
What made it difficult?	◯ Too long ◯ Words I didn't understand ◯ Questions were confusing ◯ Embarrassing ◯ Other

You have finished the survey! Thank you.

Appendix 3.B

Sexually transmitted infections and blood-borne viruses knowledge questions answered correctly, by Indigenous status, South Australia, Let's Talk About It 2019

	Total	Indigenous status			
	All participants n (%) N=2,380	**Aboriginal and or Torres Strait Islander** n (%) N=231	**Non-Indigenous** n (%) N=2,062	**Not stated** n (%) N=87	**p-value**
If a woman with HIV is pregnant, can her baby become infected with HIV?	1,548 (65%)	157 (68%)	1,340 (65%)	51 (59%)	0.414*
Not reported	97 (4%)	11 (5%)	77 (4%)	9	
Does a person with a STI always have symptoms?	2,085 (88%)	192 (83%)	1,823 (88%)	70 (80%)	0.029*
Not reported	99 (4%)	11 (5%)	79 (4%)	9	
Are people who have injected drugs at risk for Hepatitis C?	1,777 (75%)	181 (78%)	1,535 (74%)	61 (70%)	0.013*
Not reported	98 (4%)	11 (5%)	79 (4%)	8	
Does the pill (birth control) protect a woman from HIV infection?	2,125 (89%)	201 (91%)	1,853 (90%)	71 (82%)	0.218*
Not reported	101 (4%)	81 (4%)	11 (5%)	9	
Can Chlamydia make a woman unable to have a baby?	1,035 (43%)	105 (45%)	894 (43%)	36 (41%)	0.540*
Not reported	100 (4%)	11 (5%)	80 (4%)	9	
If condoms are used during sex, does this help to protect people from getting HIV?	1,979 (83%)	164 (71%)	1,745 (85%)	70 (80%)	<0.001*
Not reported	101 (4%)	81 (4%)	11 (5%)	9	
Is there medicine that can cure hepatitis C?	422 (18%)	61 (26%)	341 (17%)	20 (23%)	<0.001*
Not reported	102 (4%)	11 (5%)	11 (5%)	9	
Could someone who looks healthy pass on HIV infection?	2,043 (86%)	192 (83%)	1,782 (86%)	69 (79%)	0.303*
Not reported	104 (4%)	11 (5%)	11 (5%)	9	
Can Hepatitis B be passed on by sex?	1,013 (43%)	90 (39%)	885 (43%)	38 (44%)	0.046*
Not reported	103 (4%)	11 (5%)	83 (4%)	9	
Can Chlamydia be easily treated with antibiotics?	1,437 (60%)	160 (69%)	1,229 (60%)	48 (55%)	0.002*
Not reported	102 (4%)	11 (5%)	82 (4%)	9	

N.B. The table only report results for those that are correct and not reported. Counts less than 10 are reported without a percentage.

Test for independence by Indigenous status and STI and BBV knowledge question, Pearson Chi-square test* and Fisher's exact test†.

Appendix 3.C

Sexually active, sexual intercourse and oral sex, by Indigenous status, South Australia, Let's Talk About It 2019

	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value***
Sexually active (oral, vaginal or anal)	2,380	231	2,062	87	
Yes	1,867 (78%)	186 (81%)	1,618 (78%)	63 (72%)	0.028*
No	287 (12%)	17 (7%)	261 (13%)	9	
Not reported	226 (10%)	28 (12%)	183 (9%)	15 (17%)	
Ever had sexual intercourse (vaginal or anal)	1,867	186	1,618	63	
Yes	1,755 (94%)	180 (97%)	1,516 (94%)	59 (94%)	0.006*
No	109 (6%)	6	99 (6%)	4 (6%)	
Not reported	<5	0	<5	0	
Median age at first vaginal sex	16.6	16.0	16.7	17.0	<0.001‡
Median age at first anal sex	18.9	18.5	18.9	19.0	<0. 074‡
Ever had oral sex	2,380	231	2,062	87	
Yes	1,827 (77%)	174 (75%)	1,591 (77%)	62 (71%)	0.570*
No	327 (14%)	28 (12%)	289 (14%)	10 (11%)	
Not reported	226 (10%)	29 (13%)	182 (9%)	15 (17%)	
Median age at first oral sex	16.5	16.0	16.5	16.9	0.177‡

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and sexually active, sexual intercourse and oral sex, Pearson Chi-square test* and Kruskal Wallis test‡.

Appendix 3.D

Contraception used at last sexual encounter, by Indigenous status, South Australia, Let's Talk About It 2019

	Total	Indigenous status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value***
Number who reported being sexually active (n)					
	1,867	186	1,618	63	
Contraception used at last sexual encounter					
Condoms	744 (49%)	65 (47%)	654 (49%)	25 (46%)	0.688*
The pill	651 (43%)	33 (24%)	595 (45%)	23 (43%)	0.000*
Morning after pill	34 (2%)	9	22 (2%)	<5	0.000*
Withdrawal	343 (23%)	18 (13%)	307 (23%)	18 (33%)	0.007*
Safe period	30 (2%)	<5	27 (2%)	0	0.755†
Tuballigation	11 (1%)	<5	9	<5	1.000†
Implant	205 (14%)	37 (27%)	160 (12%)	8 (15%)	0.000*
Injection	29 (2%)	9	20 (2%)	0	0.000*
Nuvaring	<5	0	<5	<5	1.000†
Diaphragm	6	<5	5	0	0.446†
Other	102 (7%)	13 (9%)	84 (6%)	5	0.156*

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and contraception used at last sexual encounter, Pearson Chi-square test* and Fisher's exact test†.

Appendix 3.E

Other drug use, by Indigenous status, South Australia, Let's Talk About It 2019

	Total	Indigenous status			
	All participants n (%) N=2,380	**Aboriginal and or Torres Strait slander** n (%) N=231	**Non-Indigenous** n (%) N=2,062	**Not stated** n (%) N=87	**p-value**
Type of other drugs used					
None	1,613 (68%)	159 (69%)	1,402 (68%)	52 (60%)	0.795*
Cocaine	254 (11%)	23 (10%)	221 (11%)	10 (%)	0.722*
LSD/Acid/Mushroom	135 (6%)	8	122 (6%)	5	0.126*
Benzodiazepines	48 (2%)	<5	45 (2%)	<5	0.081†
Ketamine	44 (2%)	0	42 (2%)	<5	0.018†
Other	113 (5%)	10 (4%)	103 (5%)	<5	0.657*

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and other drug use, Pearson Chi-square test* and Fisher's exact test†.

Appendix 3.F

Ever tested for an STI and location of test, by Indigenous status, South Australia, Let's Talk About It 2019

	Total	Aboriginal status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Even been tested for an STI (n)	1,867	186	1,618	63	
Yes, in the last year	539 (29%)	85 (46%)	437 (27%)	17 (27%)	
Yes, more than a year ago	359 (19%)	43 (23%)	309 (19%)	7	<0.001*
I don't know	42 (2%)	10 (5%)	29 (2%)	<5	
Never tested	865 (46%)	44 (24%)	789 (29%)	32 (51%)	
Not reported	62 (3%)	<5	54 (3%)	<5	
Location of last STI test (n)	898	128	746	24	
Medical clinic/ General Practice	627 (70%)	77 (60%)	534 (72%)	16 (67%)	
Aboriginal Medical Service	30 (3%)	28 (22%)	<5	0	
Family planning/Sexual health clinic	228 (25%)	21 (16%)	199 (27%)	7	<0.001*
Other	14 (2%)	<5	11 (1%)	<5	
Tested positive for an STI (n)	898	128	746	24	
Yes, in the last year	77 (9%)	14 (11%)	60 (8%)	<5	
Yes, more than a year ago	124 (14%)	24 (19%)	98 (13%)	<5	0.104*
No	695 (77%)	90 (70%)	587 (79%)	18 (75%)	
Not reported	<5	0	<5	<5	
Ever tested positive for an STI	201 (22%)	38 (30%)	158 (21%)	5	0.034*

N.B. Counts less than 5 are presented as <5 and counts less than are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and ever tested for an STI and location of STI test, Pearson Chi-square test*.

Appendix 3.G

Univariate Logistic regression analysis – among sexually active participants who have ever been tested for an STI, by Indigenous status, Let's Talk About It 2019

	All participants N=1,805		**Aboriginal and or Torres Strait Islander** N=182		**Non-Indigenous** 1,564	
	OR (95% CI)	**p-value**	**OR (95% CI)**	**p-value**	**OR (95% CI)**	**p-value**
Indigenous status						
Non-Indigenous	Reference					
Aboriginal and or Torres Strait Islander	2.60 (1.86-3.63)	<0.001				
Gender						
Male	Reference		Reference		Reference	
Female	2.60 (2.14-3.15)	<0.001	1.69 (0.82-3.51)	0.158	2.45 (1.99-3.01)	<0.001
Age group						
16-19	Reference		Reference		Reference	
20-24	4.60 (3.63-5.81)	<0.001	3.23 (1.49-7.01)	0.003	4.67 (3.63-6.01)	<0.001
25-29	9.50 (7.18-12.56)	<0.001	6.31 (2.54-15.71)	<0.001	10.06 (7.42-13.64)	<0.001
Sexuality						
Straight/heterosexual	Reference		Reference		Reference	
LGBTI/homosexual	1.92 (1.56-2.36)	<0.001	1.24 (0.62-2.48)	0.534	1.95 (1.57-2.44)	<0.001
Remoteness						
Rural and remote	Reference		Reference		Reference	
Urban	1.29 (1.00-1.66)	0.047	1.51 (0.66-3.46)	0.328	1.31 (0.99-1.72)	0.055
Marital status						
Not married	Reference		Reference		Reference	
Married/De-facto	2.31 (1.86-2.87)	<0.001	1.24 (0.61-2.50)	0.553	2.52 (2.00-3.19)	<0.001
Education level						
Completed less than year 12	Reference		Reference		Reference	
Completed year 12	1.93 (1.50-2.48)	<0.001	1.86 (0.86-4.04)	0.116	2.04 (1.55-2.68)	<0.001
TAFE/University	4.61 (3.58-5.94)	<0.001	2.87 (1.28-6.46)	0.011	5.16 (3.90-6.81)	<0.001
Employed						
No	Reference		Reference		Reference	
Yes	1.37 (1.11-1.70)	0.004	1.87 (0.98-3.56)	0.056	1.50 (1.18-1.90)	0.001
Concurrency - partner only has sex with you						
Yes	Reference		Reference		Reference	
No	2.17 (1.47-3.21)	<0.001	2.65 (0.57-12.40)	0.216	2.10 (1.38-3.20)	0.001
No. of sexual partners in past 12 months						
1	Reference		Reference		Reference	
2-4	1.38 (1.10-1.72)	0.005	0.82 (0.38-1.76)	0.607	1.44 (1.13-1.83)	0.003
5 or more	3.93 (2.77-5.57)	<0.001	10.6 (1.37-82.36)	0.024	3.65 (2.53-5.25)	<0.001

	All participants N=1,805		Aboriginal and or Torres Strait Islander N=182		Non-Indigenous 1,564	
	OR (95% CI)	**p-value**	**OR (95% CI)**	**p-value**	**OR (95% CI)**	**p-value**
Used internet/mobile apps to meet partners						
No	Reference		Reference		Reference	
Yes	1.60 (1.31-1.95)	<0.001	1.16 (0.59-2.27)	0.663	1.60 (1.30-1.98)	<0.001
Used a condom last time had sex						
Yes	Reference		Reference		Reference	
No	1.79 (1.48-2.17)	<0.001	1.21 (0.63-2.34)	0.562	1.83 (1.49-2.25)	<0.001
Used a condom with casual partner						
Yes	Reference		Reference		Reference	
No	0.80 (0.66-0.97)	0.025	0.37 (0.18-0.77)	0.007	0.86 (0.70-1.06)	0.163
Drunk or high last sexual encounter						
No	Reference		Reference		Reference	
Yes	1.01 (0.80-1.28)	0.928	0.67 (0.33-1.33)	0.251	1.02 (0.78-1.32)	0.892
No. alcohol drinks per session						
5 or more	Reference		Reference		Reference	
1-4	1.38 (1.14-1.68)	0.001	1.26 (0.64-2.48)	0.512	1.47 (1.19-1.81)	<0.001
Used marijuana						
No	Reference		Reference		Reference	
Yes	1.29 (1.07-1.55)	0.008	0.97 (0.51-1.83)	0.914	1.24 (1.01-1.51)	0.037
Used meth/amphetamine						
No	Reference		Reference		Reference	
Yes	1.99 (1.08-3.67)	0.027	1.06 (0.20-5.62)	0.948	1.91 (0.98-3.72)	0.057
Used ecstasy						
No	Reference		Reference		Reference	
Yes	1.78 (1.40-2.74)	<0.001	0.94 (0.43-2.02)	0.865	1.90 (1.46-2.47)	<0.001
Used cocaine						
No	Reference		Reference		Reference	
Yes	2.19 (1.65-2.90)	<0.001	1.23 (0.46-3.30)	0.688	2.41 (1.78-3.27)	<0.001
Drug score						
0	Reference		Reference		Reference	
1	1.22 (0.97-1.52)	0.086	1.24 (0.58-2.65)	0.584	1.16 (0.91-1.47)	0.237
2 or more	1.95 (1.54-2.46)	<0.001	1.03 (0.47-2.23)	0.947	2.04 (1.59-2.63)	<0.001

OR – Odds ratio; CI – Confidence interval.

63 participants were not included as their indigenous status was not stated.

Appendix 3.H

Univariate Logistic regression analysis – among sexually active participants who have ever tested positive for an STI, by Indigenous status, Let's Talk About It 2019

	All participants N=1,805		**Aboriginal and or Torres Strait Islander** N=182		**Non-Indigenous** N=1,564	
	OR (95% CI)	**p-value**	**OR (95% CI)**	**p-value**	**OR (95% CI)**	**p-value**
Indigenous status						
Non-Indigenous	Reference					
Aboriginal and or Torres Strait Islander	1.57 (1.03-2.38)	0.035				
Gender						
Male	Reference		Reference		Reference	
Female	1.27 (0.90-1.81)	0.179	1.59 (0.58-4.35)	0.364	1.13 (0.77-1.65)	0.540
Age group						
16-19	Reference		Reference		Reference	
20-24	1.73 (1.06-2.82)	0.029	1.31 (0.41-6.05)	0.651	1.94 (1.11-3.38)	0.020
25-29	1.72 (1.04-2.84)	0.035	1.91 (0.60-6.05)	0.270	1.73 (0.97-3.08)	0.061
Sexuality						
Straight/heterosexual	Reference		Reference		Reference	
LGBTI/homosexual	1.01 (0.73-1.40)	0.944	0.70 (0.31-1.60)	0.402	1.09 (0.76-1.56)	0.647
Remoteness						
Rural and remote	Reference		Reference		Reference	
Urban	0.96 (0.62-1.50)	0.864	0.97 (0.34-2.76)	0.950	0.93 (0.57-1.51)	0.764
Marital status						
Not married	Reference		Reference		Reference	
Married/De-facto	1.05 (0.76-1.46)	0.762	0.92 (0.41-2.08)	0.847	1.11 (0.77-1.59)	0.592
Education level						
Completed less than year 12	Reference		Reference		Reference	
Completed year 12	0.89 (0.56-1.42)	0.641	0.28 (0.09-0.81)	0.019	1.22 (0.71-2.12)	0.474
TAFE/University	0.91 (0.59-1.41)	0.670	0.77 (0.31-1.92)	0.580	1.06 (0.62-1.79)	0.838
Employed						
No	Reference		Reference		Reference	
Yes	0.95 (0.65-1.39)	0.807	0.50 (0.23-1.08)	0.079	1.25 (0.78-1.99)	0.348
Concurrency - partner only has sex with you						
Yes	Reference		Reference		Reference	
No	1.68 (1.03-2.74)	0.036	0.95 (0.27-3.34)	0.931	1.86 (1.08-3.19)	0.025
No. of sexual partners in past 12 months						
1	Reference		Reference		Reference	
2-4	1.52 (1.04-2.22)	0.032	4.90 (1.83-13.10)	0.002	1.29 (0.85-1.97)	0.233
5 or more	2.68 (1.79-4.01)	<0.001	4.11 (1.47-11.49)	0.007	2.35 (1.50-3.69)	<0.001

	All participants N=1,805		Aboriginal and or Torres Strait Islander N=182		Non-Indigenous N=1,564	
	OR (95% CI)	**p-value**	**OR (95% CI)**	**p-value**	**OR (95% CI)**	**p-value**
Used internet/mobile apps to meet partners						
No	Reference		Reference		Reference	
Yes	1.76 (1.28-2.41)	<0.001	2.59 (1.19-5.66)	0.017	1.70 (1.19-2.42)	0.004
Used a condom last time had sex						
Yes	Reference		Reference		Reference	
No	1.29 (0.92-1.82)	0.143	1.20 (0.53-2.68)	0.665	1.38 (0.94-2.03)	0.103
Used a condom with casual sexual partner						
Yes	Reference		Reference		Reference	
No	0.67 (0.49-0.93)	0.016	0.47 (0.21-1.02)	0.055	0.74 (0.52-1.06)	0.100
Drunk or high last sexual encounter						
No	Reference		Reference		Reference	
Yes	1.34 (0.91-1.97)	0.134	1.62 (0.69-3.76)	0.266	1.21 (0.78-1.88)	0.404
No. alcohol drinks per session						
5 or more	Reference		Reference		Reference	
1-4	0.79 (0.57-1.10)	0.164	0.58 (0.25-1.32)	0.191	0.91 (0.62-1.32)	0.606
Used marijuana						
No	Reference		Reference		Reference	
Yes	1.35 (0.99-1.85)	0.059	1.03 (0.48-2.22)	0.932	1.38 (0.97-1.96)	0.074
Used meth/amphetamine						
No	Reference		Reference		Reference	
Yes	2.26 (1.08-4.73)	0.031	3.77 (0.60-23.55)	0.155	1.90 (0.80-4.52)	0.147
Used ecstasy						
No	Reference		Reference		Reference	
Yes	1.68 (1.18-2.39)	0.004	2.31 (0.96-5.57)	0.063	1.56 (1.05-2.32)	0.026
Used cocaine						
No	Reference		Reference		Reference	
Yes	1.88 (1.29-2.73)	0.001	1.81 (0.63-5.17)	0.270	1.97 (1.31-2.98)	0.001
Drug score						
0	Reference		Reference		Reference	
1	1.09 (0.73-1.62)	0.086	1.02 (0.41-2.57)	0.964	1.06 (0.67-1.66)	0.814
2 or more	1.57 (1.09-2.27)	0.015	1.72 (0.69-4.33)	0.247	1.53 (1.02-2.29)	0.041

OR – Odds ratio; CI – Confidence interval.

24 participants were not included as their indigenous status was not stated.

Appendix 3.I

Ever tested for HIV and hepatitis C and location of test, by Indigenous status, South Australia, Let's Talk About It 2019

	Total	Indigenous status			
	All participants n (%)	**Aboriginal and or Torres Strait Islander** n (%)	**Non-Indigenous** n (%)	**Not stated** n (%)	**p-value**
Ever tested for HIV	1,867	186	1,618	63	
Yes, in the last year	304 (16%)	49 (26%)	247 (15%)	8	
Yes, more than a year ago	216 (12%)	28 (15%)	185 (11%)	<5	<0.001*
I don't know	243 (13%)	38 (20%)	195 (12%)	10 (16%)	
Never tested	1,041 (56%)	67 (36%)	937 (58%)	37 (59%)	
Not reported	63 (3%)	<5	54 (3%)	5	
Location of last HIV test	520	77	432	11	
Medical clinic/ General Practice	343 (66%)	44 (57%)	291 (67%)	8	
Aboriginal Medical Service	20 (4%)	19 (25%)	<5	0	
Family planning/Sexual health clinic	137 (26%)	10 (13%)	124 (29%)	<5	
Hospital	11 (2%)	<5	7	0	<0.001†
Prison/jail or juvenile justice centre	0	0	0	0	
Other	9	0	9	0	
Ever tested for Hepatitis C	1,867	186	1,618	63	
Yes, in the last year	255 (14%)	45 (24%)	202 (12%)	8	
Yes, more than a year ago	194 (10%)	30 (16%)	161 (10%)	<5	<0.001*
Don't know	858 (46%)	61 (33%)	768 (47%)	29 (46%)	
Never	491 (26%)	46 (25%)	426 (26%)	19 (30%)	
Not reported	69 (4%)	<5	61 (4%)	<5	
Location of last Hepatitis C test	449	75	363	11	
Medical clinic/ General Practice	313 (70%)	42 (56%)	236 (72%)	8	
Aboriginal Medical Service	22 (5%)	21 (28%)	<5	0	
Family planning/Sexual health clinic	94 (21%)	9	84 (23%)	<5	
Hospital	10 (2%)	<5	6	<5	<0.001†
Prison/jail or juvenile justice centre	0	0	0	0	
Other	10 (2%)	0	9	<5	

N.B. Counts less than 5 are presented as <5 and counts less than 10 are reported without a percentage; percentages have been rounded up to the nearest whole number, columns may not equal 100%.
Test for independence by Indigenous status and ever tested for HIV and hepatitis C and location of test, Pearson Chi-square test* and Fisher's exact test†.

Chapter 4: Preliminary Evaluation of the ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network – a national sentinel surveillance system within Aboriginal community-controlled health services

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Abbreviations and acronyms

ACCHS	Aboriginal Community-Controlled Health Services
ATLAS	ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network
BBV	Blood borne viruses
CRE-ASH	The Centre for Research Excellence in Aboriginal Sexual Health and Blood-Borne Viruses
CDC	The Centers for Disease Control and Prevention
CQI	Continuous quality improvement
HIV	Human immunodeficiency viruses
NNDSS	National Notifiable Diseases Surveillance System
STI	Sexually transmissible infections
SAHMRI	South Australian Health and Medical Research Institute

4.1. Prologue

4.1.1. My role

For the preliminary evaluation of the ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network (ATLAS), I:

- designed the preliminary evaluation and drafted an evaluation proposal
- engaged with stakeholders
- drafted the stakeholder interview questions
- conducted stakeholder interviews and transcribed them
- completed the thematic analysis of interviews
- interpreted the data and drafted an evaluation report
- worked with the other authors and stakeholders to finalise the evaluation report.

4.1.2. Lessons learnt

The main lesson I learnt from this project was how simple, although complex, a surveillance system can be. The Centre for Disease Control and Prevention *Updated Guidelines for Evaluating Public Health Surveillance Systems*, provides a framework to assess the attributes of a surveillance system. These guidelines are useful for identifying all the components within a system critical to ensuring the surveillance system is operating as intended, each process is informing the system, and is meeting the needs of all stakeholders. For example, for Aboriginal Community-Controlled Health Services (ACCHS), it is essential that ATLAS is acceptable, simple, timely and useful. While the system may appear to be simple to services, ATLAS is anything but simple. The establishment and setup of ATLAS has taken a significant amount of resources and time to ensure it is acceptable and right. Similarly, the process of data extraction, analysis and interpretation, may also appear to be simple, however, it is complex and involves several systems and processes. Additionally, working in partnership with stakeholders is essential to ensuring the evaluation is focused and achieves the desired outcome.

4.1.3. Public health impact

The Aboriginal and Torres Strait Islander population are overrepresented in sexually transmissible infections (STIs) and blood borne viruses (BBVs). As a surveillance system, ATLAS has the potential to enhance the current knowledge of STIs and BBVs among the Aboriginal and Torres Strait Islander population and reduce the overall burden of disease. The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network will be able to provide important information and data on STIs and BBVs among the Aboriginal and Torres Strait population. Utilising ACCHS, often the preferred providers of primary health

care of Aboriginal and Torres Strait Islander peoples, will provide a unique opportunity to strengthen STI and BBV testing, care and management for health services and improve surveillance, monitoring and evaluation of STI and BBV.

This preliminary evaluation of ATLAS demonstrates how ATLAS is acceptable, simple, timely and flexible. While more time is required for ATLAS to prove and fulfil its intended objective, it was generally agreed that ATLAS is a useful addition to enhanced efforts in STI and BBV control. Importantly, one of the strengths of ATLAS as a surveillance system is its network of ACCHS; 29 services have joined ATLAS since it was established. The ongoing engagement of those services is critical to the ongoing success of ATLAS. This evaluation provides the ATLAS research team with an extensive summary of ATLAS, its establishment as a surveillance system and provides several recommendations which aim to strengthen ATLAS and ensure ATLAS meets its intended objective.

4.1.4. Acknowledgements

Firstly, I would like to acknowledge and thank the two ACCHS involved in the preliminary evaluation of ATLAS. Additionally, I would like to acknowledge and thank the ATLAS research team, particularly Professor James Ward (Chief Investigator) and Dr Clare Bradley (Study Coordinator) for your guidance, support and involvement in the evaluation.

4.1.5. MAE core requirements

This project fulfils the evaluation of a surveillance system component of the Master of Philosophy in Applied Epidemiology. A copy of this chapter was formatted into a preliminary evaluation report and provided to the two ACCHS involved in the preliminary evaluation. A literature and document review were undertaken as part of the evaluation.

4.2. Abstract

4.2.1. Objective

The overall aim was to undertake a preliminary evaluation of the ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network (ATLAS). The primary objective was to evaluate the attributes of ATLAS and assess if ATLAS is meeting its intended objective. The secondary objective was to provide recommendations to the ATLAS research team to strengthen the system.

4.2.2. Method

ATLAS was evaluated using a document review, stakeholder interviews and secondary analysis of ATLAS data were undertaken to assess the system attribute of ATLAS, using the Centre for Disease Control and Prevention *Updated Guidelines for Evaluating Public Health Surveillance Systems.*

4.2.3. Results

Out of the 29 Aboriginal community-controlled health services from around Australia involved in ATLAS, two Aboriginal community-controlled health services were eligible to be involved in the preliminary evaluation. We found ATLAS to be acceptable, simple, timely and flexible, and a useful addition to enhance efforts in sexually transmitted infections and blood-borne viruses' control. In addition, data quality and completeness of data were generally high. However, more time and evidence is required for ATLAS to demonstrate its value as a surveillance system. Despite this, there are several areas that could be addressed to strengthen ATLAS and its network. Six recommendations have been suggested to inform the strengthening of ATLAS as a surveillance system.

4.2.4. Conclusion

The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network provides important information and data on sexually transmitted infections and blood-borne viruses in the Aboriginal and Torres Strait Islander population; however, several remaining challenges need to be addressed in order to ensure ATLAS is successful in meeting its objective. The preliminary evaluation recommendations aim to inform the strengthening of ATLAS and contribute to ATLAS fulfilling its intended objective: to establish a national sentinel surveillance system specifically focussed on sexually transmitted infections and blood-borne viruses testing, care and management for Aboriginal community-controlled health services and other health services in the areas of surveillance, monitoring and evaluation.

4.3. Introduction

The Aboriginal and Torres Strait Islander population is overrepresented in STIs and BBVs notifications nationally (1). Higher notification rates have been consistently high for over two decades and the greatest disparity occurs in regional and remote areas of Australia (1). Common STIs in Aboriginal and Torres Strait Islander communities include *Chlamydia trachomatis* (chlamydia), *Neisseria gonorrhoea* (gonorrhoea), *Trichomonas vaginalis* (trichomonas) and infectious syphilis (1). These STIs are easy to diagnose and treat but can lead to serious sexual and reproductive health consequences if left untreated; chlamydia and gonorrhoea can lead to pelvic inflammatory disease, ectopic pregnancy, epididymitis and tubal factor infertility (2-4).

Chlamydia is the most common notifiable STI in Australia (1, 5). In 2017 the Aboriginal and Torres Strait Islander population accounted for 7% of all notifications despite representing just 3% of the total Australian population (1, 5). Chlamydia notification rates for the Aboriginal and Torres Strait Islander population were 2.8 times higher than the non-Indigenous population (1). Gonorrhoea is also common in Aboriginal and Torres Strait Islander communities, particularly among those living in remote areas (1). Similarly, in 2017, notifications among the Aboriginal and Torres Strait Islander population accounted for 15% of all gonorrhoea notifications in Australia (1). Overall, gonorrhoea notification rates were six times higher for the Aboriginal and Torres Strait Islander population than for the non-Indigenous population and 30 times higher in remote areas (1).

Trichomonas is only notifiable in the Northern Territory, but positivity data from a range of studies highlight the extent of the problem across jurisdictions. A systematic review and meta-analysis of prevalence of STIs in Aboriginal and Torres Strait Islander Australians identified 11 studies that reported a prevalence of trichomonas (6). The pooled prevalence of trichomonas for Aboriginal and Torres Strait people was 22.6% and was highest in pregnant females (6). It is speculated, other areas of Australia experience high prevalence of trichomonas, however, because trichomonas is only notifiable in the Northern Territory it is difficult to ascertain this. Trichomonas is implicated with poor reproductive health outcomes and greatly increases transmissibility of human immunodeficiency viruses (HIV) (7, 8).

In 2017, 18% of infectious syphilis notifications were among the Aboriginal and Torres Strait Islander population, and diagnoses rates were five times higher than the non-Indigenous population (1). Untreated syphilis can progress to tertiary syphilis and result in cardio-vascular syphilis, neurosyphilis, meningitis, dementia and general paresis (9). In pregnant

women, syphilis can cause congenital syphilis and result in stillborn babies (10, 11). Over half (26 of 44) of congenital syphilis notifications in the last 10 years were among Aboriginal and Torres Strait Islander infants (1). An ongoing outbreak of syphilis in northern, central and western Australia has resulted in a 300% increase in notifications for people from remote Aboriginal and Torres Strait Islander communities since 2011 (12-14).

Blood borne viruses such as viral hepatitis and HIV are also of major concern to the Aboriginal and Torres Strait Islander population, with increasing notifications occurring over the last five years despite decreasing rates of diagnoses in the non-Indigenous population (15). Of the notifications of newly-diagnosed hepatitis B in Australia, in 2017, 2% were in the Aboriginal and Torres Strait Islander population where notification rates were 2.3 times higher than the non-Indigenous population (1, 5). In 2017, the Aboriginal and Torres Strait Islander population accounted for 11% of all diagnosed hepatitis C, 4.4 times higher than the non-Indigenous population (1, 5). Moreover, the rate of newly-acquired hepatitis C (hepatitis C diagnosis with evidence of acquisition in the 24 months prior to diagnosis) in the Aboriginal and Torres Strait Islander population in 2017 was 13.7 times that of the non-Indigenous population and more prevalent in younger age groups (1, 5).

In 2017, the Aboriginal and Torres Strait Islander population accounted for 3% of all notifications for HIV (1, 5), with a notification rate 1.6 times higher in the Aboriginal and Torres Strait Islander population than for the Australian-born non-Indigenous population (1, 5). Notification rates of HIV had previously been comparable with the non-Indigenous population, for over two decades, 1992-2011; however, have diverged in recent years (1, 5).

To reduce the prevalence and burden of STIs and BBVs, we need to better understand epidemics and their context (5). This requires not only notification data as mandatorily reported to jurisdictional health departments (such as the data outlined above), but also testing, incidence, positivity and treatment data. Notification data alone has limitations for assessing an epidemic status, as they do not account for testing and treatment outcomes, nor changes in clinical practice guidelines or interventions impacting these issues (16). Combined with routinely collected socio-demographic and risk behaviour data, this combination of data sets would enable an in-depth understanding of STIs and BBVs epidemics, as well as assessments regarding the impact of interventions to control these infections/viruses on communities/populations.

The main source of information regarding STIs and BBVs within Australia currently comes from routine clinical notification data through the National Notifiable Diseases Surveillance

System (NNDSS) (5, 17). This surveillance system requires laboratories and/or clinicians report all diagnoses of notifiable STIs and BBVs to their local public health department. Several limitations impact this system's ability to truly understand the burden of disease. Firstly, the system only reports on diagnoses, and not testing data, making it difficult to determine if notifications are influenced by testing rates. While this system is important for understanding the burden of disease for notifiable conditions, it does not enable an understanding of the burden of undiagnosed infections in a population; coupling this data with testing data would close this gap somewhat. Secondly, NNDSS notifications often do not contain Aboriginal and Torres Strait Islander status, and as such, there is often underreporting and or underestimation of STIs and BBVs in the Aboriginal and Torres Strait Islander population (5, 18). For example, in New South Wales, Victoria and Tasmania less than 50% of all chlamydia notifications are complete for Aboriginal and Torres Strait Islander status (1).

Further information is required to address the persistently high and disproportionate over-representation of STI and BBV among Aboriginal and Torres Strait Islander people. The majority of STIs and BBVs in Australia are diagnosed in primary health care services (19), and ACCHS are a preferred provider of primary health care for Aboriginal and Torres Strait Islander people (20). The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network has been developed to utilise this network of ACCHS and fill some of the gaps in data on clinical testing and management of STIs and BBVs to supplement national notification data (16).

This paper outlines a preliminary evaluation conducted in 2019 to assess if ATLAS is effectively meeting its intended objective, and to establish a national sentinel surveillance system of ACCHS specifically focussed on STI and BBV testing, care and management for health service use in the areas of surveillance, monitoring and evaluation.

4.4. ATLAS

4.4.1. Description of ATLAS

The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network is a national sentinel surveillance system of ACCHS established within clinical hubs in 2018. The aim of ATLAS is to improve understanding of STI and BBV testing and management within ACCHS across Australia (16). As of the end of July 2019, there were 29 Aboriginal health services involved in ATLAS, across five clinical hubs in four states (New South Wales, Queensland, South Australia and Western Australia) (Figure 4.1) (16). The ATLAS ACCHS sites

were chosen based on convenience, representativeness of ACCHS, geographical locations and relationships through existing research partnerships. The ATLAS network is expected to grow, with other ACCHS joining ATLAS in late 2019 and set to join in 2020. Further, the ATLAS network has the potential to be one of the largest networks of ACCHS for any condition in the country.

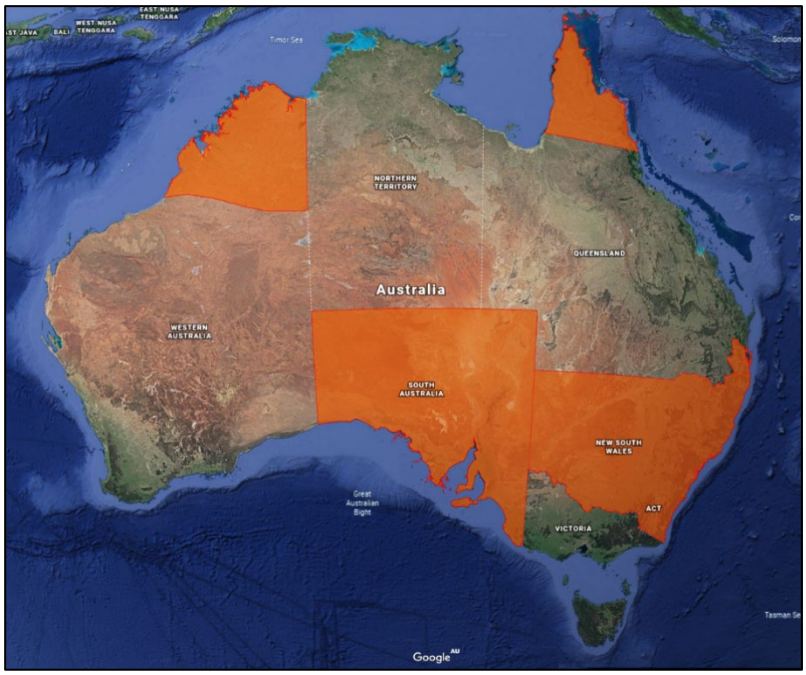


FIGURE 4.1: MAP SHOWING THE GEOGRAPHICAL LOCATIONS OF ATLAS CLINICAL HUBS

The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network is part of the Centre for Research Excellence in Aboriginal Sexual Health and Blood-Borne Viruses (CRE-ASH), which aims to investigate the ability of strategies, both novel and current best practice, to control STIs and BBVs, while addressing policy-relevant questions and influencing clinical practice (16). The CRE-ASH is funded by a National Health and Medical Research Council grant (#1100302) and led by the South Australian Health and Medical Research Institute (SAHMRI).

4.4.2. Objectives of ATLAS

The primary objective of ATLAS is to establish a national sentinel surveillance system specifically focussed on STI and BBV testing, care and management for ACCHS and other health services in the areas of surveillance, monitoring and evaluation (16). In addition, there are five secondary objectives: (i) To develop a national agreed set of STI and BBV clinical performance measures that will exist beyond the life of the CRE-ASH; (ii) To monitor trends in STI and BBV testing, positivity, and clinical management as per clinical performance measures over time; (iii) To monitor trends in STI and BBV knowledge, risk practices and

health service access of young people in order to help shape future primary care interventions; (iv) To establish a network to enable planners to determine where interventions are most required and how well they are working; and (v) To build the capacity of participating hubs and sites to use data for continuous quality improvement (CQI) processes (16).

4.4.3. Governance of ATLAS

The CRE-ASH governance structure was established to oversee activities of CRE-ASH including ATLAS. There are several components to the governance structure and the membership and responsibilities for each group are outlined below (16). Figure 4.2 provides a diagrammatic representation of the governance structure (21).

The Clinical Hub Group comprises of members from five clinical hubs representative of geographical regions nationally and ACCHS; key partners in CRE-ASH (listed below). This Clinical Hub Group oversees study development and conduct; comes together as a forum for focussed and ongoing collaboration with Aboriginal and Torres Strait Islander communities; ensures the projects, processes and findings of the CRE-ASH are relevant and have resonance with ACCHS and communities; and promotes quality research that will benefit Aboriginal and Torres Strait Islander communities (16).

- the Aboriginal Health Council of South Australia
- Apunipima Cape York Health Council
- Kimberley Aboriginal Medical Services
- Institute for Urban Indigenous Health (Brisbane)
- Aboriginal Health and Medical Research Council of NSW.

The Investigator Group is comprised of all CRE-ASH Chief Investigators (CI) and Associate Investigators (AI). The group's role is to provide scientific expertise in the design and conduct of the study and to take scientific responsibility for analysis and reporting of study outcomes (16).

The Operational Group and SAHMRI supports the day to day management of the study and oversees the development of study procedures, ensures the routine operations of the study proceed in accordance with the protocols and procedures endorsed by the Executive Committee, and engages with stakeholders and participating ACCHS on an ongoing basis (16). The Operational Group comprises a subset of Chief investigators, Associate Investigators and CRE-ASH research team members.

The External Advisory Board comprises of senior researchers and experts in sexual health: Professor David Lewis (Chair), Professor Frank Bowden, Dr Christine Selvey, Ms Lisa Bastian, and Professor Gracelyn Smallwood. The External Advisory Board's role is to provide advice and oversight to the development and implementation of CRE-ASH activities and assist with the creation of a dissemination and translation strategy in consultation with the CRE-ASH Clinical Hub Reference Group and the Capacity Building Group (16).

The Capacity Strengthening Group comprises of Chief Investigators, Associate Investigators and the ATLAS Study Coordinator, who direct and provide opportunities for capacity development by Professional Research Persons throughout the ATLAS network (16).

A face-to-face meeting is held annually with clinical hub and ACCHS representatives, the operation group and external advisory board. The face-to-face meetings provide an opportunity to update the ATLAS network on the progress of ATLAS and the CRE-ASH activities and to seek their feedback and guidance.

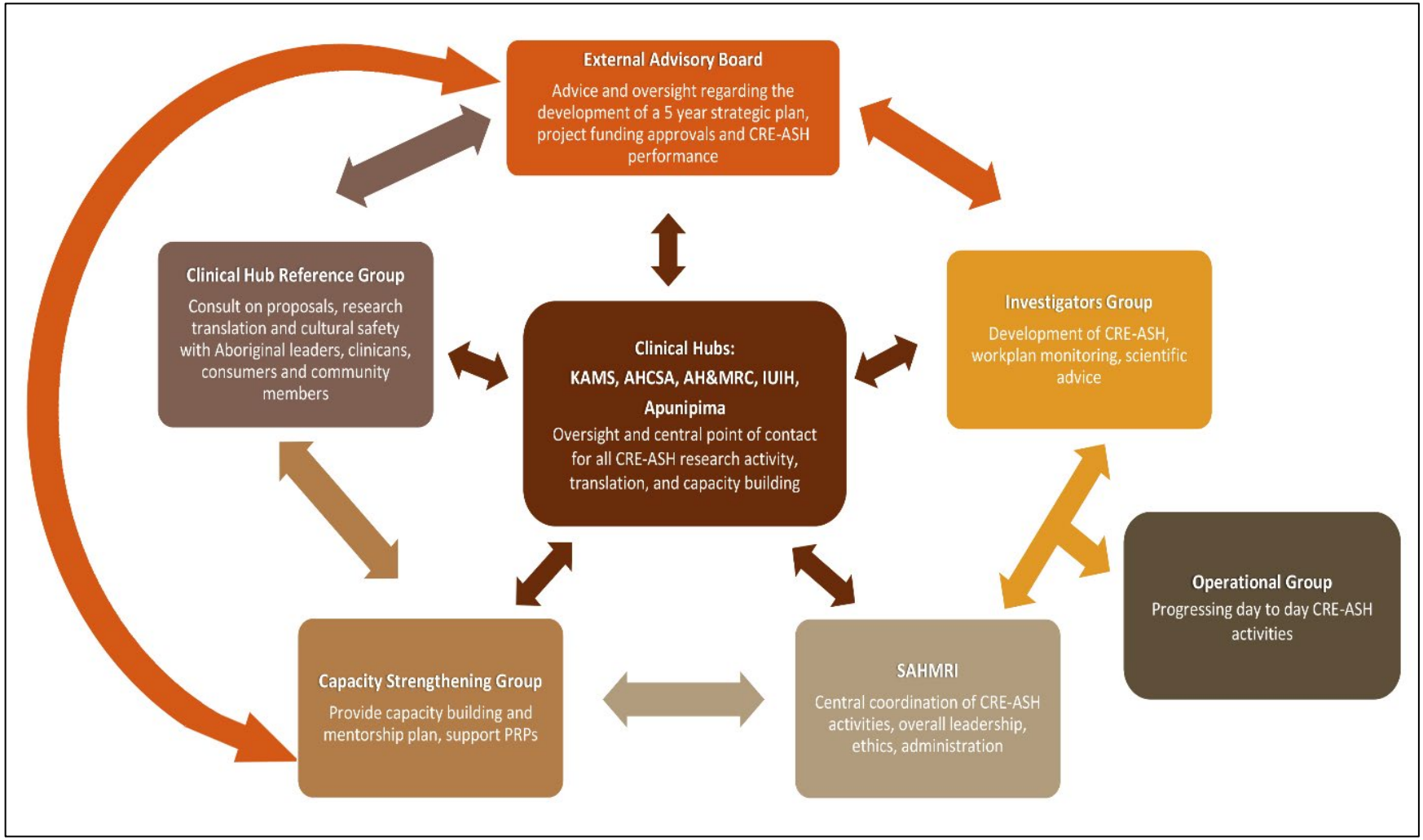
4.4.4. Engagement and implementation of ATLAS

4.4.4.1. Engagement

Prior to the implementation of ATLAS, a significant amount of engagement was conducted (and is ongoing) with each clinical hub and ACCHS to discuss engagement within the ATLAS network. Each service was visited by the Chief Investigator A , who met with senior ACCHS staff, clinicians and ACCHS board members, to ensure the approach used by ATLAS was appropriate. The Chief Investigators group also sought to ensure that ACCHS understood the potential impact of their involvement and the overall benefit to ACCHS, their community and the broader Aboriginal and Torres Strait Islander population, and addressing any concerns ACCHS might have.

Concerns included those related to privacy; storage, management and security of data; the process for data extraction, including having a third-party data extraction software installed on their ACCHS patient management system; services already undertake regular analysis of their data; the potential impact of results on the ACCHS and staff; and the stigmatisation of STI and BBV. It is worth noting that addressing the concerns of ACCHS contributed to delaying their involvement in ATLAS.

FIGURE 4.2: ATLAS GOVERNANCE STRUCTURE, 2019



4.4.4.2. Implementation

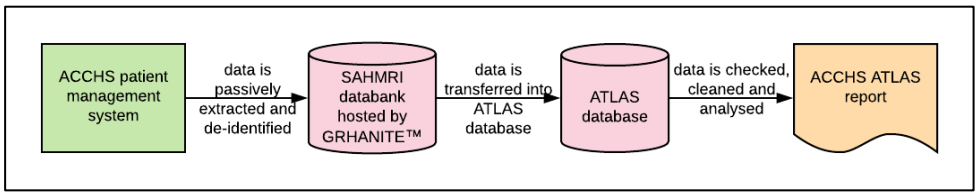
To establish ATLAS within an ACCHS is relatively simple. Where compatible, a data extraction tool GRHANITE™ (22) is installed onto the ACCHS system with IT support. Where GRHANITE™ is not compatible, other arrangements for data extraction are made and agreed upon between the ACCHS and SAHMRI.

GRHANITE™ has been designed to extract routinely collected administrative data from multiple health services and organisations and can link deidentified records for the same individual. GRHANITE™ ensures privacy and confidentiality by generating encrypted keys that can be used to link records with and between independent databases. GRHANITE™ is compatible with several general practice electronic patient management systems including many of those used by ACCHS.

The use of GRHANITE™ within ATLAS is expected to improve data quality, overcoming issues faced by prior projects that manually extracted data from paper or electronic patient management systems. GRHANITE™ has been tailored for ATLAS to extract data variables related to STI and BBV at the population level. Variables extracted from the system include demographics (e.g. gender, age, suburb, postcode), Aboriginal and Torres Strait Islander status, appointment date and type and by health professional, specimen collection date and type, treatment date and type, and immunisation date and type.

GRHANITE™ connects to ACCHS to passively acquire the data, then SAHMRI IT staff connect to a GRHANITE™ portal to import the data into a database at SAHMRI (Figure 4.3). Whether data has been extracted by GRHANITE™ or by another mechanism, once the data has been received at SAHMRI, the data is checked, cleaned and analysed. From the perspective of the ACCHS, the day-to-day operation of ATLAS requires minimal involvement.

FIGURE 4.3: SIMPLIFIED FLOW DIAGRAM OF DATA COLLECTION, CLEANING AND ANALYSIS ATLAS, 2019



4.4.5. Reporting of ATLAS

An initial baseline report was provided to each ACCHS summarising their data for the 24-month period from January 2017 to December 2018. Moving forward, regular six-monthly reports will be provided. Each report provides data on the ACCHS client demographics and

12 key performance measures developed and agreed upon between the study team, the clinical hub and ACCHS representatives. The conceptualisation of the 12 key performance measures started with previous projects and have evolved over time to meet the need of all stakeholders within ATLAS. The key performance measures focus on testing, treatment and retesting of STI and BBV that reflect clinical requirements, guidelines and reporting requirements. The 12 key performance measures are:

1. STI Testing Rate: Proportion of medical consultation attendees tested for STIs (chlamydia, gonorrhoea, trichomonas, syphilis and HIV) during the reporting period.
2. STI Testing Coverage: Proportion of current clients for medical consultations tested for STIs once in a 12-month period.
3. Unique STI Test Positivity: Proportion of medical consultation attendees with at least one positive STI test in a 12-month period.
4. Completeness of STI Screening: Proportion of positive chlamydia and/or gonorrhoea and/or trichomonas results among medical consultation attendees also tested for syphilis and HIV within 30 days from the date of initial specimen collection.
5. STI Treatment Interval: Time (days) from date of positive STI (chlamydia, gonorrhoea, trichomonas) investigation request to date of treatment.
6. STI Retesting Rate: Proportion of medical consultation attendees retested at approximately three months (60 to 120 days) following treatment for an initial positive STI (chlamydia/gonorrhoea/trichomonas) result.
7. STI Repeat Positivity Rate: Proportion of medical consultation attendees retested at approximately three months (60 to 120 days) after treatment for an initial positive chlamydia/gonorrhoea result and who retested positive for chlamydia/gonorrhoea at this time.
8. Hepatitis B Testing Rate: Proportion of medical consultation attendees receiving an hepatitis B test and among those testing negative, the proportion subsequently vaccinated.
9. Hepatitis C Testing Rate: Proportion of medical consultation attendees tested for hepatitis C and among those testing positive, the proportion subsequently tested for ribonucleic acid or viral load.
10. Hepatitis C Treatment Uptake: Proportion of hepatitis C ribonucleic acid positive medical consultation attendees prescribed Direct Acting Antiviral treatment.

11. Hepatitis C Sustained Virological Response (SVR): Proportion of medical consultation attendees who, after having been prescribed Direct Acting Antiviral treatment, achieve undetectable viral load (at completion of Direct Acting Antiviral treatment).
12. Human Papillomavirus Screening Rate: Proportion of female medical consultation attendees screened for human papillomavirus in line with national guidelines.

4.4.6. Resources required to operate ATLAS

The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network is funded by an National Health and Medical Research Council grant which covers the cost of the establishment and ongoing management of ATLAS until the end of 2020. The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network requires several resources, including the procurement of GRHANITE™, direct staff and operating costs and costs associated with engagement with ACCHS and ATLAS governance structures. Direct staff costs include in total 2.4 full-time equivalent staff across three positions; the ATLAS Study Coordinator, ATLAS Data Manager and Epidemiologist. All these resources have financial implications and ongoing funding for ATLAS is required to sustain the infrastructure.

4.5. Evaluation method

The aim of this preliminary evaluation was to assess if ATLAS was meeting its intended objective, to establish a national sentinel surveillance system specifically focussed on STI and BBV testing, care and management for ACCHS and other health services in the areas of surveillance, monitoring and evaluation. Additionally, the evaluation identified strengths, areas for improvement and provided recommendations.

4.5.1. Design

To assess the effectiveness of ATLAS in meeting its primary objective, the United States Department of Health and Human Services, Centers for Disease Control and Prevention (CDC) *Updated Guidelines for Evaluating Public Health Surveillance Systems* (23) were utilised to provide a framework to systematically evaluate ATLAS. The CDC *Updated Guidelines for Evaluating Public Health Surveillance Systems* aim is 'to promote the best use of public health resources through the development of efficient and effective public health surveillance systems' (23), by assisting with the integration of surveillance and health information systems and the electronic exchange of health data.

Document review, stakeholder interviews and secondary analysis of ATLAS data were undertaken to assess the CDC attributes and evaluate ATLAS. The following system attributes were assessed:

Acceptability – Acceptability includes both participant and the organisational willingness to be involved or contribute to the surveillance system (23). We assessed the willingness of ACCHS involvement in the ATLAS network.

Simplicity – Simplicity of a surveillance system refers to both its structure and ease of operation (23). We assessed the simplicity of operation of ATLAS as a system and its processes.

Flexibility – Flexibility is the ability of a surveillance system to accommodate change and adapt appropriately (23). We assessed ATLAS's ability to respond to ACCHS feedback.

Data Quality – Data quality refers to completeness and validity of information gathered by the surveillance system (23). We assessed overall data quality and completeness of data variables extracted within the ATLAS system.

Representativeness – Representativeness encompasses accuracy to describe the population (person and place) over time (23). We assessed whether the outcomes are generalisable to the wider population.

Timeliness – Timeliness incorporates timeframes of all steps within the surveillance system (23). We assessed the timeliness of ATLAS processes.

Stability – Stability of a surveillance system assesses the reliability and availability of the system to operate without failure (23). We assessed whether the resourcing of ATLAS was sufficient.

Usefulness – Usefulness of a surveillance system is demonstrated through its contribution to prevent, control and improve understanding of health events and ability to influence (23). Usefulness was assessed by how useful ATLAS has been for ACCHS.

Positive predictive value and sensitivity were not assessed due to lack of primary data at the time of this preliminary evaluation to assess these attributes. Furthermore, positive predictive value and sensitivity are not essential features of ATLAS. The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network is a sentinel surveillance system and therefore is not focussed on identifying all STI and BBV cases; rather, it is focused on monitoring trends in testing and positive results of the target population. The additional information that ATLAS does acquire on the 12 key performance measures and knowledge of risk practices and health service access of young people will be helpful in understanding whether ATLAS is meeting its intended objectives as a surveillance system.

4.5.2. Eligibility

To be eligible to participate in the preliminary evaluation, ACCHS must be part of the ATLAS network and have received their initial baseline report prior to the commencement of the evaluation. ACCHS that have received a baseline report will have had a greater level of engagement with ATLAS and are therefore able to provide insight into the operation of ATLAS within their ACCHS. ACCHS that have met these criteria were invited to participate in the preliminary evaluation.

4.5.3. Literature and document review

A literature and document review were undertaken to review the public health importance of STI and BBV surveillance in Australia, particularly for Aboriginal and Torres Strait Islander people and communities. PubMed was searched using the terms 'sexually transmissible infection', 'blood borne virus', 'chlamydia', 'gonorrhoea', 'trichomonas', 'syphilis', 'human immunodeficiency virus', 'hepatitis C', 'surveillance', 'Aboriginal', 'Torres Strait Islander', 'Indigenous', 'Australia'. Grey literature and key ATLAS documents were also included.

4.5.4. Stakeholder interviews

Stakeholder interviews were conducted with individual ACCHS staff and with members of the ATLAS research team using a semi-structured questionnaire (Appendix 4.1). The aim of the interviews was to discuss the usefulness, simplicity, flexibility, acceptability, timeliness, data quality, representativeness, and stability of ATLAS through assessing and understanding responses of stakeholders. The questionnaire was administered either face-to-face or by using video conferencing software *Zoom* and were recorded with participant's consent for further analysis. Stakeholder interviews were thematically analysed against the CDC *Guidelines for Evaluating Public Health Surveillance Systems* attributes (23).

4.5.5. Analysis of ATLAS data

Baseline data (January 2017 to December 2018) from ACCHS were analysed to assess completeness (e.g. missing data), including those data used to inform the calculations for performance measures and demographic variables. The following variables were assessed; patient age at time of appointment, Aboriginal and Torres Strait Islander status, patient gender, patient active status, appointment date, appointment type, STI test type, STI test result, test request date, prescribing date, product name (treatment type – medication/drug name), vaccination status, vaccination date, vaccination type, and practitioner category.

4.5.6. Ethics approval

This preliminary evaluation was approved by The Australian National University (2017/909). Written consent was obtained from all interview participants.

4.6. Results

4.6.1. Public health importance

National notifications for STI and BBV are captured through the NNDSS, which was established in 1990 (17). The NNDSS coordinates the national surveillance of over 50 communicable diseases or disease groups including STI and BBV (17). Notifications are made to state and territory health authorities under the provisions of the public health legislation, which inform the NNDSS (17). However, there are limitations to relying on notifications within this system, particularly the underreporting of Aboriginal and Torres Strait Islander status (18, 24).

Underreporting of Aboriginal and Torres Strait Islander status has the potential to misrepresent the true extent of STI and BBV infections in the Aboriginal and Torres Strait Islander population (1, 18, 24) and exacerbate the overrepresentation of the Aboriginal and Torres Strait Islander population in STI and BBV notification rates (1, 25-27). Often, national STI and BBV data does not include data from jurisdictions where Aboriginal and Torres Strait Islander status is not reported in at least 50% of notifications of STI and BBV, including chlamydia, hepatitis B and newly acquired hepatitis B, hepatitis C and gonorrhoea (1). This is concerning as the Aboriginal and Torres Strait Islander population is a priority population in relation to STI and BBV control (28-30).

The high notifications rates of STI and BBV among the Aboriginal and Torres Strait Islander population are of major concern and require focussed attention to redress. In rural and remote Australia, notification rates among the Aboriginal and Torres Strait Islander population are significantly higher than those in urban areas (1). An ongoing outbreak of syphilis among the Aboriginal and Torres Strait Islander population in northern, central and western Australia, which commenced in January 2011, highlights the challenges in STI and BBV surveillance and control (12-14, 31). These challenges are compounded by various factors, such as sexual behaviour and number of sexual partners, health seeking behaviour, access to health services, and demographic characteristics that influence the incidence of STI. Additionally, BBV (32) are found to be more complex among the Aboriginal and Torres Strait Islander population (15, 33, 34).

Enhanced surveillance can be used to better understand the complexity of STI and BBV incidence in priority populations. In Australia, sentinel surveillance has been used to provide a more comprehensive understanding of STI and BBV among priority populations, including the Aboriginal and Torres Strait Islander population (30). Evidence indicates, in two studies

by Goller *et al.* and O'Conner *et al.,* that the high incidence of chlamydia among the Aboriginal and Torres Strait Islander populations is associated with certain factors such as being of younger age and heterosexual (35, 36). Additionally, sentinel surveillance can be used to measure the impact of interventions among the Aboriginal and Torres Strait Islander population (37).

4.6.2. Stakeholder interviews

As of July 2019, there were 29 ACCHS engaged in the ATLAS network; however, only two ACCHS from one clinical hub were at the stage of having had baseline data extracted, analysed and reported back. Therefore, only staff from those two ACCHS and the clinical hub were involved in the preliminary evaluation. Additionally, CRE-ASH ATLAS research team members were also interviewed.

4.6.2.1. Interview characteristics

Five interviews were completed with seven individuals, including one group interview with three individuals. The group interview involved staff from one of ATLAS's clinical hubs, and all were either involved in the establishment, the day-to-day management or uses of ATLAS output within the clinical hub. The remaining interviews were with CRE-ASH ATLAS research team members, including a Chief Investigator, CRE-ASH Study Coordinator, ATLAS Data Manager and Epidemiologist (Table 4.1).

TABLE 4.1: CHARACTERISTICS OF PARTICIPANTS INTERVIEWED FOR THE EVALUATION OF THE ATLAS SENTINEL SURVEILLANCE SYSTEM, 2019

Interview format	ATLAS involvement	Role
Group	ATLAS ACCHS	Manager – Data and Research Analyst – Data and Research Doctor and Clinical Director
Individual	ATLAS research team member	Epidemiologist CRE-ASH Study Coordinator ATLAS Data Manager Chief Investigator

4.6.3. Data collection, cleaning and analysis

A flow diagram of the process of data collection, cleaning and analysis used by the ACCHS included in this preliminary evaluation is illustrated in Figure 4.4. GRHANITE™ was not used in this instance as it was not compatible with the electronic patient management systems used by the two ACCHS. Instead, data was extracted manually by the ACCHS and transferred to SAHMRI. Further comments about this process are provided below.

4.6.4. Evaluation outcomes against CDC attributes

4.6.4.1. Acceptability

Acceptability includes both participant and the organisational willingness to be involved in or contribute to the surveillance system (23).

Of the ACCHS involved in the preliminary evaluation, ATLAS appears to be well accepted as a sentinel surveillance system by both ACCHS staff involved. Staff from ACCHS identified several reasons as to the acceptability of ATLAS, including ATLAS having the potential to provide:

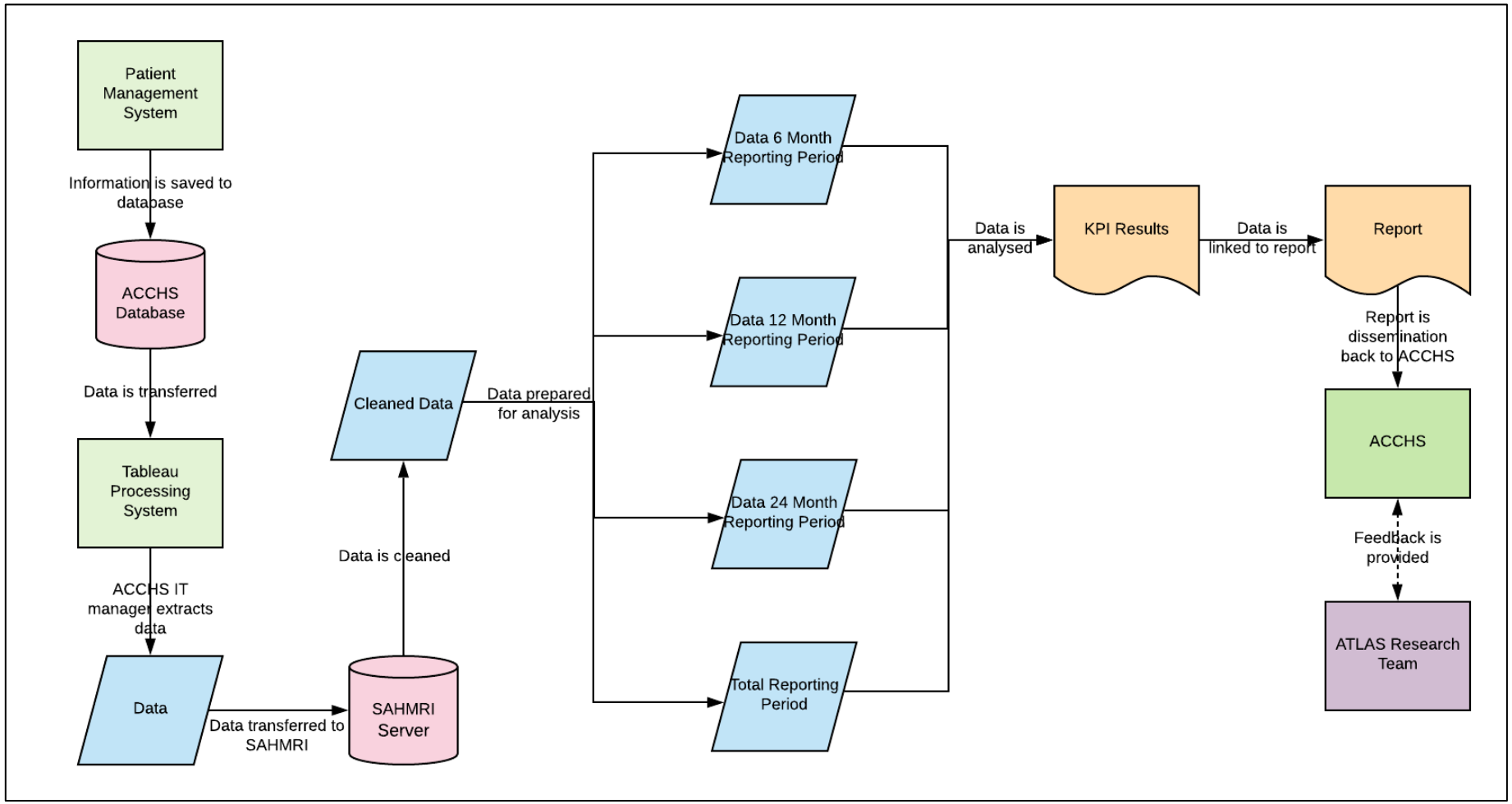
- Streamlining of data extraction, analysis and reporting of data in a format that is user friendly
- Provision of additional resources to the ACCHS that are not necessarily available (e.g. specialist expertise)
- Opportunity to benchmark and compare their service to others
- A methodological approach that is consistent with their organisation values and principles
- Added credibility by having their data analysed by an external organisation/individual
- Experience and reputation of CRE-ASH ATLAS research team, Chief Investigators and host organisation
- Overall benefit and potential impact of being a part of a national surveillance system and network.

It was noted that support from ACCHS was important and demonstrated the level of acceptability of one ACCHS, as stated by one of the ATLAS research team members,

> *They have given us support that we just couldn't buy, having people there that know their system, that know their data and know how it works and prepared to help us, to allow us to get to the data, is an incalculable value to us; it just couldn't have happened without that. (ATLAS research team member)*

Engagement is important to the ongoing acceptability of ATLAS, particularly face-to face engagement. It was suggested that ATLAS is a system based on trust, and trust must be strengthened; the more you know people properly the more you have a relationship with people, and it is difficult to do that over the phone. Most stakeholders believe it was important to continue the annual face-to-face meeting.

FIGURE 4.4: FLOW DIAGRAM OF THE PROCESS OF DATA COLLECTION, CLEANING AND ANALYSIS OF ACCHS INCLUDED IN THE PRELIMINARY EVALUATION OF THE ATLAS SYSTEM, 2019.



4.6.4.2. Simplicity

Simplicity of a surveillance system refers to both its structure and ease of operation (23).

The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network has been designed to passively extract data from ACCHS's electronic patient management systems, minimising the impact ATLAS has on ACCHS. From the perspective of the ACCHS the operation of ATLAS is simple; data is extracted, cleaned, analysed and presented back. The day-to-day operation of ATLAS requires minimal involvement from ACCHS, other than their ongoing engagement in ATLAS. However, the back-end of the system is more complex and requires several processes for cleaning, analysis and reporting before the data is presented back to ACCHS.

The amount of time and resources required to report on the 12 key performance measures is not insignificant. The two ACCHS included in this preliminary evaluation were the test sites for ATLAS and its establishment as a surveillance system. The processes for cleaning, analysis and reporting of the data were reported to require a significant amount of work; revisions of cleaning, analysis and reporting processes are ongoing and evolving through an iterative process. Additionally, the data extracted from the two ACCHS was extracted as several datasets (e.g. appointments, STI test, treatment, immunisation for human papillomavirus & hepatitis B, cervical screening, pap smear (Papanicolaou test)), requiring a significant amount of cleaning and linking before it could be analysed. Scripts developed by the ATLAS research team used during the cleaning process of the ATLAS system have minimised the volume of filtering, checks and cleaning required.

Moving forward, the operation of ATLAS should be simplified, as its systems and structures will be well established. The extraction, cleaning, analysis and reporting aspects of ATLAS will be simplified, streamlined and automated and should only require monitoring and maintenance. Similarly, as the network grows, the implementation of ATLAS within other ACCHS should be straightforward.

4.6.4.3. Flexibility

Flexibility is the ability of a surveillance system to accommodate change and adapt appropriately (23).

The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network has been designed to be flexible in its approach, the setup of ATLAS within services and in its analysis and reporting of data. Moreover, ATLAS has been designed to operate with most of the electronic patient management systems that ACCHS may use. This will ensure there are no

limitations to ACCHS involvement, by working closely with ACCHS and their data in the initial set up of ATLAS.

At the CRE-ASH annual face-to-face meeting in December 2018, ACCHS staff provided feedback on the ATLAS performance measures and reporting. The feedback included the format of reports, length of reports, what is seen as important and what was not, frequency of reporting, and the way in which data can be presented so it is palatable and easy to digest for busy ACCHS staff. This feedback was noted and incorporated, with changes made to the performance measures and reporting. In addition, ongoing feedback has been sought and provided by ACCHS staff since the annual face-to-face meeting in relation to ATLAS reports and has informed future ATLAS reporting.

Furthermore, ATLAS has been designed as an infrastructure for research. CRE-ASH will be able to facilitate access to the ATLAS network, and with approval from contributing ACCHS, be available to provide researchers with data to answer research questions, either on specific diseases, health services delivery or on population health.

4.6.4.4. Data Quality

Data quality refers to completeness and validity of information gathered by the surveillance system (23).

The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network extracts data directly from ACCHS, any issues with data quality within the ATLAS system are largely due to data quality issues with the ACCHS data itself. Therefore, the quality of data within ATLAS is dependent on the quality of ACCHS data. Due to the limitation of this evaluation being a preliminary evaluation, there was not the capacity to assess the quality of data extraction or completeness of data between the two ACCHS and ATLAS. Overall, data quality was reported as being good and any previous issues had been addressed during the early stages of ATLAS being established. However, data quality issues were noted by the ATLAS research team in relation to data extracted from ACCHS, specifically completeness of variables and variables with free text.

The following variables were used to inform the performance measures calculations (Table 4.2) and were assessed for completeness; patient age at time of appointment, Aboriginal and Torres Strait Islander status, gender, patient active status, appointment type, STI test type, STI test result, test request date, prescribing date, product name, vaccination status, vaccination date, vaccination type, and practitioner category.

TABLE 4.2: VARIABLES USED TO INFORM ATLAS SYSTEM PERFORMANCE MEASURES, 2019

Performance measures	Denominator variable(s) (N)	Sample variable(s) (n)	Other variables used
STI testing rate	Practitioner category (doctor, nurse, Aboriginal health practitioner)	STI test type (chlamydia, gonorrhoea, trichomonas, syphilis, HIV)	Patient gender Patient age at time of appointment Aboriginal and Torres Strait Islander status Appointment date
STI testing coverage	Practitioner category (doctor, nurse, Aboriginal health practitioner) Patient active status	STI test type (chlamydia, gonorrhoea, trichomonas, syphilis, HIV)	Patient gender Patient age at time of appointment Aboriginal and Torres Strait Islander status Appointment date
Unique STI test positivity	STI test type (chlamydia, gonorrhoea, trichomonas, syphilis, HIV) Practitioner category (doctor, nurse, Aboriginal health practitioner)	STI test result (positive)	Patient gender Patient age at time of appointment Test request date
Completeness of testing	STI test result (positive (chlamydia, gonorrhoea, trichomonas) Practitioner category (doctor, nurse, Aboriginal health practitioner)	STI test type (syphilis and HIV)	Patient gender Patient age at time of appointment Appointment date
Treatment interval	STI test result (positive chlamydia, gonorrhoea, trichomonas)	Prescribing date	Patient gender Test request date Patient age at time of appointment Practitioner category (doctor, nurse, Aboriginal health practitioner)
STI retesting rate	STI test results (positive chlamydia, gonorrhoea, trichomonas)	STI test type Test request date, Prescribing date	Patient gender Patient age at time of appointment Appointment date Practitioner category (doctor, nurse, Aboriginal health practitioner)

Performance measures	Denominator variable(s) (N)	Sample variable(s) (n)	Other variables used
STI repeat positivity rate	STI test results (positive) Product type Prescribing date	STI test type STI test result (positive) Appointment date	Patient age at time of appointment Test request date Practitioner category (doctor, nurse, Aboriginal health practitioner)
Hepatitis B testing rate	STI test type (hepatitis B)	STI test type (hepatitis B) STI test results (negative)	Patient gender Patient age at time of appointment Test request date Practitioner category (doctor, nurse, Aboriginal health practitioner)
Hepatitis C testing rate	STI test type (hepatitis C)	STI test type (hepatitis C) STI test result (hepatitis C positive) STI test type (hepatitis C ribonucleic acid)	Patient gender Patient age at time of appointment Appointment date Test request date Practitioner category (doctor, nurse, Aboriginal health practitioner)
Hepatitis C treatment uptake	STI test results (hepatitis C ribonucleic acid positive)	Product type (Direct Acting Antiviral therapies*) Prescribing date	Patient gender Patient age at time of appointment Appointment date Test request date Practitioner category (doctor, nurse, Aboriginal health practitioner)
Hepatitis C sustained virological response	Product type (Direct Acting Antiviral therapies*)	STI test result (viral load)	Patient gender Patient age at time of appointment Appointment date Test request date Practitioner category (doctor, nurse, Aboriginal health practitioner)
Human papillomavirus screening rate	Practitioner category (doctor, nurse, Aboriginal health practitioner)	Test type (human papillomavirus)	Patient age at time of appointment Aboriginal and Torres Strait Islander status Test request date

Overall, completeness of data was generally high among the variables extracted, only five issues were identified as having missing data and have been illustrated in Table 4.3. The

Practitioner category variable accounted for four of the five issues related to completeness. It is important to note, these issues related to data-entry at the ACCHS end and are not the results of ATLAS systems or processes. ATLAS can only extract data that is there, if data is missing it cannot be extracted.

TABLE 4.3: COMPLETENESS OF ACCHS VARIABLES USED TO INFORM PERFORMANCE, ATLAS SYSTEM PERFORMANCE MEASURES, 2019

	ACCHS 1		ACCHS 2	
Variable	**Total**	**Missing n (%)**	**Total**	**Missing n (%)**
Appointment data				
Aboriginal and Torres Strait Islander status	150,229	0 (0%)	87,281	1 (0.00%)
Practitioner category	121,526	101 (0.08%)	87,281	1,961 (2.2%)
Treatment data				
Practitioner category	4,199	135 (3.2%)	2,300	111 (4.8%)

Where data was missing, observations were excluded from calculations. Additionally, there were several data entry issues noted, particularly for the variable *Test results*. For example, results for a chlamydia test were variously recorded (1, detected, negative, not detected, not done and positive). Also, a common data entry error was different spellings of words (treatment (drug) name).

Processes have been implemented to assist with these issues. Scripts have been developed by the ATLAS research team to filter, check and clean the data. These checks are performed when data has been received and any issues with variables with incomplete information or incorrect coding are flagged. They are subsequently investigated by the ATLAS Data Manager and followed up. This process of checking and cleaning the data has made the overall process more streamlined and comprehensive. It should ensure the reporting of key performance measures and other data for both static reports and, in future, the web-based dashboard are consistent. However, this is an ongoing and iterative process.

4.6.4.5. Representativeness

Representativeness encompasses accuracy to describe the population (person and place) over time (23).

At this stage limited evidence is available to determine representativeness of the data in ATLAS. The overall ATLAS network is intended to be representative of the broader ACCHS, Aboriginal and Torres Strait Islander population structure and STIs in the Aboriginal and Torres Strait Islander population (Figure 4.1). The two ACCHS included in the preliminary

evaluation are both located in an urban area of a major capital city and are representative of the communities they serve but not necessarily of the broader ATLAS network or Aboriginal and Torres Strait Islander population nationally and it is unclear if individuals presenting at the ACCHS are representative of the target population.

In saying this, ACCHS staff from the two ACCHS have indicated the baseline report data helps reaffirm current knowledge, is consistent with ACCHS data and reporting processes and clinician's knowledge. At this early stage of ATLAS implementation, it is difficult to say if, at a more localised level, the trends being seen in the ACCHS population were reflective of the broader (local) population. This would be difficult to determine for several reasons. Firstly, most people with an STI are asymptomatic. Secondly, not everyone with symptoms seeks medical care. Finally, of those that do, not all are tested or test positive or are notified and reported.

4.6.4.6. Timeliness

Timeliness incorporates timeframes of all steps within the surveillance system (23).

As ATLAS is still in its infancy, it is difficult to give a true assessment of its timeliness. Nevertheless, timeliness of processes and communication of the surveillance system can always be improved, particularly in relation to maintaining enthusiasm of ACCHS and staff and their ongoing commitment to their involvement in ATLAS.

Concerns were raised in relation to the timeliness of ATLAS processes and many of those concerns were associated with a lack of communication from the ATLAS research team about delays specific to collating, analysing and reporting of data, the reason and length of delays. These initial delays related to the development of the back-end of the system. The processes for cleaning, analysis and reporting of the data required a significant amount of work to establish, which ultimately delayed ACCHS receiving their baseline report. Suggestions for mitigating issues around timeliness in the future include, regular and frequent communication between the ATLAS research team and ACCHS, consistent and regular data extraction, six-monthly reporting periods, and clarity of expectations and timeframes for providing feedback, these should be negotiated between the ATLAS research team and ACCHS.

4.6.4.7. Stability

Stability of a surveillance system assesses the reliability and availability of the system to operate without failure (23).

Moving forward, the reliability of ATLAS as a surveillance system of ACCHS will be dependent on its ability to fulfil its intended objective. The value of ATLAS is in part demonstrated by the involvement of ACCHS. Their ongoing support, involvement and belief in ATLAS should ensure that the stability of ATLAS as a surveillance system. The stability of ATLAS will be dependent on ongoing funding and maintaining infrastructure, technical knowledge and skills and personnel to ensure ATLAS operates as it is intended too.

4.6.4.8. Usefulness

Usefulness of a surveillance system is demonstrated through its contribution to prevent, control and improve understanding of health events and ability to influence (23).

It is too early to determine the true usefulness of ATLAS as a surveillance system to prevent and control STIs and BBVs and address adverse health-related events including an improved understanding of the public health implication of such events. However, ACCHS staff reported ATLAS to be useful in terms of helping to better understand their own sexual health data, specifically testing data, improving clinician's knowledge around testing and treatment and as a potential resource and reference for all staff. At one ACCHS, the baseline report has informed CQI activities by identifying priorities and gaps in service delivery. Overall, feedback on the baseline report has been positive. The reports have been well received by staff; they felt information is presented in a clear and concise manner, and reports were visually appealing and useful. Feedback on the baseline reports will inform future reporting.

Additionally, through the establishment of ATLAS, several secondary outcomes have been achieved. These include:

- 12 key performance measures focused on testing, treatment and retesting of STI and BBV
- Support for strengthening capacity within ACCHS in relation to:
    - collection, analysis and reporting of STI and BBV data
    - management of an automated data system and web-based dashboard
    - opportunities for ACCHS staff and others involved in the ATLAS network to engage in research activities.

Further, the following secondary outcomes are planned to occur over the life of the system:

- Support strengthening capacity within ACCHS in relation to enhanced long term control and ownership of data at the ACCHS level
- Inform CQI activities at individual ACCHS

- Inform clinical guidelines and policy in relation to the Aboriginal and Torres Strait Islander population and the broader population.

Overall, ATLAS has significant potential as a resource to inform service delivery, CQI and clinical guidelines at the ACCHS level; more broadly, as a resource for research. The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network will add depth to what is currently known about STI and BBV, by supplementing current notification data with a surveillance system that captures not only diagnoses but important testing and treatment data.

Additionally, there will be opportunity to expand the ATLAS network to other Aboriginal and Torres Strait Islander (government) health services and linking into other projects such as the The Australian Collaboration for Coordinated Enhanced Sentinel Surveillance of STIs and BBVs. It will provide a level of understanding around patterns of care and access that has never been available before.

4.7. Discussion

It was generally agreed by stakeholders that ATLAS is a useful addition to enhance efforts in STI and BBV control. The aim of this evaluation was to undertake a preliminary assessment of whether ATLAS is effectively meeting its intended objective: to establish a national sentinel surveillance system specifically focussed on STI and BBV testing, care and management for ACCHS and other health services in the areas of surveillance, monitoring and evaluation.

The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network is on its way to meeting its primary objective, the establishment of a national sentinel surveillance system of ACCHS specifically focussed on STI and BBV. However, more time is required for ATLAS to demonstrate its value as a surveillance system, particularly in supporting work to reduce the high notifications rates of STI and BBV among the Aboriginal and Torres Strait Islander population. This includes fulfilling its additional objectives, as only one so far is complete: to develop a national agreed set of STI and BBV clinical performance measures. Over the coming years ATLAS should be able to meet its four additional objectives. Unfortunately, it is too early to monitor and identify trends in STI and BBV testing and positivity; to monitor and identify STI and BBV knowledge; risk practices and health service access of young people; identify interventions; build the capacity of participating hubs; and inform CQI processes. However, this should not be too difficult to achieve.

Out of the 29 ACCHS from around Australia involved in ATLAS, two ACCHS were eligible to be involved in the preliminary evaluation as they had received baseline reports. In those two

sites, ATLAS was considered acceptable, simple, timely and flexible. However, components within these attributes such as timeliness and communication between ACCHS and the ATLAS research team, stability and securing of future funding, demonstrating value and importance in relation to STI and BBV testing and management and representativeness, could be improved.

It is worth noting, a significant amount of engagement has occurred with ACCHS in the design and implementation of ATLAS. Not only has this been critical to ensuring the success of establishing ATLAS as a sentinel surveillance system, it is equally important to the ongoing success of ATLAS and the continuing engagement of ACCHS. The ATLAS network currently involves 29 ACCHS from around Australia. This demonstrates the acceptability of an initiative such as ATLAS and the potential role it can have in reducing the gap in knowledge, clinical testing and management of STIs and BBVs in the Aboriginal and Torres Strait Islander population. High levels of engagement with stakeholders and end users have been noted as being successful with other surveillance systems, including those focused on STI such as the Australian Collaboration for Coordinated Enhanced Sentinel Surveillance of STIs and BBVs (formally the Australian Collaboration for Chlamydia Enhanced Sentinel Surveillance) (30) or more broadly the NNDSS (18) and the Australasian Maternity Outcomes Surveillance System (38). A significant amount of time, effort and resources have gone into guaranteeing the partnership between ACCHS and SAHMRI is fruitful. This is aided by the fact ATLAS is a simple surveillance system to run and maintain once the system has been established. Simplicity has been identified in the evaluation of other surveillance systems as a key factor in ensuring useability and success (30).

The timeliness of ATLAS will improve as the system becomes more established and processes are refined. This will be supported by the implementation of a web-based dashboard in late 2019 or early 2020, which will enable ACCHS to securely access their data when required. The aim is that the web-based dashboard will be almost real time, with regular data extraction from ACCHS, and cleaning and analysis of data occurring at regular intervals (dependent on the ACCHS's preference). The web-based dashboard will allow ACCHS to analyse their data on any STI or BBV, time period, or population and download the data. This will empower services to have increased control of their data. Overall, the dashboard will enable a greater degree of timeliness, simplicity and flexibility of ATLAS.

Not all Aboriginal and Torres Strait Islander people with STI and BBV will be identified through ATLAS; however, ATLAS has been designed to focus on ACCHS with the aim of monitoring STI

and BBV testing and positivity in this target population. The two ACCHS included in the preliminary evaluation were representative of the communities they serve but not necessarily of the broader ATLAS network or Aboriginal and Torres Strait Islander population nationally. Representativeness of ATLAS could improve overtime as the network grows and more ACCHS join. Additionally, this has the potential to improve the underreporting of Aboriginal and Torres Strait Islander status that occurs with other surveillance systems. Our assessment of data quality and completeness found of the two ACCHS, only one observation from the data had Aboriginal and Torres Strait Islander status missing. This demonstrates ACCHS ability to accurately record and report Aboriginal and Torres Strait Islander status. This is a significant difference to the underreporting that occurs in the NNDSS, where for some STI and BBV reporting of Aboriginal and Torres Strait Islander status is less than 50% of all notifications (1).

In addition to notification data, ATLAS also captures testing data. Testing data can be used to inform notification data and indicate whether increases in notifications are true increases of incidence or due to increases in testing. Furthermore, testing data can be used to inform mathematical modelling of undiagnosed infections in a population (e.g. HIV (39), chlamydia (40), gonorrhoea (5)).

The potential impact of ATLAS as a network of ACCHS to identify, inform, respond and measure the impact of interventions related to outbreaks is significant. As previously mentioned, the ongoing syphilis outbreak in northern, central and western Australia could benefit from the additional knowledge drawn from an enhanced sentinel surveillance system such as ATLAS. It could possibly improve timely reporting of notifications and enhance early detection of increases in cases and facilitate early public health interventions, ultimately minimising the severity and length of the outbreak. This impact has been seen in relation to other sentinel surveillance systems. For example, the Australian Collaboration for Coordinated Enhanced Sentinel Surveillance of STIs and BBVs data has been used to inform a HIV Pre-exposure Prophylaxis study in Victoria, Australia (41).

The challenge moving forward is ATLAS needs to demonstrate its value as a surveillance system and its impact on reducing the disproportionately higher rates of STIs and BBVs among the Aboriginal and Torres Strait population. Additionally, ATLAS will need to improve service delivery, CQI activities and inform guidelines and policy in relation to STIs and BBVs within its initial funding timeframe. Furthermore, to ensure ATLAS continues to be successful ongoing funding is required. Appropriate actions should be taken to address this issue.

4.8. Recommendations

The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network has the potential to provide an important infrastructure and mechanism for the surveillance of STI and BBV within ACCHS and reduce STI and BBV within the Aboriginal and Torres Strait Islander population. Despite this, there are several areas requiring attention to strengthen ATLAS and its network. Based on this preliminary evaluation I recommend that:

1. A face-to-face meeting between ACCHS, clinical hubs, the ATLAS research team and investigators be held annually to update the ATLAS network on the progress of ATLAS and the CRE-ASH activities and seek their feedback and guidance.
2. A reporting framework be developed outlining regular reporting requirements and timeframes, with a formalised communication channel.
3. Use of ATLAS be encouraged and facilitated as a research resource both within the ATLAS network and externally. This will contribute toward ATLAS being able to demonstrate its usefulness and value.
4. Appropriate funding sought to ensure ATLAS is maintained as a surveillance system to fulfil its role in monitoring trends in STI and BBV testing, positivity, and clinical management in the Aboriginal and Torres Strait Islander population.
5. An investment made in both ATLAS itself and in staffing – ACCHS staff and the ATLAS research team – to ensure technical knowledge and skills are developed and retained within the network.
6. Regular and/or ongoing monitoring and evaluation of ATLAS as a surveillance system and network be conducted to ensure stability of the system.

4.9. Evaluation limitations

There were limitations to this evaluation. The first, being a preliminary evaluation. ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network has only been operating since the second half of 2018, at the time of conducting the evaluation only two ACCHS had received their baselines reports and were eligible to participate. Given the size of the ATLAS network it would have been preferable to have more ACCHS involved in the evaluation, which would have given a more in-depth insight into the operation and impact of ATLAS and the network. Additionally, it is unknown how representative individuals attending ACCHS are in terms of the whole target population. The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network is a sentinel surveillance system, however, it is not focussed on identifying all STI/BBV cases. However, ATLAS focuses on ACCHS with the aim of monitoring STI and BBV testing and positivity in this target population. Also, it is

unclear if there has been changes in testing or clinicians' behaviour, or whether there have been campaigns to target particular individuals or populations, over the period of reporting; all these factors will have an impact on positivity rates. ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network

4.10. Conclusion

The ATLAS Aboriginal and Torres Strait Islander Sexual Health Surveillance Network provides important information and data on STI and BBV in the Aboriginal and Torres Strait Islander population; however, several remaining challenges need to be addressed in order to ensure ATLAS is successful in meeting its objective. Firstly, ongoing funding needs to be sourced for the sustained management of ATLAS and secondly, the value of ATLAS as a surveillance system and its impact in reducing STI and BBV and improving service delivery in relation to STI and BBV needs to be demonstrated.

The preliminary evaluation recommendations presented above are proposed to inform the strengthening of ATLAS, and contribute to ATLAS fulfilling its intended objective: to establish a national sentinel surveillance system specifically focussed on STI and BBV testing, care and management for ACCHS and other health services in the areas of surveillance, monitoring and evaluation.

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Appendix 4.1

Evaluation of ATLAS – Interview Questions

Questions will be asked about usefulness, simplicity, data quality, representativeness, flexibility, acceptability, timeliness and stability. All questions are not relevant to every stakeholder. Sample questions are provided below, questions asked during the interview are dependent on stakeholder involvement in ATLAS.

Attributes	Questions
	1. What is your role and how are you involved in ATLAS?
Usefulness	2. How useful is ATLAS for you and your service? (Probe: use, application of findings, increased testing, informed clinical knowledge, work or funding as a result of findings, how could you use it?) 3. What outputs from ATLAS are you aware of? How has that information been used? (Probe: ask for an example) 4. Have the data/outputs been used to detect outbreaks, trends?
Representativeness	5. Do you think the outcomes are representative of the wider service/Aboriginal and or Torres Strait Islander community? 6. Are the outcomes consistent with other evidence?
Simplicity	7. What input is required from your service? (Probe: staffing) 8. How is data managed? (Probe: entering, access, storage) 9. What is the process of maintaining ATLAS? (Probe: time and resources, running and maintaining, process of coordination, training required)
Data quality	10. Is the data easy to collect? 11. Are there any issues with data quality and completeness? (Probe: sample size, conclusions, trend over time) 12. Are all the indicators useful? 13. Are there other indicators that should be included? (Probe: ask for an example and reason) 14. How is ATLAS reported? 15. Is the report easy to understand and use? (probe: positive and negative aspects of the report) 16. How would you improve reporting of ATLAS?
Flexibility	17. Is ATLAS easy to modify? (probe: ease of change, limitation and ability to modify in the future)
Acceptability	18. Do you consider ATLAS a valid and necessary undertaking? (probe: why, why not, in terms of surveillance use) 19. What are the implications of your service not participating in ATLAS? (Probe: application of data, surveillance)
Timeliness	

Stability	20. Are the timeframes of the system adequate? (Probe: just the timeframes on the aspects you are involved in, collection, analysis and reporting) 21. How long does it take from receiving data to producing a report? 22. How is ATLAS funded? 23. What would be a more sustainable way to operate ATLAS? 24. What time, resources and organisational support are needed to maintain ATLAS? 25. How do you see ATLAS working in the future? 26. Is there anything else you would like to tell me about ATLAS?

Chapter 5: A case-control study and outbreak of *Salmonella* Havana linked to alfalfa sprouts, South Australia, 2018

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Abbreviations and acronyms

CDCB	Communicable Disease Control Branch
CI	Confidence intervals
FCDB	Food and Controlled Drugs Branch
PIRSA	Department of Primary Industries and Regions South Australia
S. Havana	*Salmonella* Havana
S. Oranienburg	*Salmonella* Oranienburg
SA	South Australia
SA Health	South Australian Department for Health and Wellbeing
SAMSS	South Australian Monitoring and Surveillance System
the Act	*South Australian Public Health Act 2011*

5.1. Prologue

5.1.1. My role

During my Master of Philosophy in Applied Epidemiology I was not placed in a public health unit. However, my field supervisor and I took the opportunity to make arrangements with the Disease Surveillance and Investigation team, Communicable Disease Control Branch (CDCB), South Australian Department for Health and Wellbeing (SA Health), to be involved in an outbreak investigation.

In June 2018, I was contacted regarding an outbreak and took the opportunity to be involved. I was brought into this outbreak investigation to assist the Disease Surveillance and Investigation team with the epidemiological investigations. My primary roles were:

- to review the case-control study questionnaire
- to draft a ministerial brief regarding the outbreak (Appendix A)
- to enter data from the completed case-control questionnaires
- to clean and analyse the data.

In addition, I participated in risk assessment meetings regarding the outbreak and other relevant meetings including high-level decision-making meetings with the Chief Public Health Officer of South Australia. I also wrote the outbreak investigations as a manuscript which was published in *Communicable Diseases Intelligence* and forms the main component of this chapter (Appendix B);

> Harfield S, Beazley R, Denehy E, Centofanti A, Dowsett P, Housen T, et al. An outbreak and case-control study of Salmonella Havana linked to alfalfa sprouts in South Australia, 2018. *Communicable Diseases Intelligence* (2018). 2019;43.

5.1.2. Lessons learnt

The outbreak investigation provided an excellent real-time exercise to put epidemiological theory into practice. I gained experience in outbreak investigations which was highly valuable. I learnt how foodborne disease outbreak investigations are complex, requiring a team effort and close cooperation and communication between relevant government agencies and experts to ensure several components came together: information and data collection, the synthesis of findings from the laboratory investigation, environmental health investigations and the epidemiology investigations.

This outbreak involved the CDCB, the Food and Controlled Drugs Branch of SA Health, SA Pathology and South Australian Local Government. As the implicated food source was a

primary produce, the Department of Primary Industries and Regions South Australia were also involved. This outbreak used the three components of a foodborne disease outbreak investigation: laboratory investigation, epidemiological investigation and environmental investigation. As previously mentioned, I was part of the epidemiological investigation, Disease Surveillance and Investigation team.

The main purpose of an outbreak investigation is to identify and eliminate the source of the outbreak to stop further cases, by stopping exposure to the outbreak source. The role of the outbreak investigation is to identify the exposure. Traditionally, outbreak investigations are described as involving ten steps (1). However, not every investigation will require all ten steps, nor are they conducted in order from step one through to step ten. I was involved as a member of the investigation team; in the descriptive analysis of cases and controls; development, testing and comparing of hypothesis; implementation of control and prevention measures; and the preparation of a written report and communication of findings.

There were several challengers in relation to undertaking this outbreak investigation. Outbreak investigation often require a quick response, however, this is dependent on the level and appropriateness of information available. While we were able to undertake a case-control study within a day, this required a significant amount of resources to undertake, particularly, several peoples' time which would have otherwise been allocated to monitoring other notifications and diseases. This outbreak investigation utilised information from laboratory, environmental and epidemiological investigations, which required time to acquire. Importantly, while there was an urgency to make an announcement about the outbreak to the public and to prevent further cases from occurring, an important discussion between the outbreak investigation team, the Chief Public Health Officer and other SA Health staff was held, weighing up the evidence against, public safety versus the implications of being incorrect about the source of the outbreak and its potential impact on industry and reputation. A decision was made to wait for laboratory confirmation, which in the end supported environmental and epidemiological investigations.

We chose to conduct a case-control study for this outbreak as opposed to a cohort study. The primary reason for this decision was the outbreak did not have an appropriate number of cases to make it feasible to undertake a cohort study and there was no defined population. Waiting for the outbreak to reach an appropriate number of cases or to be a defined population would risk delaying public health action and public safety. For the case-control

study we also chose to un-match the controls, while statistically there was no difference between cases and controls by sex and age for our case-control study, there are often benefits and limitations as to whether controls are matched or un-matched. Benefits for matching controls minimises confounding and biases by considering sex, age and other population characteristics or risk factors. At the same time there are benefits to un-matching controls, such as, it provides an opportunity to develop a greater understanding of the disease of interest. Additionally, factors already known to be risk factors for the disease can be limited. Further, certain statistical analysis (logistic regression) allow for confounding factors to be accounted for in the analysis. Finally, un-matching makes it easier to identify and recruit controls.

5.1.3. Public health impact

The aim of this outbreak investigation was to determine the cause of illness and to prevent further illness from occurring. To our knowledge, this is the first documented outbreak of *Salmonella* Havana (*S.* Havana) in Australia.

Efforts to control this outbreak were successful. Once laboratory confirmation was received, prompt and effective actions were taken to stop further members of the community from falling ill – a media release and announcement was made by the Chief Public Health Officer (Appendix C & D). A coordinated effort was required, including an immediate notification to the producer to stop production and a state-wide recall of all alfalfa sprout products made by the producer.

5.1.4. Acknowledgements

I would like to acknowledge and thank the Communicable Disease Control Branch, particularly the Disease Surveillance and Investigation team led by Emma Denehy and Rebecca Beazley outbreak investigation lead, for their assistance and support in allowing me to be a part of the outbreak investigation and their team. Iwould also like to acknowledge and thank the Food and Controlled Drugs Branch and Primary Industries and Regions South Australia. Finally, I want to recognise and pay respect to their extraordinary contributions towards disease surveillance in South Australia.

5.1.5. MAE core requirements

This project fulfils the outbreak investigation component of the Master of Philosophy in Applied Epidemiology. The outbreak investigation was written up as a manuscript and published in *Communicable Diseases Intelligence.*

5.2. Abstract

An epidemiological investigation and a retrospective case-control study were conducted into an outbreak of *S.* Havana in alfalfa sprouts, in Adelaide, Australia. In total, 31 cases of *S.* Havana were notified during June and July 2018 and linked to the outbreak. Eighteen cases and 54 unmatched controls were included in a case-control study. Results from the case-control study indicated an increased risk of illness linked to the consumption of alfalfa sprouts; this was supported by trace-back, sampling and environmental investigations. This outbreak of *S.* Havana was caused by consumption of alfalfa sprouts from one local sprout producer. It is unclear as to when in the production of alfalfa sprouts, contamination occurred. However, contaminated seeds and poor pest control are the most likely causes. This investigation highlights the importance of ensuring producers take appropriate action to minimise the likelihood of contamination and comply with legislation and standards for primary production and food safety.

5.3. Introduction

Salmonellosis is commonly associated with foodborne outbreaks. Outbreaks are often linked to infected produce, animals and contaminated animal feed used in food production (2). The incubation period for salmonellosis is 6 to 72 hours, usually 12 to 36 hours. Symptoms may include fever, diarrhoea, loss of appetite, headache, stomach cramps, nausea and vomiting (2). Salmonellosis may be particularly severe in young children, the elderly and people with immune suppression (2).

In Australia, *Salmonella* is a nationally notifiable disease and accounted for 33.4% of all foodborne notifications in South Australia (SA) between 2013 and 2017 (3). During June 2018, a notable increase in *S.* Havana notifications was detected through routine surveillance by the Communicable Disease Control Branch (CDCB), South Australian Department for Health and Wellbeing (SA Health). Notifications of *S.* Havana are relatively infrequent in Australia. During the period 2013–2017, 3 to 14 *S.* Havana cases were reported annually to CDCB. No previous outbreaks have been attributed to *S.* Havana in Australia (3). Internationally, only one other outbreak reported in 1998 in the United States of America linked *S.* Havana to alfalfa sprouts (4). *S.* Havana has also been previously identified in poultry (5-8) and feedstock (7, 9, 10).

This investigation included a description of the outbreak, a retrospective case control study, microbiological investigation, and trace-back that led to the identification of cases and the prevention of further cases.

5.4. Method

A descriptive epidemiological investigation and a retrospective case-control study were conducted. This epidemiological investigation was covered by the *South Australian Public Health Act 2011* (the Act) and approval from the Australian National University Human Research Ethics Committee (2017/909). Informed consent was obtained from all participants. A case for the outbreak investigation was defined as laboratory-confirmed infection with *S.* Havana in SA reported to CDCB from 1 June until 31 July 2018.

5.4.1. Epidemiological investigation

In SA, reporting of notifiable conditions to the CDCB, by medical practitioners and diagnostic pathology services, is required under the Act. Notifications are monitored by CDCB staff to determine whether further investigations are required.

Interviewing of laboratory-confirmed salmonellosis cases was conducted by trained CDCB staff using the OzFoodNet *Salmonella* Hypothesis Generating Questionnaire (11). The questionnaire collected information on demographics, onset of illness, symptoms, recent travel, environmental exposures, food history, and locations where food was purchased during the seven days prior to illness onset. Information from the hypothesis-generating interviews informed the case-control hypothesis and was used to assist trace-back.

5.4.2. Case-control study

A case-control study was conducted to test the hypothesis, that illness was associated with consumption of frequently identified foods from the hypothesis-generating questionnaires. A case for the case-control study was defined as a laboratory-confirmed case of *S.* Havana in SA reported to CDCB from 1 June until 20 June 2018. A case was eligible for the case-control study if initially interviewed with the Hypothesis Generating Questionnaire and interviewed with the case-control study questionnaire prior to the media announcement regarding the outbreak on 20 June 2018. Cases not interviewed with the case-control study questionnaire prior to the media announcement were excluded. Controls were recruited using a list randomly generated from the South Australian Monitoring and Surveillance System (SAMSS) survey, a population health survey that monitors trends in health risk factors and chronic disease (12). The SAMSS survey is collected monthly from about 600 adults and children using a Computer-Assisted Telephone Interviewing system. Participants must be residents of SA

with access to a telephone (including mobile phone). The sampling strategy uses a 'dual overlapping sampling technique applied (mobile phone 70%: landline 30%) through random digit dialling' (13).

An unmatched control sample was calculated by the Prevention and Population Health Branch of SA Health using the 2018 SAMSS recontacting spreadsheet. Sample size was estimated using the percentage of cases consuming sprouts in the hypothesis-generating study and data from the Victorian Food Frequency study, which estimated the prevalence of eating alfalfa sprouts among healthy community controls. Controls were interviewed by telephone by trained interviewers between 9:30 am and 2:00 pm on 20 June 2018. Controls were excluded if they were not reached prior to the media announcement at 2:00 pm on 20 June 2018, reported being ill, had returned from interstate or overseas within the last seven days or if another member of the household had an onset of diarrhoea in the two weeks prior to the onset of diarrhoea in the laboratory-confirmed control-case selected for the study. Only one attempt by telephone was made to contact each control.

5.4.3. Statistical analysis

Data obtained from the case-control study questionnaire were entered into a MS Excel® 2016 before analysis using Stata® version 15. Univariate analysis was conducted on all food exposures, and generated crude odds ratios, p-values and 95% confidence intervals (exact). The statistical significance threshold was 5%. Categorical variables were assessed via chi-squared test (sex) and continuous variables via *t*-test (age).

5.4.4. Trace-back, sampling and environmental investigation

Information from hypothesis-generating interviews informed trace-back, sampling and environmental investigations. Business and retailer records were used to identify common suppliers and product producers. Environmental and product samples were collected during environmental inspections. Retail samples of products were collected in the marketplace. All samples were submitted for microbiological analysis. Investigations were conducted by local government council environmental health officers as authorised by the *Food Act 2001* (SA) (14), at a hotel implicated in the outbreak, included inspection of kitchen facilities and observation of food preparation procedures. Details of staff illness, absenteeism, and product suppliers' details were requested. Food samples were also collected. Additional inspections of businesses implicated by cases were carried out by Food and Controlled Drugs Branch of SA Health (FCDB) and Department of Primary Industries and Regions South Australia (PIRSA) through trace-back of distributors and product producers. Environmental and product samples were collected from the production site at the time of this inspection.

Several follow-up inspections of the producer were conducted by FCDB and PIRSA. Food samples and environmental samples were sent to SA Pathology, for microbiological analysis using standardised methods (15).

5.5. Results

5.5.1. Epidemiological investigation

In total, 31 cases of *S.* Havana were notified to the CDCB from 1 June to 31 July 2018 and linked to the outbreak investigation (Figure 5.1), comprising 19 females (61%) and 12 males (39%), with an age range of 22–87 years and a median age of 65 years. Cases were from both rural SA (17 cases) and metropolitan Adelaide (14 cases). The most frequently reported symptoms were diarrhoea (97%), lethargy (94%), abdominal pain (81%), nausea (77%), fever (74%), headache (68%), muscle ache (61%) and vomiting (42%). The days unwell ranged from 2 to 23 days with a median of 8. Thirteen (42%) cases were hospitalised.

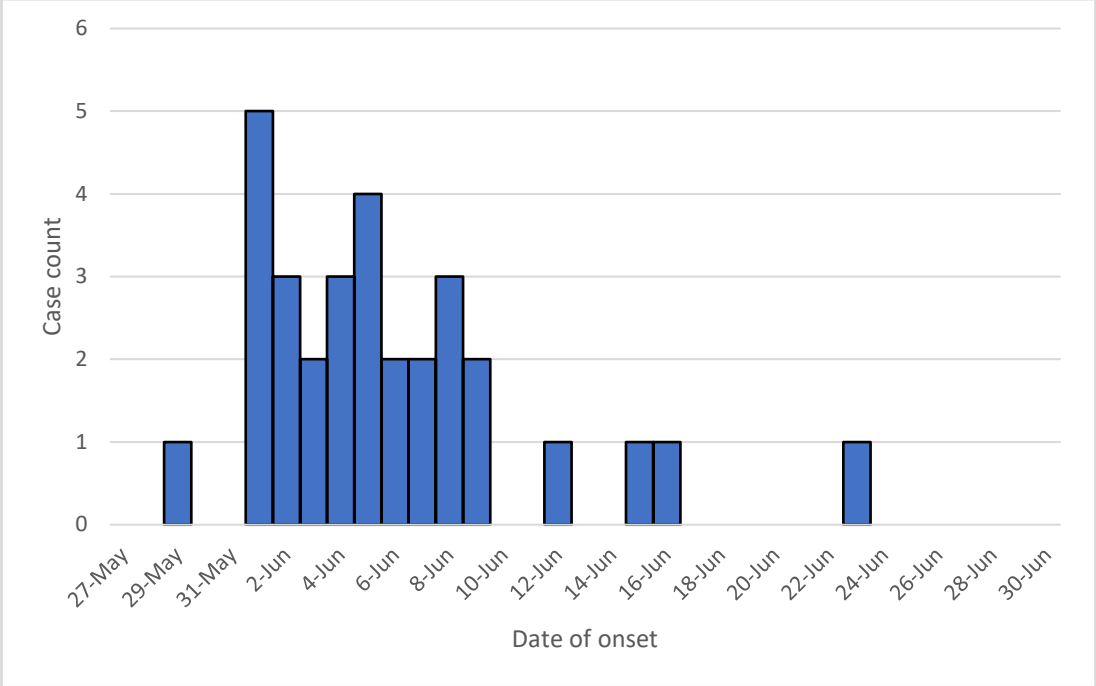

FIGURE 5.1: EPIDEMIOLOGICAL CURVE OF S. HAVANA NOTIFICATIONS IN SOUTH AUSTRALIA BY DATE OF ONSET, 29 MAY – 23 JUNE 2018

The hypothesis-generating interviews were conducted between 13 and 19 June 2018 with 17 cases. The interviews identified eight cases with the same hotel (Hotel X) as a common exposure. No meals were common between the eight cases. Foods identified from hypothesis generating interviews as frequently consumed included carrots, apples, bananas, pasteurised milk, cheese, potatoes, tomatoes, chicken and avocado. Five cases who did not

eat at the hotel identified eating alfalfa sprouts purchased from one of the following: a supermarket, bakery, fruit and vegetable store, or health food store.

5.5.2. Environmental investigation

Local government council environmental health officers inspected Hotel X on 14 June 2018. The environmental health officers identified alfalfa sprouts were served as a garnish on all hot meals, along with snow pea shoots and mesclun lettuce. Seven food samples were collected, four alfalfa sprouts samples (two from open bags and two from closed bags), one mesclun lettuce leaves sample and two snow pea sprouts samples. Overall, the inspection showed general compliance with the Australian and New Zealand Food Standards Code (16) was satisfactory. One staff member, a food handler, was identified as being unwell; however, it was unclear if the food handler had worked while ill. No stool sample was obtained for this person. Hotel X used alfalfa sprouts supplied by a local distributer who sourced the alfalfa sprouts from one local sprout producer (producer A). Traceback of alfalfa sprouts implicated by cases not linked to Hotel X were also conducted with a supermarket, bakery, fruit and vegetable store, and health food store. Trace-back identified alfalfa sprouts were all from the one sprout producer (producer A).

Random retail sampling occurred on 18 June 2018 and 146 samples of alfalfa and other sprout products were collected. Two South Australian alfalfa producers provided product to the SA marketplace. To ensure a thorough and open investigation both producers were investigated (producer A, producer B). The FCDB and PIRSA undertook joint environmental investigations at both South Australian alfalfa producers on 19 June 2018. Significant food safety issues at one producer (producer A) included vermin control: an inspection identified vermin faeces underneath pallets in the bulk storage area storing seeds. Fifty-one samples were collected along the production line from producer A: 42 were food and seed samples including a variety of alfalfa and snow pea sprouts, and nine were environment samples including vermin faeces. At producer B, 117 samples were collected from a mix of different sprout products.

Of the seven food samples collected by local council environmental health officers at Hotel X on 14 June 2018, three alfalfa sprouts samples returned positive results for *S.* Havana on 20 June 2018. Of the random retail samples collected, five returned positive results for *S.* Havana and were from the same sprout producer (producer A). Eleven positive results were returned on sprout product samples collected from producer A, with six *S.* Havana and five *Salmonella* Oranienburg (*S.* Oranienburg). While *S.* Oranienburg was identified from samples collected

from the sprout producer, no cases of *S.* Oranienburg had been notified in SA since April 2018. No positive results were identified from producer B.

5.5.3. Case control study

Eighteen cases were identified and included in the case-control study. Cases included seven males (39%) and 11 females (61%), with an age range 22–87 years and a median age of 69 years. Of the 268 potential controls contacted, 54 unmatched controls were eligible to be enrolled into the study. Exclusion of controls was due to individuals being non-contactable (96%), reportedly ill (3%) or reportedly having travelled recently (1%). Controls included 19 males (30%) and 35 females (70%), with an age range 21–94 years and a median age of 71 years. There was no statistically significant difference between cases and controls in age (*t*-test = 1.70, p-value = 0.10), nor in sex (chi2(1) = 0.53, p-value = 0.47).

Table 5.1 shows the results for the univariate epidemiological analysis. Increased risk of illness was shown for alfalfa sprouts (odds ratio 26.0, 95% CI 2.62–1217.60, p-value <0.001). Multivariate analysis was not conducted as only one food exposure, alfalfa sprouts, was statistically significant (p-value <0.05) and had a crude odds ratio greater than 2.0 with the 95% confidence interval not crossing unity.

TABLE 5.1: *S.* HAVANA OUTBREAK – ODDS RATIOS FOR FOOD EXPOSURES, SOUTH AUSTRALIA, 1ST–20TH JUNE 2018

	Cases (n=18)		Control (n=54)		Univariate analysis		
Exposure	Exposed	%	Exposed	%	Crude OR	95% CI	p-value
Alfalfa sprouts	6	33.33	1	1.85	26.00	2.62-1217.60	0.00
Black pepper	6	33.33	38	70.37	0.21	0.06-0.75	0.02
Cauliflower	8	44.44	20	37.04	2.67	0.79-9.44	0.07
Capsicum	5	27.78	27	50.00	0.42	0.10-1.51	0.14
Eggs	12	66.67	46	85.19	0.42	0.10-1.95	0.18
Avocado	9	50.00	19	35.19	1.84	0.54-6.21	0.26
Lettuce	11	61.11	27	50.00	1.83	0.52-6.90	0.29
Raw tomato	9	50.00	36	66.67	0.56	0.16-2.00	0.31
Broccoli	10	55.56	36	66.67	0.59	0.17-2.07	0.34
Fresh garlic	4	22.22	16	29.63	0.68	0.14-2.64	0.54
Chicken	7	38.89	27	50.00	0.78	0.21-2.75	0.66
Yoghurt	9	50.00	24	44.44	1.25	0.37-4.18	0.68
Snow pea shoot	1	5.56	2	3.70	1.53	0.02-30.92	0.73
Pumpkin	10	55.56	34	62.96	0.84	0.24-3.05	0.76
Cucumbers	7	38.89	20	37.04	1.08	0.30-3.66	0.89
Raw onions	6	33.33	20	37.04	0.93	0.24-3.26	0.90
Almonds	8	44.44	24	44.44	1.00	0.29-3.32	1.00

OR, odds ratio; CI, confidence interval

5.5.4. Public health action

Based on epidemiology, laboratory results and trace-back, an emergency order under the *Food Act 2001* (SA) was served on producer A to cease distributing products, which were only distributed within SA, and a consumer level recall of all alfalfa products from the supply chain was issued on 21 June 2018. A media release and public health alert to warn South Australians not to eat alfalfa sprout products from producer A was issued on 20 June 2018. PIRSA returned to producer A to evaluate the effectiveness of the food recall and conduct a more intensive overview of the facility and processes on 22 June 2018. No breakdown in the production process was identified; however, there were several structural deficiencies identified. Producer A was advised to rectify issues around vermin entry points and remove any equipment that could not be easily cleaned and sanitised, and to review their food safety programme to ensure it adequately addressed critical control points as required under the Food Standards Code – Production and Processing Standard for Seed Sprouts (4.2.6). The producer committed to cease the production of all sprout products and to rectify issues identified. Food and Controlled Drugs Branch returned to producer A on 29 June 2018 to witness the secure destruction of the recalled product.

5.6. Discussion

Consumption of alfalfa sprouts linked to one sprout producer showed a significant association with illness, an odds ratio of 26.0 (95% CI 2.62–1217.60, p-value <0.001). The findings and observations from the environmental investigation and laboratory results, which included positive results for *S.* Havana from three samples collected from Hotel X, five samples from random retail samples and six from samples collected from sprout producer A, provided further support to the epidemiological evidence. This was a significant achievement given that the case-control study was conducted in one day. This outbreak was the largest identified *S.* Havana outbreak in Australia to date. In total, 31 cases of *S.* Havana were reported and linked to the outbreak.

Alfalfa sprouts are considered a high-risk product due to the risk of microbial contamination inherent in sprout seeds and production (17), sprouts require warm and humid conditions to grow, which is also ideal for bacterial pathogens (18). It is unclear as to when in the production of alfalfa sprouts contamination occurred. However, contaminated seeds are the most likely cause given their high risk. Alfalfa sprouts are usually consumed raw which increases the risk of human infection. Alfalfa sprouts (19-25) and other sprouts(24, 26-28) have been linked to other *Salmonella* outbreaks internationally. Only one other outbreak was

identified in the literature, in 1998 in the United States of America, which linked *S.* Havana to alfalfa sprouts (4). This particular outbreak involved 18 cases from California and Arizona and identified contaminated seed as the likely source.

With 13 (44%) cases hospitalised, the hospitalisation rate in this outbreak was high, in comparison to the normal hospitalisation rate for salmonellosis of 21% in 2018 for SA (29). This suggests either there might have been a high dose of contamination on the alfalfa sprouts or the outbreak strain might be more pathogenic than other *Salmonella* strains, thus leading to a higher burden of disease for this specific strain.

To minimise future outbreaks linked to alfalfa sprouts and other sprouts, it is suggested sprouts producers take appropriate action to minimise the likelihood of contaminated products, including using a decontamination step to minimise the bacterial load on sprout seeds and in the sprouting process and ensuring they comply with legislation and standards for primary production and food safety. In SA, all sprouts producers are required to hold accreditation under the Primary Produce (Food Safety Schemes) Act 2004 and the Primary Produce (Food Safety Schemes) (Plant Products) Regulations 2010; comply with Food Standards Code – Production and Processing Standard for Seed Sprouts (4.2.6); and have an approved food safety arrangement.

There are several limitations to our outbreak investigation. Firstly, recall by individuals of foods eaten is always a concern in a retrospective case-control study, as asking someone to recall what they ate before becoming ill can be a challenge, particularly if it has been several days since the incident. Also, the Hypothesis Generating Questionnaire asks about what food did you eat, requesting a person to recall the food they consumed, whereas the case-control study questionnaire is framed as 'did you eat…', which is more likely to prompt a person's memory. This might help explain why those who ate at Hotel X did not recall being served alfalfa sprouts on their meal as a garnish when asked about at it during the Hypothesis Generating Questionnaire. However, one case who ate at Hotel X recalled eating alfalfa sprouts when asked using the case-control study questionnaire. Secondly, controls were not matched, however, statistically there was no difference between the cases and controls for age or sex. Thirdly, univariant analysis identified alfalfa sprouts were the most likely cause with statistically significant odds ratio. However, the confidence interval is wide (2.62–1217.60), which is related to the small sample size.

5.7. Conclusion

This outbreak of *S.* Havana in SA was caused by consumption of alfalfa sprouts from one local sprout producer. Alfalfa sprouts are considered a high-risk product due to risk of microbial contamination in sprout seeds, and production occurring in an environment which is ideal for growth of bacterial pathogens. In this outbreak it is unclear as to when in the production of alfalfa sprouts contamination occurred. However, contaminated seeds and poor pest control are the most likely causes. This investigation highlights the importance of ensuring producers comply with legislation and standards for primary production and food safety and equipment is adequately maintained to minimise the likelihood of contamination.

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Appendix 5.A
Ministerial brief – Salmonella Havana Outbreak

Government of South Australia
SA Health

MINUTE

MINUTES forming ENCLOSURE to

Doc no: A689104

To: THE OFFICE OF THE MINISTER FOR HEALTH

Submitted by **Professor Paddy Phillips, Chief Medical Officer & Chief Public Health Officer, Public Health and Clinical Systems**

☐ Authorised by **Vickie Kaminski, Chief Executive, SA Health** / /

***SALMONELLA HAVANA* OUTBREAK -**

Timing: FOR INFORMATION

Recommendations: It is recommended that you:

1. Note an outbreak of *Salmonella Havana* infection occurring in rural and metro South Australia (SA), link to alfalfa sprouts.

Noted

Minister for Health

/ /

PURPOSE

- To inform the Minister about an ongoing outbreak of *Salmonella Havana* infection and actions undertaken by the Department to investigate and protect the public.

SUMMARY

- Twenty-one cases have been reported to Communicable Disease Control Branch since 1 June 2018. As of 20 June 2018, 15 have been interviewed.
- Cases comprise of 11 females and ten males. Cases are from both rural South Australia and metropolitan Adelaide. Age range is from 22 years to 87 years, with a median age of 64 years. Seven cases have been hospitalised.
- Alfalfa sprouts were highly consumed by cases and further investigations into the source of the alfalfa sprouts identified that they were likely to be sources from the same supplier.
- The Communicable Disease Control Branch will be undertaking a case control study to confirm alfalfa sprouts as the source of the *Salmonella Havana* infection.

INVESTIGATION AND ACTION

- Interviews have been conducted using the national *Salmonella* Hypothesis Generating Questionnaire. So far, 17 cases have been interviewed. Eight of these cases have reported eating at a hotel in the Fleurieu Peninsula region during their incubation

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period. A further two cases of Salmonella species (awaiting further typing) have also been interviewed and implicated the same hotel as the source of their infection.

- In addition, five cases that did not eat at the hotel in the Fleurieu Peninsula region have also recall eating alfalfa sprouts.
- Environmental inspection was carried out by Alexandrina Council on 14th June 2018, at the implicated hotel and identified that alfalfa sprouts were served as a garnish on all hot meals, along with snow pea shoots and mescalin lettuce. Out of the seven samples collected, three samples of alfalfa sprouts have been detected presumptive for *Salmonella*. Samples have been sent to the *Salmonella* reference lab for confirmation test and typing.
- Traceability of the three presumptive samples of alfalfa sprouts have been established. All three samples were supplied to distributer Adelaide Fresh by producer SA Sprouts.
- Food Surveillance (SA Health) and PIRSA conducted a joint environmental inspection of SA Sprouts on 19th June 2018. Fifty-one samples were collected and sent to the lab on 19th June 2018. During the inspection rat faeces were also found underneath product sitting on a palette, samples were taken and provided to the lab.
- PIRSA have advised the business to clean and discard seed from the contaminated palette. However, as of 20th June 2018, SA Sprouts are still distributing product.
- Retail sampling of sprout products occurred on the 18th and 19th June 2018 at several locations across the Adelaide region and were provided to the lab. Results are expected to be known by Thursday 21st June 2018 at the earliest.

SA HEALTH REPRESENTATIVE

- N/A

BACKGROUND

- *Salmonella* infection is a notifiable disease as prescribed under the *South Australian Public Health Act 2011*.
- On the 5th June 2018, Communicable Disease Control Branch identified an increase in *Salmonella Havana* notifications via routine surveillance reporting, and an investigation was launched.
- Several *Salmonella Havana* infections have also been noted in Northern Territory (one case), New South Wales (one case), Queensland (six cases), Victoria (three cases) and Western Australia (three cases) since 1st January 2018.
- Previous outbreaks of *Salmonella Havana* have implicated fresh produce as a source of infection e.g. alfalfa sprouts in the United States of America in 1998, and chicken has also been implicated in two separate outbreaks in 2014, one in the Philippines and the other in Portugal.
- The Food Act 2001 is committed to the Minister for Health and requires food for sale to be both safe and suitable for human consumption.
- *Salmonella* is spread via the faecal-oral route: i.e. foodborne or by person-to-person transmission. It is likely this outbreak is primarily foodborne.
- Symptoms of *Salmonella* may include, diarrhoea (sometimes with blood or mucus), fever, vomiting, headaches and loss of appetite. Illness may be particularly severe in the very young, the elderly and malnourished people. Recovery from *Salmonella* infection usually occurs within a week and antibiotic treatment is not normally required. However, severe cases may require antibiotics. Mild and asymptomatic infections can occur and may contribute to the transmission of disease.

COSTING COMMENT

•

IMPACTS ON ANOTHER CEO OR DCE OR EXECUTIVE DIRECTOR

- N/A

ADVICE FROM OTHERS

- N/A

ATTACHMENT(S)

- N/A

PROFESSOR PADDY PHILLIPS
CHIEF MEDICAL OFFICER & CHIEF PUBLIC HEALTH OFFICER
PUBLIC HEALTH AND CLINICAL SYSTEMS

/ /

A/Director/Director endorsement:

Dr Louise Flood
A/Director
COMMUNICABLE DISEASE CONTROL BRANCH

/ /

Dr Kevin Buckett
Director
PUBLIC HEALTH SERVICES

/ /

Appendix 5.B

Manuscript - An outbreak and case-control study of Salmonella Havana linked to alfalfa sprouts in South Australia, 2018

Australian Government
Department of Health

COMMUNICABLE DISEASES INTELLIGENCE

2019 Volume 43

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An outbreak and case-control study of *Salmonella* Havana linked to alfalfa sprouts in South Australia, 2018

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Original article

An outbreak and case-control study of *Salmonella* Havana linked to alfalfa sprouts in South Australia, 2018

Stephen Harfield, Rebecca Beazley, Emma Denehy, Alessia Centofanti, Paul Dowsett, Tambri Housen and Louise Flood

Abstract

An epidemiological investigation and a retrospective case-control study were conducted into an outbreak of *Salmonella* Havana in alfalfa sprouts, in Adelaide, Australia. In total, 31 cases of *S.* Havana were notified during June and July 2018 and linked to the outbreak. Eighteen cases and 54 unmatched controls were included in a case-control study. Results from the case-control study indicated an increased risk of illness linked to the consumption of alfalfa sprouts; this was supported by trace-back, sampling and environmental investigations. This outbreak of *S.* Havana was caused by consumption of alfalfa sprouts from one local sprouts producer. It is unclear as to when in the production of alfalfa sprouts the contamination occurred. However, contaminated seeds and poor pest control are the most likely causes. This investigation highlights the importance of ensuring that producers take appropriate action to minimise the likelihood of contamination and to comply with legislation and standards for primary production and food safety.

Keywords: *Salmonella* Havana, alfalfa sprouts, outbreak, case-control study, South Australia

Introduction

Salmonellosis is commonly associated with foodborne outbreaks. Outbreaks are often linked to infected produce, animals and contaminated animal feed used in food production.[1] The incubation period for salmonellosis is 6 to 72 hours, usually 12–36 hours. Symptoms may include fever, diarrhoea, loss of appetite, headache, stomach cramps, nausea and vomiting.[1] Salmonellosis may be particularly severe in young children, the elderly and people with immune suppression.[1]

In Australia, *Salmonella* is a nationally notifiable disease and accounted for 33.4% of all foodborne notifications in South Australia (SA) between 2013 and 2017.[2] During June 2018, a notable increase in *Salmonella* Havana (*S.* Havana) notifications was detected through routine surveillance by the Communicable Disease Control Branch (CDCB), South Australian Department for Health and Wellbeing (SA Health). Notifications of *S.* Havana are relatively infrequent in Australia. During the period 2013–2017, three to fourteen *S.* Havana cases were reported annually to CDCB. No previous outbreaks have been attributed to *S.* Havana in Australia.[2] Internationally, only one other outbreak reported in 1998 in the United States of America (USA) linked *S.* Havana to alfalfa sprouts.[3] *S.* Havana has also been previously identified in poultry [4–7] and feedstock.[6,8,9]

This investigation included a description of the outbreak, a retrospective case control study, microbiological investigation, and trace-back that led to the identification of cases and the prevention of further cases.

Method

A descriptive epidemiological investigation and a retrospective case-control study were conducted. This epidemiological investigation was covered by the *South Australian Public Health Act 2011* (the Act) and approval from the Australian National University Human Research Ethics Committee (2017/909). Informed consent was obtained from all participants. A case for the outbreak investigation was defined as laboratory-confirmed infection with *S.* Havana in SA reported to CDCB from 1 June until 31 July 2018.

Epidemiological investigation

In South Australia, reporting of notifiable conditions to the CDCB, by medical practitioners and diagnostic pathology services, is required under the Act. Notifications are monitored by CDCB staff to determine whether further investigations are required.

Interviewing of laboratory-confirmed salmonellosis cases was conducted by trained CDCB staff using the OzFoodNet *Salmonella* Hypothesis Generating Questionnaire (HGQ).[10] The questionnaire collected information on demographics, onset of illness, symptoms, recent travel, environmental exposures, food history, and locations where food was purchased during the seven days prior to illness onset. Information from the hypothesis-generating interviews informed the case-control hypothesis and was used to assist trace-back.

Case-control study

A case-control study was conducted to test the hypothesis that illness was associated with consumption of frequently identified foods from the hypothesis-generating questionnaires.

A case for the case-control study was defined as a laboratory-confirmed case of *S.* Havana in SA reported to CDCB from 1 June until 20 June 2018. A case was eligible for the case-control study if initially interviewed with the HGQ and interviewed with the case-control study questionnaire prior to the media announcement regarding the outbreak on 20 June 2018. Cases not interviewed with the case-control study questionnaire prior to the media announcement were excluded. Controls were recruited using a list randomly generated from the South Australian Monitoring and Surveillance System (SAMSS) survey, a population health survey that monitors trends in health risk factors and chronic disease.[11] The survey is collected monthly from about 600 adults and children using a Computer-Assisted Telephone Interviewing system. Participants must be residents of SA with access to a telephone (including mobile phone). The sampling strategy uses a 'dual overlapping sampling technique applied (mobile phone 70%: landline 30%) through random digit dialling'.[12]

An unmatched control sample was calculated by the Prevention and Population Health Branch of SA Health using the 2018 SAMSS recontacting spreadsheet. Sample size was estimated using the percentage of cases consuming sprouts in the hypothesis-generating study and data from the Victorian Food Frequency study, which estimated the prevalence of eating alfalfa sprouts among healthy community controls. Controls were interviewed by telephone by trained interviewers between 9:30 am and 2:00 pm on 20 June 2018. Controls were excluded if they were not reached prior to the media announcement at 2 pm on 20 June 2018, reported being ill, had returned from interstate or overseas within the last seven days or if another member of the household had an onset of diarrhoea in the two weeks prior to the onset of diarrhoea in the laboratory-confirmed control-case selected for the study. Only one attempt by telephone was made to contact each control.

Statistical analysis

Data obtained from the case-control study questionnaire were entered into a Microsoft Excel® 2016 database before analysis using Stata® version 15. Univariate analysis was conducted on all food exposures, and generated crude odds ratios, *p*-values and 95% confidence intervals

(exact). The statistical significance threshold was 5%. Categorical variables were assessed via chi-squared test (sex) and continuous variables via *t*-test (age).

Trace-back, sampling and environmental investigation

Information from hypothesis-generating interviews informed trace-back, sampling and environmental investigations. Business and retailer records were used to identify common suppliers and product producers. Environmental and product samples were collected during environmental inspections. Retail samples of products were collected in the marketplace. All samples were submitted for microbiological analysis.

Investigations conducted by local government council environmental health officers (EHO) as authorised by the *Food Act 2001* (SA),[13] at a hotel implicated in the outbreak, included inspection of kitchen facilities and observation of food preparation procedures. Details of staff illness, absenteeism, and product suppliers' details were requested. Food samples were collected.

Additional inspections of businesses implicated by cases were carried out by the Food and Controlled Drugs Branch, SA Health (FCDB) and by the Department of Primary Industries and Regions, South Australia (PIRSA) through trace-back of distributors and product producers. Environmental and product samples were collected from the production site at the time of this inspection. Several follow-up inspections of the producer were conducted by FCDB and PIRSA.

Food samples and environmental samples were sent to SA Pathology, SA Health, for microbiological analysis using standardised methods.[14]

Results

Epidemiological Investigation

In total, 31 cases of *S.* Havana were notified to the CDCB from 1 June to 31 July 2018 and linked to the outbreak investigation (Figure 1), comprising 19 females (61%) and 12 males (39%), with an age range of 22–87 years and a median age of 65 years. Cases were from both rural SA (17 cases) and metropolitan Adelaide (14 cases). The most frequently reported symptoms were diarrhoea (97%), lethargy (94%), abdominal pain (81%), nausea (77%), fever (74%), headache (68%), muscle ache (61%) and vomiting (42%). The days unwell ranged from 2 to 23 days with a median of 8. Thirteen (42%) cases were hospitalised.

The hypothesis-generating interviews were conducted between 13 and 19 June 2018 with 17 cases. The interviews identified eight cases with the same hotel (Hotel X) as a common exposure. No meals were common between the eight cases. Foods identified from hypothesis-generating interviews as frequently consumed included carrots, apples, bananas, pasteurised milk, cheese, potatoes, tomatoes, chicken and avocado. Five cases who did not eat at the hotel identified eating alfalfa sprouts purchased from one of the following: a supermarket, bakery, fruit and vegetable store, or health food store.

Environmental investigation

Local government council EHOs inspected Hotel X on 14 June 2018. The EHOs identified alfalfa sprouts were served as a garnish on all hot meals, along with snow pea shoots and mesclun lettuce. Seven food samples were collected, four alfalfa sprouts samples (two from open bags and two from closed bags), one mesclun lettuce leaves sample and two snow pea sprouts samples. Overall, the inspection showed that general compliance with the Australian and New Zealand Food Standards Code[15] was satisfactory. One staff member, a food handler, was identified as being unwell; however, it was unclear if the food handler had worked while ill. No stool sample was obtained for this person. Hotel X used alfalfa sprouts supplied by a local distributer who sourced the alfalfa sprouts from one local sprouts producer (producer A). Trace-back of alfalfa sprouts implicated by cases not linked to Hotel X were also conducted with a supermarket, bakery, fruit and vegetable store,

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Figure 1. Epidemiological curve of S. Havana notifications in South Australia by date of onset, 29 May – 23 June 2018

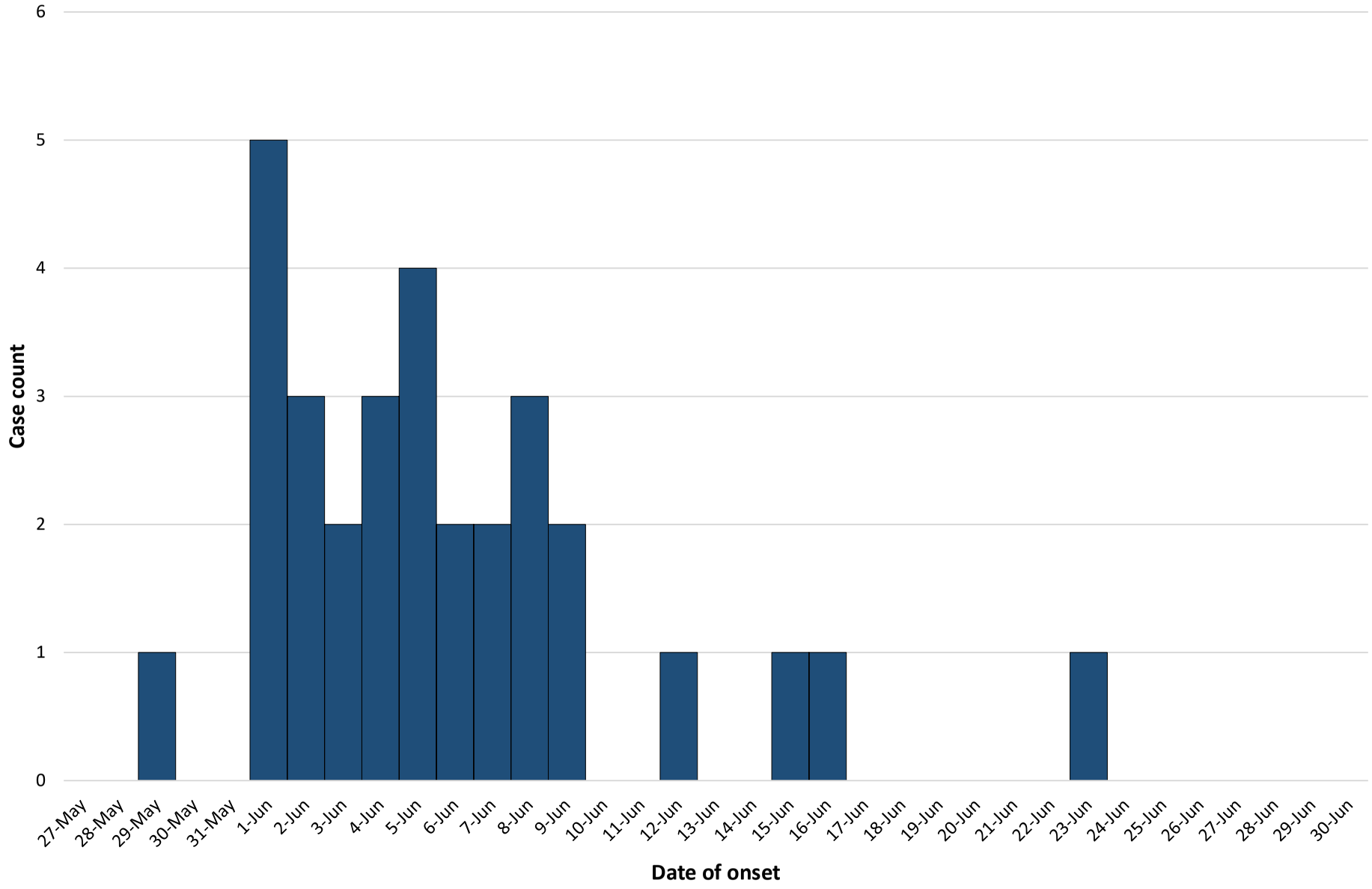

Table 1. *S.* Havana outbreak – relative risks for food exposures, South Australia, 1–20 June 2018

	Cases (n=18)		Control (n=54)		Univariate analysis		
Exposure	**Exposed**	**%**	**Exposed**	**%**	**Crude OR[a]**	**95% CI[b]**	***p*-value**
Alfalfa sprouts	**6**	**33.33**	**1**	**1.85**	**26.00**	**2.62–1217.60**	**<0.001**
Black pepper	6	33.33	38	70.37	0.21	0.06–0.75	0.02
Cauliflower	8	44.44	20	37.04	2.67	0.79–9.44	0.07
Capsicum	5	27.78	27	50.00	0.42	0.10–1.51	0.14
Eggs	12	66.67	46	85.19	0.42	0.10–1.95	0.18
Avocado	9	50.00	19	35.19	1.84	0.54–6.21	0.26
Lettuce	11	61.11	27	50.00	1.83	0.52–6.90	0.29
Raw tomato	9	50.00	36	66.67	0.56	0.16–2.00	0.31
Broccoli	10	55.56	36	66.67	0.59	0.17–2.07	0.34
Fresh garlic	4	22.22	16	29.63	0.68	0.14–2.64	0.54
Chicken	7	38.89	27	50.00	0.78	0.21–2.75	0.66
Yoghurt	9	50.00	24	44.44	1.25	0.37–4.18	0.68
Snow pea shoot	1	5.56	2	3.70	1.53	0.02–30.92	0.73
Pumpkin	10	55.56	34	62.96	0.84	0.24–3.05	0.76
Cucumbers	7	38.89	20	37.04	1.08	0.30–3.66	0.89
Raw onions	6	33.33	20	37.04	0.93	0.24–3.26	0.90
Almonds	8	44.44	24	44.44	1.00	0.29–3.32	1.00

a OR, odds ratio
b CI, confidence interval

and health food store. Trace-back identified that alfalfa sprouts were all from the one sprouts producer (producer A).

Random retail sampling occurred on 18 June 2018 and 146 samples of alfalfa and other sprout products were collected. Two South Australian alfalfa producers provided product to the SA marketplace. To ensure a thorough and open investigation both producers were investigated (producer A, producer B). The Food and Controlled Drugs Branch and PIRSA undertook joint environmental investigations at both South Australian alfalfa producers on 19 June 2018. Significant food safety issues at one producer (producer A) included vermin control: an inspection identified vermin faeces underneath pallets in the bulk storage area storing seeds. Fifty-one samples were collected along the production line from producer A: 42 were food and seed samples including a variety of alfalfa and snow pea sprouts, and nine were environment samples including vermin faeces. At producer B, 117 samples were collected from a mix of different sprout products.

Of the seven food samples collected by local council EHOs at Hotel X on 14 June 2018, three alfalfa sprouts samples returned positive results for *S.* Havana on 20 June 2018. Of the random retail samples collected, five returned positive results for *S.* Havana and were from the same sprout producer (producer A). Eleven positive results were returned on sprout product samples collected from producer A, with six *S.* Havana and five *S.* Oranienburg. While *S.* Oranienburg was identified from samples collected from the sprouts producer, no cases of *S.* Oranienburg had been notified in SA since April 2018. No positive results were identified from producer B.

Case-control study

Eighteen cases were identified and included in the case-control study. Cases included seven males (39%) and 11 females (61%), with an age range 22–87 years and a median age of 69 years. Of the 268 potential controls contacted, 54 unmatched controls were eligible to be enrolled into the study. Exclusion of controls was due to individuals being non-contactable (96%), reportedly ill (3%) or reportedly having travelled recently (1%). Controls included 19 males (30%) and 35 females (70%), with an age range 21–94 years and a median age of 71 years. There was no statistically significant difference between cases and controls in age (test $t = 1.70$, p-value = 0.10), nor in sex ($chi^2(1) = 0.53$, p-value = 0.47).

Table 1 shows the results for the univariate epidemiological analysis. Increased risk of illness was shown for alfalfa sprouts (odds ratio 26.0, 95% CI 2.62–1217.60, p-value <0.001). Multivariate analysis was not conducted as only one food exposure, alfalfa sprouts, was statistically significant (p-value <0.05) and had a crude odds ratio greater than 2.0 with the 95% confidence interval not crossing unity.

Public Health Action

Based on epidemiology, laboratory results and trace-back, an emergency order under the *Food Act 2001* (SA) was served on producer A to cease distributing products, which were only distributed within SA, and a consumer level recall of all alfalfa products from the supply chain was issued on 21 June 2018. A media release and public health alert to warn South Australians not to eat alfalfa sprout products from producer A was issued on 20 June 2018.

PIRSA returned to producer A to evaluate the effectiveness of the food recall and conduct a more intensive overview of the facility and processes on 22 June 2018. No breakdown in the production process was identified; however, there were several structural deficiencies identified. Producer A was advised to rectify issues around vermin entry points and remove any equipment that could not be easily cleaned and sanitised, and to review their food safety programme to ensure it adequately addressed critical control points as required under the Food Standards Code (FSC) – Production and Processing Standard for Seed Sprouts (4.2.6). The producer committed to cease the production of all sprout products and to rectify issues identified.

Food and Controlled Drugs Branch returned to producer A on 29 June 2018 to witness the secure destruction of the recalled product.

Discussion

Consumption of alfalfa sprouts linked to one sprouts producer showed a significant association with illness, an odds ratio of 26.0 (95% CI 2.62–1217.60, *p*-value <0.001). The findings and observations from the environmental investigation and laboratory results, which included positive results for *S.* Havana from three samples collected from Hotel X, five samples from random retail samples and six from samples collected from sprout producer A, provided further support to the epidemiological evidence. This was a significant achievement given that the case-control study was conducted in one day. This outbreak was the largest identified *S.* Havana outbreak in Australia to date. In total, 31 cases of *S.* Havana were reported and linked to the outbreak.

Alfalfa sprouts are considered a high-risk product due to the risk of microbial contamination inherent in sprout seeds and production:[16] sprouts require warm and humid conditions to grow, which is also ideal for bacterial pathogens.[17] It is unclear as to when in the production of alfalfa sprouts the contamination occurred. However, contaminated seeds are the most likely cause given their high risk. Alfalfa sprouts are usually consumed raw which increases the risk of human infection. Alfalfa sprouts[18–24] and other sprouts[23, 25–27] have been linked to other *Salmonella* outbreaks internationally. Only one other outbreak was identified in the literature, in 1998 in the USA, which linked *S.* Havana to alfalfa sprouts.[3] This particular outbreak involved 18 cases from California and Arizona and identified contaminated seed as the likely source.

With 13 (44%) cases hospitalised, the hospitalisation rate in this outbreak was high, in comparison to the normal hospitalisation rate for salmonellosis of 21% in 2018 for SA.[28] This suggests that either there might have been a high dose of contamination on the alfalfa sprouts or the outbreak strain might be more pathogenic than other *Salmonella* strains, thus leading to a higher burden of disease for this specific strain.

To minimise future outbreaks linked to alfalfa sprouts and other sprouts, it is suggested that sprouts producers take appropriate action to minimise the likelihood of contaminated product, including using a decontamination step to minimise the bacterial load on sprout seeds and in the sprouting process and ensuring they comply with legislation and standards for primary production and food safety. In South Australia, all sprouts producers are required to hold accreditation under the *Primary Produce (Food Safety Schemes) Act 2004* and the Primary Produce (Food Safety Schemes) (Plant Products) Regulations 2010; comply with Food Standards Code – Production and Processing Standard for Seed Sprouts (4.2.6); and have an approved food safety arrangement.

There are several limitations to our outbreak investigation. Firstly, recall by individuals of foods eaten is always a concern in a retrospective case-control study, as asking someone to recall what they ate before becoming ill can be a challenge particularly if it has been several days in between. Also, the HGQ asks about what food did you eat, requesting a person to recall the food they consumed, whereas the case-control study questionnaire is framed as 'did you eat…', which is more likely to prompt a person's memory. This might help explain why those who ate at Hotel X did not recall being served alfalfa sprouts on their meal as a garnish when asked about at it during the HGQ. However, one case who ate at Hotel X recalled eating alfalfa sprouts when asked using the case-control study questionnaire. Secondly, controls were not matched, however statistically there was no difference between the cases and controls for age or sex. Thirdly, univariant analysis identified alfalfa sprouts were the most likely cause with statistically significant odds ratio, *p*-value and confidence interval. However, the confidence interval is wide (2.62–1217.60), which is related to the small sample size.

Conclusion

This outbreak of *S.* Havana in SA was caused by consumption of alfalfa sprouts from one local sprouts producer. Alfalfa sprouts are considered a high-risk product due to risk of microbial contamination in sprout seeds, and production occurring in an environment which is ideal for growth of bacterial pathogens. In this outbreak it is unclear as to when in the production of alfalfa sprouts the contamination occurred. However, contaminated seeds and poor pest control are the most likely causes. This investigation highlights the importance of ensuring that producers comply with legislation and standards for primary production and food safety and that equipment is adequately maintained to minimise the likelihood of contamination.

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Appendix 5.C

Media release – Salmonella cases linked to alfalfa sprouts

Media Release

SA Health

Wednesday, 20 June 2018

SALMONELLA CASES LINKED TO ALFALFA SPROUTS

South Australians are being warned not to eat alfalfa sprout products produced by Adelaide business SA Sprouts, after several people became ill with Salmonella havana.

SA Health's Chief Medical Officer and Chief Public Health Officer, Professor Paddy Phillips, said there had been 21 recent confirmed cases of Salmonella havana, including seven people who were hospitalised.

"We are advising anyone who has purchased the recalled SA Sprouts alfalfa sprouts products to return them to the place of purchase for a refund, or throw them away," Professor Phillips said.

"We also want to alert cafes and restaurants to check their suppliers and not serve any SA Sprouts alfalfa sprout products until further notice.

"In cases of salmonella a common food source is not often identified, however a joint investigation between SA Health, local government and Primary Industries and Resources SA (PIRSA) has linked these cases to SA Sprouts alfalfa sprouts.

"We are working closely with the producer and suppliers while we continue to investigate."

SA Sprouts products are sold at Drakes Foodland, IGA and numerous greengrocers.

Products included in the recall are alfalfa (125g and 200g tubs, 1kg bags), green alfalfa (125g tubs), alfalfa and radish (125g tubs), alfalfa and onion (125g tubs), alfalfa and mustard (125g tubs), alfalfa and Chinese cabbage (125g tubs), alfalfa and garlic (125g tubs), salad mix (175g tubs) and gourmet sprouts (100g trio pack with alfalfa, snow pea, small sprouted bean).

People can experience symptoms of salmonella infection between six and 72 hours after exposure and symptoms usually last for three to seven days.

Symptoms include fever, diarrhoea, vomiting, headaches, stomach cramps and loss of appetite.

Anyone who develops these symptoms and is concerned should see their doctor, particularly young children, older people, pregnant women and people who are immunocompromised because they are at risk of more severe illness.

There have been 751 cases of salmonella infection (all types) reported to SA Health this year, compared to 829 at the same time last year and a total of 1432 for 2017.

For more information, visit www.sahealth.sa.gov.au/foodsafety.

For more information

Call the SA Health Media Line
Telephone: 08 8226 6488

www.twitter.com/sahealth www.youtube.com/sahealthaustralia

Government of South Australia
SA Health

Appendix 5.D

Photos – Chief Public Health Officer media announcement 20 June 2018

Chapter 6: Teaching in the Master of Philosophy in Applied Epidemiology

Contents

Tables of figures

Abbreviations and acronyms

HREC	Human Research Ethics Committee
MAE	Master of Philosophy in Applied Epidemiology
SOCO	Single Overarching Communication Outcome

6.1. Prologue

As core competencies of the Master of Philosophy in Applied Epidemiology (MAE) we were asked to facilitate two teaching sessions, a teaching session to first year MAE scholars and to provide a 'Lessons from the Field' to our fellow scholars. Each teaching session provides an opportunity to share knowledge and skills that we have acquired or developed throughout our own MAE experience.

6.1.1. My roles and lessons learnt

The teaching session to first year MAE scholars was a group lesson with two other scholars, Anthea Katelaris and Mario Vittorino. The teaching session aimed to facilitate a basic understanding of a Single Overarching Communication Outcome in relation to the communication of a public health message. My role in the development and delivery of the teaching session was equally shared between myself and the other two members of the group. From the exercise, I learnt that the best way to teach is to be clear about the learning objectives, concise with the information provided, provide an example and a task for people to apply and assess their new knowledge. It is also important to ensure that the lesson is interesting, fun and interactive so people are engaged, and I think we achieved that.

For my 'Lessons from the Field' I choose to share my knowledge on conducting research with Aboriginal and Torres Strait Islander communities. I have been involved in conducting research with Aboriginal and Torres Strait Islander people and communities for over five years and during that time have learnt a significant amount. Importantly, I have learnt about how to conduct research with Aboriginal and Torres Strait Islander communities the 'right way'. These learnings make for valuable lessons for others, applicable not only to research with Aboriginal and Torres Strait Islander communities, but with other disadvantaged and diverse populations.

6.2. Teaching first years MAE scholars

A presentation of our lesson was provided to first year MAE scholars (Appendix 6.A), it covered a lesson outline, learning objectives, what is a Single Overarching Communication Outcome (SOCO), components of a SOCO, SOCO example, SOCO template, when to use it and SOCO task and assessment.

6.2.1. Learning objectives

- Describe what a is SOCO
- When it can be used
- Practice developing a SOCO.

6.2.2. Task and assessment

First year students were grouped into six small groups and were asked to develop a SOCO based on one of three scenarios provided to them: salmonella, measles or mosquitoes (Appendix 6.B). Each group was provided a SOCO Worksheet (Appendix 6.C) to assist with developing a SOCO. Each group presented their SOCO back to the class and fellow students were asked to provide feedback on each group's presentation. In addition, one member from each group was selected to communicate their SOCO in a media interview style scenario.

See scenarios (Appendix 6.B) and SOCO Worksheet (Appendix 6.C) for further detail about the small group work.

6.2.3. Evaluation

Our teaching session was evaluated at the end of the session. Most of the first year MAE scholars rated the objective and purpose of the session, presenters' style, pace of session, content and likely future use of SOCOs highly (Figure 6.1, Figure 6.2, Figure 6.3, Figure 6.4 and Figure 6.5).

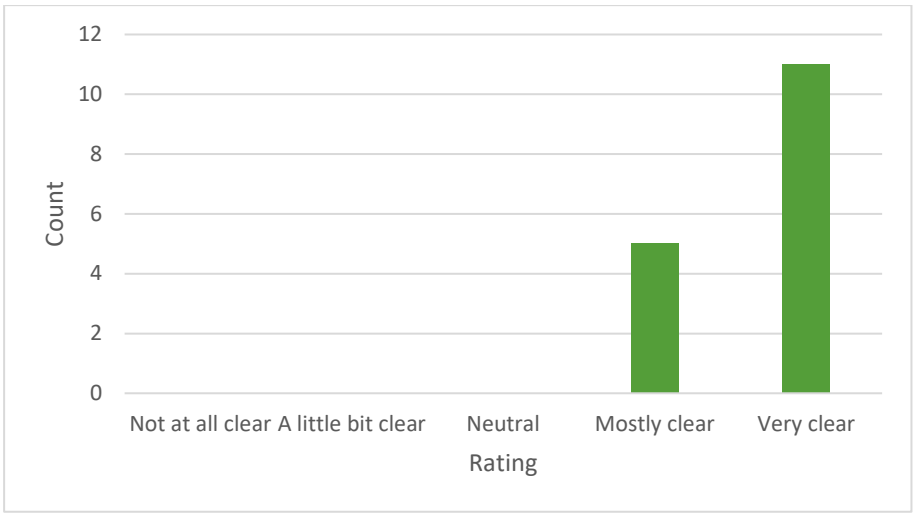

FIGURE 6.1: FIRST YEAR MAE SCHOLARS RESPONSE TO, WERE THE OBJECTIVES AND PURPOSE OF THE SESSION CLEAR TO YOU?

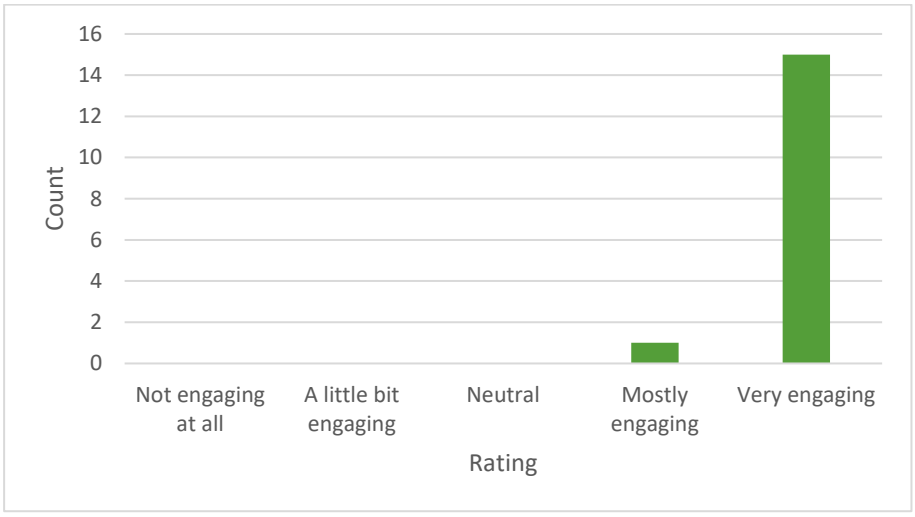

FIGURE 6.2: FIRST YEAR MAE SCHOLARS RESPONSE TO, WAS THE PRESENTATION STYLE ENGAGING?

FIGURE 6.3: FIRST YEAR MAE SCHOLARS RESPONSE TO, HOW DID YOU FIND THE PACE OF THE SESSION?

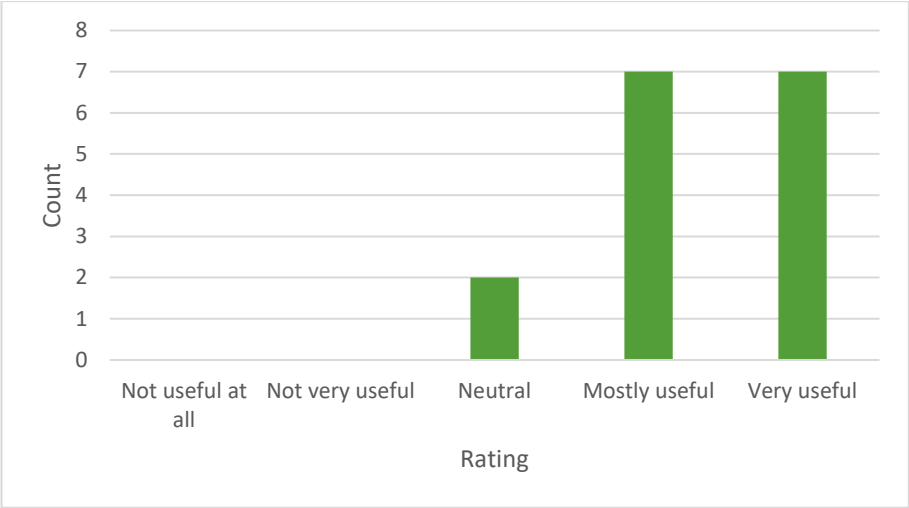

FIGURE 6.4: FIRST YEAR MAE SCHOLARS RESPONSE TO, HOW USEFUL WAS THE CONTENT?

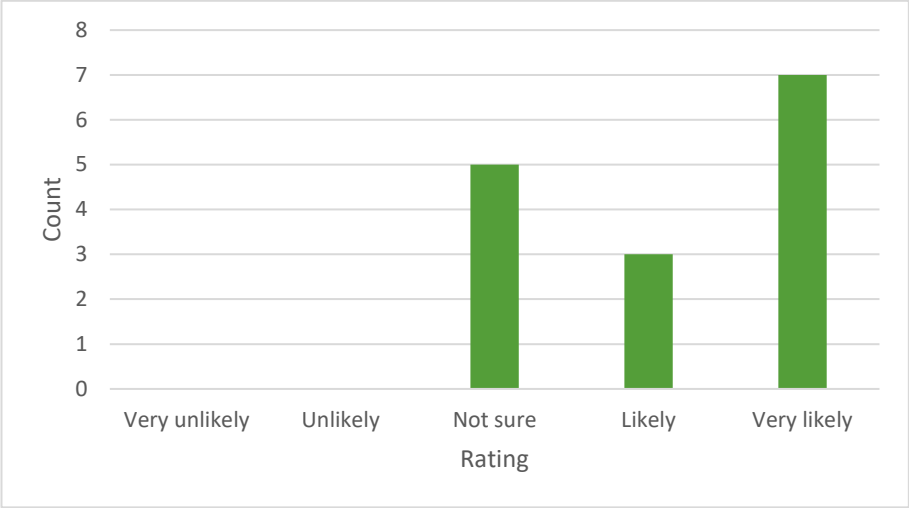

FIGURE 6.5: FIRST YEAR MAE SCHOLARS RESPONSE TO, HOW LIKELY ARE YOU TO USE SOCOS IN THE FUTURE?

Finally, first years were asked, 'What was good, what could be improved, and is there anything else you would like to tell us?' Comments included:

Engaging and fun. Good to get to the point and learn to be prepared with a message you want to get across. Interactive.

Group exercise was useful. Interview were fun.

Interactive. Makes you realise how hard it is.

Really enjoyed the interview part, quite funny and makes you put what you've just learnt into immediate action.

Overall, the teaching session was interesting, fun and interactive. It seemed that all students were participating and were engaged in the session.

6.3. Lessons from the field

6.3.1. Topic

The topic for my lesson from the field was 'Conducting research with Aboriginal and Torres Strait Islander communities'.

6.3.2. Learning objectives

- To understand the history of research with Aboriginal and Torres strait Islander peoples and communities
- To understand the principles and values of conducting research with Aboriginal and Torres Strait Islander communities
- To engage in discussions about appropriate research conduct with Aboriginal and Torres Strait Islander peoples and communities

6.3.3. Required readings

The group were asked to read the following documents, which provide some insight into conducting research with Aboriginal and Torres Strait Islander peoples and communities.

- Chapter 1: setting the scene for research – Researching Indigenous Health: A practical guide for researchers (pages 3-15)
- NHMRC Ethical conduct in research with Aboriginal and Torres Strait Islander Peoples and communities: Guidelines for researchers and stakeholders
- The Blackfulla Test: 11 reasons that Indigenous health research grant/publication should be rejected

6.3.4. Exercise

After completing the required readings, the group were asked to:

- One week prior to the lesson, provide a half page reflection on their interpretation of the principles and values of Aboriginal and Torres Strait Islander research; and
- Consider the following in preparation for a group discussion
    - History and its impact on Aboriginal and Torres Strait Islander research
    - Knowledge and culture informing research practices

- Principles and values of Aboriginal and Torres Strait Islander research
- Facilitators and barriers to conducting research with Aboriginal and Torres Strait Islander peoples and communities
- The implications of not considering Aboriginal and Torres Strait Islander principles and values when conducting research with Aboriginal and Torres Strait Islander peoples and communities.

6.3.5. Overview

A brief introduction to the topic was provided.

6.3.5.1. History

Aboriginal and Torres Strait Islander communities have had an interesting history with research practices in Australia. Early research in Australia included negative race-based research practices, which sought to prove that Aboriginal people were mentally and physically inferior human beings compared to Europeans (1). This history has been 'ingrained in the psyches of successive generations of Aboriginal and Torres Strait Islander peoples and more recent examples of poor research practices have contributed to the degrees of distrust that developed towards researchers and research institutions' (1 p4).

Increasingly, Aboriginal and Torres Strait Islander community leaders and organisations have called for research 'on' Aboriginal and Torres Strait Islander peoples to end. Since then, there has been the development of ethics principles and guidelines to improve ethical frameworks for research that consider and include Aboriginal and Torres Strait Islander peoples.(1) Much of this work has included Aboriginal and Torres Strait Islander ways of knowing and being or worldview, encompassing cultural values and principles. The aim has been to improve research practices but also to increase research done in partnership with Aboriginal and/or Torres Strait Islander researchers and community members. This emphasises the need for researchers to work with Aboriginal and Torres Strait Islander communities to identify appropriate research questions, to design and conduct studies that have a strength base approach, to disseminate findings, and to translate findings into practice and policy. There is a strong desire from Aboriginal and Torres Strait Islander communities and organisations for all researchers to adhere to these guidelines.

6.3.5.2. Ethics principles and guidelines

The current version of the *National Statement on Ethical Conduct in Human Research* (the National Statement) is the result of over half a century of ethical review of human research

in Australia (2). Prior to this, there was no national standard for ethical conduct for research involving humans.

The National Statement aims to promote ethically good human research by ensuring participants are respected and protected, and research is of benefit to the community (3). The National Statement clarifies the responsibilities of:

- institutions and researchers for the ethical design, conduct and dissemination of results of human research; and
- review bodies in the ethical review of research.

The National Statement is intended for use by:

- any researcher conducting research with human participants;
- any member of an ethical review body reviewing that research;
- those involved in research governance; and
- potential research participants.

The National Statement provides the foundations for which other guidelines and statements are based on, such as:

- Ethical conduct in research with Aboriginal and Torres Strait Islander Peoples and communities: Guidelines for researchers and stakeholders 2018
- Keeping research on track II 2018
- South Australian Aboriginal Health Research Accord

6.3.5.3. Human Research Ethics Committees

Human Research Ethics Committees (HREC) have an important role in ensuring researchers conducting research with humans are conducting research in line with the National Statement and adhere to ethical standards and guidelines. There are over 200 HRECs in organisations across Australia and anyone intending on conducting research should apply to their institutions HREC (4).

6.3.5.4. Aboriginal Human Research Ethics Committees

Research involving Aboriginal and/or Torres Strait Islander peoples and communities will need to have approval by an Aboriginal HREC as well as another HREC. Often approval by an Aboriginal HREC is required prior to applying for approval from a non-Indigenous organisations HREC. This ensures the research meets local principles and values, as well as those outlines in the *Ethical conduct in research with Aboriginal and Torres Strait Islander*

Peoples and communities. In addition, Aboriginal HREC will ask researchers to demonstrate: how the researchers and research have and will consult and engage with Aboriginal organisations; how the research will benefit participants and communities and build research capacity within their community; and how the research aligns with the 6 values identified in the *Ethical conduct in research with Aboriginal and Torres Strait Islander Peoples and communities*.

6.3.5.5. Additional readings

- NHMRC Website – Ethical guidelines for research with Aboriginal and Torres Strait Islander Peoples
- Lowitja Institute Ethics Hub
- Guidelines for ethical research in Australian Indigenous studies
- ANU – Ethics & integrity, Key ethical concerns

6.3.5.6. References

1. Australian Institute of Aboriginal and Torres Strait Islander Studies. Researching right way: Aboriginal and Torres Strait Islander health research ethics – A domestic and international review. Canberra, Australia: AIATSIS; 2013.
2. National Health and Medical Research Council. National Statement on Ethical Conduct in Human Research Canberra, Australia: NHMRC; [Available from: https://www.nhmrc.gov.au/research-policy/ethics/national-statement-ethical-conduct-human-research.
3. National Health and Medical Research Council. National Statement on Ethical Conduct in Human Research 2007 (Updated 2018). Canberra, Australia: The National Health and Medical Research Council, The Australian Research Council, Universities Australia; 2018.
4. National Health and Medical Research Council. Human Research Ethics Committees Canberra, Australia: NHMRC; [Available from: https://www.nhmrc.gov.au/research-policy/ethics/human-research-ethics-committees.

6.3.6. Lessons from the field session

The lessons from the field session was conducted during a one-hour Zoom webinar. It provided an opportunity to discuss with the group their further reflections on the readings. Following on from this I facilitated a conversation on the following:

- History and its impact on Aboriginal and Torres Strait Islander research
- Knowledge and culture informing research practices
- Principles and values of Aboriginal and Torres Strait Islander research
- Facilitators and barriers to conducting research with Aboriginal and Torres Strait Islander peoples and communities

- The implications of not considering Aboriginal and Torres Strait Islander principles and values when conducting research with Aboriginal and Torres Strait Islander peoples and communities.

From the discussions, it was evident that the group had developed an understanding of the principles and values of Aboriginal and Torres Strait Islander research. In addition, understood how previous research practices involving Aboriginal and Torre Strait Islander peoples has shaped current research practices involving the Aboriginal and Torre Strait Islander community; how Indigenous knowledge and values inform current research practices; learnt what the facilitators and barriers are to conducting appropriate research with Aboriginal and Torres Strait Islander community; and what the implications are for not considering Aboriginal and Torres Strait Islander principles and values principles and values when conducting research with Aboriginal and Torres Strait Islander community.

Overall, the session was well received. I felt comfortable with the delivery of the lesson and that the amount of content was sufficient to meet the learning objectives and clearly they were met. I also felt that group were engaged in the session and informal feedback from them was positive.

Appendix 6.A

SOCOs

Stephen Harfield
Anthea Katelaris
Mario Vittorino

1

Lesson outline

1. **What is a SOCO (10mins)**
   - When would you use a SOCO
   - SOCO examples
2. **Students develop a SOCO (10 mins)**
3. **Students report back on their SOCO (10 mins)**
   - Wrap up and evaluation

2

Learning objectives

Students are able to:

- Describe what a is SOCO
- When it can be used.
- Practice developing a SOCO

3

What is this "SOCO"?

- Google it!
  "Scenes of Crime Officer?"
- Wikipedia:

4

What is SOCO?

Single Overarching Communication Outcome

- Outcome (or objective) or change you want to see as a result of communicating the SOCO.
- It is NOT your message.
  - (But closely informs your key message)

5

Scientists and experts speak like this!

Main message

6

Tip 2: Get to the point!

Main message

7

Components of a SOCO

Answer four questions before a communication process:

1. What is your issue?
2. Why do you want to focus on this issue and why now?
3. Who needs to change behaviour (target audience)?
4. What is the change that you want to see in your audience as a result of your communications (THIS IS YOUR SOCO)

8

SOCO example

- https://www.facebook.com/WesternSydneyHealth/videos/news-western-sydney-local-health-districts-dr-shopna-bag-was-interviewed-by-nine/1661260774143169/

9

Components of a SOCO

Answer four questions before a communication process:

1. What is your issue?
2. Why do you want to focus on this issue and why now?
3. Who needs to change behaviour (target audience)?
4. What is the change that you want to see in your audience as a result of your communications (THIS IS YOUR SOCO)

10

Template

SOCO

- What is the objective or outcome you want to achieve?

Key message

- Include in 1 sentence (or 2) the key message.

Supporting statements

- This should include three to four supporting statements.

Background

- Background information and data that would be useful to know but not necessarily say to the media.

11

When to use?

- All media!
  - Well suited to radio/TV grabs
  - To structure media releases
    - Public health alerts
    - Media on your research
- Elevator pitch/briefings

12

Let's do it!

- Developing a SOCO Group activity
  - Salmonella
  - Measles
  - Mosquitoes

13

Your turn

Single Overriding Communications Objective (SOCO) Worksheet

Topic / incident
Target audience Who is the main audience or population segment you would like this message to reach?
SOCO What is the objective or outcome you want to achieve?
Key message 1(to 2) sentences. This should be the message that if they quote nothing else, you would want them to play.
Supporting statements This should include three to four supporting statements (key facts). These are not they key messages but supporting additional statements that contain useful additional information.
Background This section should include background information and data that would be useful to know but not necessarily say to the media. It might include context regarding frequency of events or responses that have already been undertaken.

14

Learning objectives

Students are able to:

- Describe what a is SOCO
- When it can be used.
- Practice developing a SOCO

15

Appendix 6.B
Scenario 1

Easter mosquito messaging SOCO

Key message

- At this time of year, especially with wetter than normal summer, it is important people avoid being bitten by mosquitoes to prevent diseases like Ross River virus.

Supporting messages

- Apply mosquito repellent regularly, the most effective repellents have DEET or Picaridin
- Cover up with light coloured clothing as much as possible
- When camping make sure your tent is well protected with fly screens or sleep under mosquito nets

Supporting information if asked

- Ross River Virus symptoms include fever, rash, and joint pains.
- Murray Valley Encephalitis infections cause no symptoms in most people but in some can cause a severe headache, neck stiffness, sensitivity to light and drowsiness.
- Kunjin virus causes no symptoms in most people but in some can cause fever, enlarge lymph nodes, rash, and painful joints.

Ross River notifications in NSW

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2013	38	46	34	57	101	49	36	23	27	36	30	30	507
2014	33	35	44	72	85	57	38	50	46	67	59	90	676
2015	117	305	431	264	102	50	54	60	53	61	69	54	1,620
2016	43	60	78	81	66	25	14	15	21	19	46	228	696
2017	429	274	200	142	174	89	29	40	53	56	36	12	1,534

NSW GOVERNMENT Health

Communicable Diseases Factsheet

Mosquitoes are a health hazard

Mosquitoes aren't just a nuisance – they can transmit serious diseases. To protect against mosquitoes and reduce the risk of diseases they transmit: cover-up with a loose-fitting long sleeved shirts and long pants when outside; apply mosquito repellent to exposed skin; take special care during peak mosquito biting hours, especially around dawn and dusk; remove potential mosquito breeding sites from around the home, and; screen windows and doors. Take extra precautions when travelling overseas in areas with a high risk of serious mosquito-borne diseases.

Last updated: 17 January 2017

Avoid mosquito bites

Mosquitoes can transmit a number of serious human diseases. In NSW, some types of mosquitoes can transmit viruses such as Ross River and Barmah Forest and, rarely, the virus that causes Murray Valley encephalitis. Some parts of northern Queensland have a type of mosquito that can transmit dengue fever, chikungunya and Zika infections.

Overseas travellers may be at risk of mosquito-borne diseases such as malaria, dengue, yellow fever, chikungunya or Zika. While vaccines are available for some diseases (e.g. yellow fever and Japanese encephalitis) and chemoprophylaxis medicine can help prevent malaria, all travellers should also use repellents and other general protective measures to avoid mosquito bites.

Wear appropriate clothing

Minimising the amount of exposed skin reduces the risk of mosquito bites. Wear loose, light-coloured clothing with long sleeves and pants. Also wear socks and shoes where possible.

Some mosquitoes will bite through clothing. Consider using clothing pre-treated with insecticides. Remember that repellent must still be applied to exposed skin.

Apply mosquito repellent to exposed skin

Use a mosquito repellent on all exposed skin areas. Reapply the repellent according to instructions or when you notice mosquitoes biting.

Avoid putting repellent near the eyes and mouth, or over open wounds, broken skin or abrasions. Always follow the product label instructions.

The most effective mosquito repellents contain Diethyl Toluamide (DEET) or Picaridin. Repellents containing oil of lemon eucalyptus (OLE) (also known as Extract of Lemon Eucalyptus) or para menthane diol (PMD) also provide adequate protection.

The strength of a repellent determines the the duration of protection with the higher concentrations providing longer periods of protection. Always check the label for reapplication times.

Botanical-based products (such as Eucalyptus or Citronella) provide only limited protection and require frequent reapplication.

Use just enough repellent to cover exposed skin. After returning indoors, rinse off repellent with soap and water

Mosquito repellent needs to be reapplied after swimming. The duration of protection from repellent is also reduced with perspiration, such as during strenuous activity or hot weather so it may need to be reapplied more frequently.

If you're using sunscreen (and you should), apply the sunscreen first and then apply the repellent. Be aware that DEET-containing repellents may decrease the sun protection factor (SPF) of sunscreens so you may need to re-apply the sunscreen more frequently.

And for children - most skin repellents are safe for use on children aged 3 months and older when used according to directions, although some formulations are only recommended for children aged 12 months and older - always check the product label for recommended age use. Never allow young

children to apply their own repellent. Infants aged less than 3 months can be protected from mosquitoes by using an infant carrier draped with mosquito netting that is secured along the edges.

Protection during pregnancy - registered mosquito repellents used according to product label instructions are considered safe for use during pregnancy and while breast-feeding.

Use appropriate insecticides

Aerosol insecticide sprays, mosquito coils (used outdoors) and vapourising mats (used indoors) can help to clear rooms or areas of mosquitoes or repel mosquitoes from an area. These products should be used in addition to, not in place of, other measures such as appropriate clothing and skin repellents.

New personal (e.g. clip-on) spatial repellent products containing active ingredients such as metofluthrin are likely to augment the effect of other measures but most have yet to be fully evaluated.

Devices that use light to attract and electrocute insects have not been proven to be effective in reducing mosquito numbers and often kill more harmless insects.

Be aware of the peak risk times for mosquito bites

Take extra care during peak mosquito biting hours to reduce the risk of infection. Avoid the outdoors or take preventive actions (such as appropriate clothing and skin repellent). In NSW, most mosquitoes become active at dawn and dusk, and into the evening.

When travelling overseas it is important to be aware of the biting patterns of the local mosquitoes which transmit diseases. For example:

- The mosquitoes that transmit diseases such as dengue, chikungunya, Zika will bite all through the day.
- The mosquitoes that transmit malaria are most active at dawn and dusk, and into the evening.

Reduce mosquito risk around the home

Stop adult mosquitoes entering the home by using flyscreens on windows and doors, and screening chimneys, vents and other entrances. Repair any damaged screens.

Consider also using a surface insecticide spray in areas where mosquitoes like to rest. During the day, mosquitoes rest and hide in cool shady areas such as in and around the home before emerging at dusk to feed. Make sure you avoid aquaria and fish ponds as fish are acutely sensitive to these insecticides.

Mosquitoes need water to breed and some mosquitoes can breed in very small amounts of water, such as in the water that collects in a discarded soft-drink can. Measures to reduce the risk of mosquitoes breeding in around the home include:

- cleaning up your backyard and removing all water-holding rubbish, including tires and containers
- keeping your lawns mowed
- flushing and wiping out bird baths and water features once a week.
- filling pot plant bases with sand to avoid standing water
- storing anything that can hold water undercover or in a dry place, and keeping bins covered
- flushing out the leaves of water-holding plants such as bromeliads once a week
- keeping drains and roof guttering clear to avoid standing water
- covering or securely screening the openings of septic tanks and rainwater tanks.

Properly cleaned and chlorinated swimming pools are rarely a source of mosquito breeding but neglected pools can be a haven for mosquitoes.

Reduce mosquito risk around the farm

If you live on a farm, additional precautions are needed to reduce opportunities for mosquitoes to breed. These include:

- keeping dams and ground pools free of vegetation
- checking dam walls and irrigation bays for water leaks
- being careful not to over-irrigate to avoid water collecting in low-lying areas for long periods of time
- not allowing irrigation water to flow into and lie undisturbed in roadside table drains.

Reduce mosquito risk while travelling

In addition to the general protection measures above, travellers should also:

- stay and sleep in screened or air-conditioned rooms
- use a bed net if the area where you are sleeping is exposed to the outdoors. Nets are most effective when they are treated with a pyrethroid insecticide, such as permethrin. Pre-treated bed nets can be purchased before travelling, or nets can be treated after purchase.
- avoid known areas of high mosquito-borne disease transmission or outbreaks. This is particularly important for people at higher risk of complications from mosquito-borne diseases, such as pregnant women if exposed to Zika or malaria.

See the Staying healthy when travelling overseas factsheet [1] for further information on travel. The Smartraveller website [2] also has health information for specific destinations.

For further information please call your local public health unit on **1300 066 055** or visit the NSW Health website at www.health.nsw.gov.au .

[1] Staying healthy when travelling overseas factsheet:
http://www.health.nsw.gov.au/Infectious/factsheets/Pages/staying-healthy-when-travelling-overseas.aspx
[2] Smartraveller website: http://smartraveller.gov.au/

Questions and Answers about mosquito bite avoidance

NSW GOVERNMENT Health

Mosquito borne diseases can cause serious illness. In Australia, arboviruses such as Ross River, Barmah Forest, dengue and Murray Valley Encephalitis and Kunjin/West Nile are known to cause human disease. The best way to prevent these diseases is by protecting yourself and your family from mosquito bites.

How to avoid mosquito bites?

- Cover up as much as possible (light-coloured, loose-fitting clothing and covered footwear).
- Use mosquito repellents
- Use mosquito netting for children's cribs, prams and strollers
- Prevent mosquito breeding around the home

How to choose and use mosquito repellent?

Choosing a Repellent:

- Repellents containing DEET or Picaridin are most effective.
- Repellents containing oil of lemon eucalyptus (OLE) or Para Menthane Diol (PMD) also provide adequate protection.
- Higher concentrations provide longer protection.
- Natural repellents such as citronella and eucalyptus provide very limited protection from mosquitoes.

Using a Repellent:

- Always follow the directions on the product label.
- Apply a thin layer evenly to the exposed skin.
- Duration of protection depends on concentration. Follow reapplication times suggested on the product label.
- Reapply repellent after intense exercise, hot weather and after swimming. Sunscreen should always be applied before repellents.
- Do not use repellent on infants aged 3 months or younger.
- Do not allow young children to apply their own repellent. Avoid application to hands, eyes and mouth

How to control mosquitoes around home?

- Prevent mosquito entry by using flyscreens on windows and doors. Screen chimneys, vents and other entrances.
- Consider using surface spray in cool shady areas in and around the home where mosquitoes rest during day.
- Clean up your backyard and remove all water-holding rubbish, including tires and containers where mosquitoes can breed.
- Keep lawns mowed.
- Keep gutters and drains clean so water runs freely.
- Store anything that can hold water undercover or in a dry place, and keep bins covered.
- Change pet drinking bowls, bird baths and vase waters at least once a week, and more regularly in very warm weather.
- Cover or securely screen the openings of septic tanks and rainwater tanks.
- Fill pot plant base with sand to avoid standing water.
- Keep swimming pools well maintained or empty or securely cover them if not in use.

How to control mosquitoes inside the home?

- Maintain flyscreens on windows, doors, vents and chimneys.
- Consider use of over the counter insecticide sprays against visible mosquitoes in your home.
- Mosquito coils (used outdoors) and vapourising mats (used indoors) can help to repel mosquitoes from an area of interest.

How to avoid mosquitoes during travel or camping?

- Reside or sleep in screened or air conditioned rooms.
- Use a bed net if you are sleeping outdoors or if the area is known for mosquitoes. Nets are most effective when they are treated with a pyrethroid insecticide, such as permethrin. Pre-treated bed nets can be purchased before travelling, or nets can be treated after purchase.
- Avoid known areas of high mosquito-borne disease transmission or outbreaks.

Scenario 2

Sarah Salmo

Subject: S Havana situation update

Hi Sarah,

Some quick notes on S Havana.

See you when I'm back from hols.

Mark.

Infection of salmonella can occur between six and 72 hours after exposure and symptoms usually last for three to seven days. Symptoms include fever, diarrhoea, vomiting, headaches, stomach cramps and loss of appetite.

On average 2-5 cases of Salmonella Havana are reported monthly. To date there have been 767 cases of Salmonella infections (all types) reported to the Department of Health this year, compared to 1,128 at the same time last year.

21 cases of Salmonella Havana link to alfalfa sprouts have been reported to the Department of Health including seven who have been hospitalised.

Alfalfa sprouts products including alfalfa (125g and 200g tubs, 1kg bags), green alfalfa (125g tubs), alfalfa and radish (125g tubs), alfalfa and onion (125g tubs), alfalfa and mustard (125g tubs), alfalfa and Chinese cabbage (125g tubs), alfalfa and garlic (125g tubs), salad mix (175g tubs) and gourmet sprouts (100g trio pack with alfalfa, snow pea, small sprouted bean) from A Sprouts & Co have been identified as the source of the outbreak.

Media Release

SA Health

Wednesday, 20 June 2018

SALMONELLA CASES LINKED TO ALFALFA SPROUTS

South Australians are being warned not to eat alfalfa sprout products produced by Adelaide business SA Sprouts, after several people became ill with Salmonella havana.

SA Health's Chief Medical Officer and Chief Public Health Officer, Professor Paddy Phillips, said there had been 21 recent confirmed cases of Salmonella havana, including seven people who were hospitalised.

"We are advising anyone who has purchased the recalled SA Sprouts alfalfa sprouts products to return them to the place of purchase for a refund, or throw them away," Professor Phillips said.

"We also want to alert cafes and restaurants to check their suppliers and not serve any SA Sprouts alfalfa sprout products until further notice.

"In cases of salmonella a common food source is not often identified, however a joint investigation between SA Health, local government and Primary Industries and Resources SA (PIRSA) has linked these cases to SA Sprouts alfalfa sprouts.

"We are working closely with the producer and suppliers while we continue to investigate."

SA Sprouts products are sold at Drakes Foodland, IGA and numerous greengrocers.

Products included in the recall are alfalfa (125g and 200g tubs, 1kg bags), green alfalfa (125g tubs), alfalfa and radish (125g tubs), alfalfa and onion (125g tubs), alfalfa and mustard (125g tubs), alfalfa and Chinese cabbage (125g tubs), alfalfa and garlic (125g tubs), salad mix (175g tubs) and gourmet sprouts (100g trio pack with alfalfa, snow pea, small sprouted bean).

People can experience symptoms of salmonella infection between six and 72 hours after exposure and symptoms usually last for three to seven days.

Symptoms include fever, diarrhoea, vomiting, headaches, stomach cramps and loss of appetite.

Anyone who develops these symptoms and is concerned should see their doctor, particularly young children, older people, pregnant women and people who are immunocompromised because they are at risk of more severe illness.

There have been 751 cases of salmonella infection (all types) reported to SA Health this year, compared to 829 at the same time last year and a total of 1432 for 2017.

For more information, visit www.sahealth.sa.gov.au/foodsafety.

For more information

Call the SA Health Media Line
Telephone: 08 8226 6488

www.twitter.com/sahealth www.youtube.com/sahealthaustralia

Salmonella infection - including symptoms, treatment and prevention

Salmonella infection is one of many possible causes of gastroenteritis (also known as 'gastro'). There are thousands of different types of Salmonella bacteria and they occur in many domestic and wild animals, including birds, sometimes causing illness in them. Two specific types of *Salmonella* can cause typhoid and paratyphoid fever, which causes a different illness to that described below. Typhoid and paratyphoid infections can be serious and are not common in Australia.

Salmonella infection is a notifiable condition[1]

How *Salmonella* is spread

Salmonella infection usually results from ingestion of the bacteria from contaminated food, water or hands. Eggs, milk, meat or poultry are particularly high risk foods. Fruit and vegetables may also be contaminated, especially if manure has been used as fertiliser.

People may become infected if they transfer animal faeces containing *Salmonella* bacteria from their hands to their mouths, for example, if eating after touching animals and failing to wash their hands.

Person-to-person spread may occur when hands, objects or food become contaminated with faeces from people who are infected and the bacteria are then taken in by mouth by another person.

Signs and symptoms

Symptoms may include:

- fever
- diarrhoea
- loss of appetite
- headache
- stomach cramps
- nausea and vomiting.

Sometimes there may be blood or mucus in the faeces. Dehydration is a serious complication. The illness may be particularly severe in young children, the elderly and people with immune suppression.

A small percentage of people may develop arthritis after having a *Salmonella* infection.

Diagnosis

Diagnosis is made by growing *Salmonella* bacteria from a faecal specimen or by detecting *Salmonella* in a faecal sample using a PCR (polymerase chain reaction) test in a pathology laboratory.

Incubation period

(time between becoming infected and developing symptoms)

6 to 72 hours, usually 12 to 36 hours.

Infectious period

(time during which an infected person can infect others)

The faeces are always infectious when symptoms are present. Some people continue to carry *Salmonella* bacteria in the bowel and shed them in the faeces for months after recovering.

Treatment

Recovery from *Salmonella* infection usually occurs within a week and antibiotic treatment is not normally required. However, a doctor may prescribe antibiotics for young infants, the elderly and in some other situations. See also Typhoid and paratyphoid.

Gastroenteritis is a common illness, which can be particularly serious in young children.

The following are general recommendations for the treatment of gastroenteritis:

- Give plenty of fluids. Oral rehydration solution is highly recommended for children with mild to moderate dehydration. It is available at pharmacies and should be administered following the instructions on the packaging.
- Mildly unwell children should be given their usual fluids more often. Carbonated (fizzy) drinks or undiluted juice should be avoided.
- Medicines to prevent vomiting or diarrhoea should not be given (especially in children), except where specifically advised by a doctor.
- Breastfed babies should continue to be breastfed throughout their illness.
- Children on formula or solid diets should restart their normal diet (including full strength lactose containing milk) following rehydration with oral rehydration solution.
- Children who are hungry or ask for food should be given small portions of their usual foods, but avoid foods high in sugar or fat.

When to seek medical advice

Seek medical advice if any of the following symptoms occur:

Adults

- Signs of dehydration, such as thirst and decreased urination, lethargy, dry mouth, feeling faint on standing
- fever
- severe abdominal pain
- bloody diarrhoea.

Children

- Signs of dehydration, such as thirst and decreased urination, lethargy, dry mouth, sunken eyes, feeling faint on standing
- fever
- abdominal pain
- bloody diarrhoea
- any symptoms in a child less than 12 months of age.

Prevention

- Exclude people with *Salmonella* infection from childcare, preschool, school and work until there has been no diarrhoea for 24 hours. If working as a food handler in a food business, the exclusion period should be until there has been no diarrhoea or vomiting for 48 hours.
- Infants, children and adults with *Salmonella* infection should not swim until there has been no diarrhoea for 24 hours.
- Cook meat thoroughly, until the juices run clear.
- Do not purchase dirty or cracked eggs.
- Strict food handling procedures should be used when preparing dishes containing raw or incompletely cooked eggs, such as homemade ice cream and mayonnaise.
- Do not consume unpasteurised milk.
- Follow good food handling procedures.
- Follow good hand washing and keeping areas clean procedures.
- Recognise the risk of *Salmonella* infections in pets. Chickens, ducklings, tropical freshwater fish and turtles are particularly risky for small children.
- Hand washing after handling raw meat, (especially chicken) or raw eggs
- Always wash fruit (including melons) and vegetables before eating. If home grown, wash them before bringing them into the house.
- Infected people who no longer have symptoms should take special care with hand washing if they are involved in food preparation or in caring for patients in hospital, the elderly or children.

Scenario 3

Measles

A case of measles in a NSW resident was notified in this reporting week (Table 1), and an alert for passengers was issued by NSW Health after ACT Health confirmed a case of measles in an ACT resident who had transited through Sydney International Airport while infectious.

The new case was in an adult male resident of metropolitan Sydney who had recently returned from the Philippines. The young man had a record of receiving two doses of measles vaccine earlier in his life, however was unfortunately still susceptible to the infection. While two doses of measles vaccine are highly effective in preventing infection, one per cent of people don't respond to the vaccine and are susceptible to infection. Fortunately the young man was effectively isolated while infectious and the local public health unit were able to follow up directly and provide preventive treatment to potential contacts at a medical centre and work place.

A total of 14 infectious measles cases have spent time in NSW since the end of December 2018. Of these, two were residents of the ACT, and one a resident of Queensland. The majority of cases have been acquired during overseas travel, and alerts have been issued to passengers of five international flights. Information regarding previous cases can be found in CDWR 2019 weeks 1, 2 and 4.

Two doses of measles containing vaccine provide the best protection against measles. NSW Health recommends all people aged 12 months or older, and born during or after 1966 receive two doses of measles vaccine. Two doses are offered to children under the National Immunisation Program, and NSW Health provides free measles-mumps-rubella (MMR) to anyone born during or after 1966, who does not have evidence of having received two doses in the past.

For more information see the NSW Health Alerts page, visit the Measles web page, or download the Measles fact sheet.

NSW HEALTH

Media Release

14 January 2019

MEASLES ALERT FOR AIRLINE PASSENGERS

NSW Health is alerting passengers of QF20, which landed at Sydney International Airport at 6.30am on Friday January 11 from Manila, that a passenger on the flight was infectious with measles.

The passenger, a male in his 20s, developed measles while in the Philippines, and was diagnosed with the infection after returning home.

The man visited Leichhardt Medical and Dental Centre on January 12, where the infection was suspected, and isolation measures put in place. Other patients there at the same time are being contacted and offered preventive treatment, if needed.

People who were on QF20, or at Sydney International Airport early in the morning of January 11, should be alert for measles symptoms until January 29 as the time from exposure to the onset of symptoms is 10 - 18 days.

"If you develop symptoms please call ahead to your GP so that you do not wait in the waiting room with other patients," Dr Sheppeard said.

NSW Health has been in contact with Qantas, advising the airline of the man's condition.

"The measles-mumps-rubella (MMR) vaccine is safe and highly effective protection against measles, and is available for free for those aged 1 to 52 from your GP. If you are unsure whether you have had two doses, it is quite safe to have another dose."

NSW Health once again urges people travelling to south-east Asia where measles is prevalent to ensure they a fully vaccinated before heading overseas.

Outbreaks of measles in popular tourist destinations means the risk for measles being imported into Australia at the moment is high.

Measles is highly contagious and is spread in the air through coughing or sneezing by someone who is unwell with the disease.

Symptoms of measles include fever, sore eyes and a cough followed three or four days later by a red, blotchy rash spreading from the head and neck to the rest of the body.

For more information on measles, visit:
http://www.health.nsw.gov.au/Infectious/factsheets/Pages/Measles_Factsheet.aspx

Media contact: NSW Health Public Affairs 02 9962 9890; email – media@health.nsw.gov.au.

Communicable Diseases Factsheet

Measles

Measles is a serious disease that is easily spread through the air. Immunisation is effective in preventing the disease. All children and adults born during or after 1966 should be vaccinated with 2 doses of measles containing vaccine if not already immune.

Last updated: February 2019

What is measles?

- Measles is a viral disease that may have serious complications.
- In the past, measles infection was very common in childhood. Most peple born before 1966 will have been infected with measles as a child and are likely to be immune.
- Thanks to immunisation measles is now rare in Australia.
- Measles remains common in many parts of the world, and large outbreaks continue to occur in a number of countries. This is why it is important to make sure you are fully protected against measles prior to overseas travel.

What are the symptoms?

The first symptoms are fever, tiredness, cough, runny nose, sore red eyes and feeling unwell. A few days later a rash appears. The rash starts on the face, spreads down to the body and lasts for 4-7 days. The rash is not itchy. Young children (especially infants) may also experience diarrhoea.

Up to a third of people with measles have complications. These include ear infections, diarrhoea and pneumonia, and may require hospitalisation. About one in every 1000 people with measles develops encephalitis (swelling of the brain).

How is it spread?

Measles is usually spread when a person breathes in the measles virus that has been coughed or sneezed into the air by an infectious person.

Measles is one of the most easily spread of all human infections. Just being in the same room as someone with measles can result in infection.

People with measles are usually infectious from just before the symptoms begin until four days after the rash appears. The time from exposure to becoming sick is usually about 10 days. The rash usually appears around 14 days after exposure.

Who is at risk?

People are at risk of measles if:

- They have never had measles infection **OR**
- They have not had two doses of measles containing vaccine **OR**
- They have a weakened immune system (e.g., people who are receiving chemotherapy or radiotherapy for cancer or people who take high-dose steroid medications) even if they have been fully immunised or have had past measles infection.

  AND they have had contact with someone with measles infection

How is it prevented?

- The best protection against measles is immunisation with two doses of measles containing vaccine, given at least 4 weeks apart.
- In Australia two doses of measles containing vaccine are offered to children under the National Immunisation Program (NIP). The first dose is scheduled at 12 months of age as measles-mumps-rubella (MMR) vaccine. The second dose is scheduled at 18 months as measles-mumps-rubella-varicella (MMRV) vaccine. These vaccines provide protection against mumps, German measles, and chicken pox as well as measles.
- People planning travel with children between 9 and 18 months of age should discuss their travel plans with their GP as the schedule can be adjusted for children travelling to areas with a high risk of measles. If you start your child's schedule before 12 months, they will still need to receive MMRV at 18 months of age, even if they receive 2 doses of MMR.
- Anyone born during or after 1966 and who has never had measles infection should see their doctor to make sure that they have had two doses of measles containing vaccine at least four weeks apart. If not the vaccine is free in NSW
- It is safe to have the vaccine more than twice, so people who are unsure whether they are immune should be vaccinated
- People with measles should stay at home until they are no longer infectious (i.e. until 4 days after the rash starts) to reduce the possibility of spreading it to other people.

How is it diagnosed?

Measles is suspected when a person feels unwell, has a cough, runny nose and/or sore eyes and a fever, followed by a rash.

Whenever measles is suspected, samples from the nose, throat and urine should be collected to confirm the diagnosis. A blood test may also be performed. Confirmation of the diagnosis is important as it allows prompt public health follow-up of other people who are at risk of measles.

How is it treated?

People with measles infection are normally advised to rest, drink plenty of fluids, and take paracetamol to treat the fever. There is no specific treatment.

What is the public health response?

Doctors, hospitals and laboratories, schools and childcare centres must notify cases of measles to the local public health unit. Public health unit staff will interview the doctor and patient (or carers) to find out how the infection occurred, identify other people at risk of infection, implement control measures (such as immunisation and restrictions on attending school or work) and provide other advice.

The fact sheet, "Measles: Information for Contacts" provides information for clinicians to provide to measles contacts, following assessment and/or provision of post exposure prophylaxis. (https://www.health.nsw.gov.au/Infectious/factsheets/Factsheets/measles-information-for-contacts.pdf)

Further information

For further information please call your local Public Health Unit on 1300 066 055 or visit the New South Wales Health website www.health.nsw.gov.au

Information for measles contacts

What is a measles contact?
Because measles is highly infectious, contacts are people who shared the same air as someone who was infectious with measles. This can include simply being in the same room or waiting area as someone with measles.
It is easy to be a contact of measles without realising, because people are infectious before the rash develops. This is why it is important to ensure you are immune to measles, particularly if planning travel overseas.

What should I do if I am a measles contact?
Contacts of measles should look out for symptoms of measles until 18 days after their last contact the person who was infectious with measles. As a precaution it is a good idea not to have contact with anyone who is at risk of measles during this time, such as infants too young to be vaccinated.
If you begin to develop symptoms of measles:

- do not attend public places such as work, school, early childhood education or care services, or shopping centres, and avoid using public transport.
- See a doctor, preferably your general practitioner, as soon as possible. Call ahead to inform staff of your symptoms so that arrangements can be made to limit your contact with other people in the surgery. If you have been treated as a measles contact, take the 'Measles contact assessment form' with you.
- Call your local Public Health Unit (1300 066 055)

Appendix 6.C

Single Overriding Communications Objective (SOCO) Worksheet

Topic and/or incident What is the topic or incident?	
SOCO This is the single overriding communications objective. Include in one to two sentences the key message. This should be the message that if they quote nothing else that you would want them to play.	
Supporting statements This should include three to four supporting statements (key facts). These are not they key messages but supporting additional statements that contain useful additional information.	
Background This section should include background information and data that would be useful to know but not necessarily say to the media. It might include context regarding frequency of events or responses that have already been undertaken.	
Target audience Who is the main audience or population segment you would like this message to reach?	