

Examining zoonotic notifications in Aboriginal and Torres Strait Islander populations over time: An analysis of the National Notifiable Diseases Surveillance System from 1996-2021

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Abstract

Objective: This paper utilised the National Notifiable Diseases Surveillance System database to analyse the commonly notified zoonotic disease presentations in Aboriginal and Torres Strait Islander populations over 25 years, from 1996-2021.

Methods: We analysed the top four zoonotic notifications using a descriptive analysis, a time series analysis assessing the trends and seasonal indices, and a de-seasonalised analysis to assess the years contributing to an increase above the trend.

Results: Results show an increase in notifications for salmonellosis and campylobacteriosis over the last 10 years. On average, all diseases saw an increase in notifications above the trend in Q1 (Jan-Mar) and less so Q2 (Apr-Jun), and a decrease in notifications below the trend in Q3 (Jul-Sep) and less so in Q4 (Oct-Dec), which is aligned with increases in zoonotic notifications in Australia's hotter and wetter months.

Conclusion: The results present zoonotic notifications in Aboriginal and Torres Strait Islander populations over time and highlight potential implications of climate change due to increasing notifications, and increasing temperatures and extreme weather events in recent years.

Implications for public health: The findings can inform preventative health approaches for zoonoses in Indigenous populations, with One Health approaches recommended.

Key words: zoonoses, Aboriginal and Torres Strait Islander, notifications, seasonal, One Health

Introduction

Zoonotic diseases are a health concern globally and disproportionately affect Aboriginal and Torres Strait Islander people's health and wellbeing.^{1,2} Aboriginal and Torres Strait Islander peoples in Australia face elevated risk of disease related to environmental and animal health factors with many communities under-resourced and facing barriers in accessing preventative health care. Whilst zoonotic diseases are a risk for Indigenous communities, they are also among the most underdiagnosed diseases in humans with the full burden of disease not well understood.³

Zoonoses refer to diseases that can be transmitted between animals and people, including via air-borne, vector, direct or indirect contact,

food-borne, water-borne and soil-borne transmission.⁴ Both domestic and wild animals can be involved in the transmission of zoonotic pathogens with environmental exposures commonly involved, such as through exposure to vectors, contaminated soil and water. Therefore, understanding the One Health relationships (recognising the integral health links between people, animals and their shared environment) is essential.

Globally, the effective management of zoonotic diseases is seen as a priority by leading health organisations with a One Health approach promoted for the management of current and emerging health risks.⁵ The concept of One Health is likely to be an effective approach to understanding and addressing inequitable health risks faced by

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Indigenous populations as One Health closely aligns with Indigenous views of health that support holistic approaches and recognise health and wellbeing outside of the individual.⁶ Indigenous views of health support cultural connections with the environment and animals through a long history of caring for Country and protecting animal populations and habitats, with subsequent health and wellbeing impacts for communities.

A One Health approach to the monitoring, prevention and control of zoonoses within Aboriginal and Torres Strait Islander populations is recommended to improve disease management due to the multifaceted nature of zoonoses and alignment with holistic views of health.⁷ One Health has also been highlighted as a method to explore climate change impacts and social relationships between animals, people and the shared environment within Indigenous community settings.⁸ However, the incorporation of One Health and Indigenous knowledges is not well understood, and there is a need to recognise and support Indigenous views of health that could benefit One Health approaches.

Nationally notifiable diseases in Australia are defined as diseases that are a public health priority and meet multiple assessment criteria, including importance for Aboriginal and Torres Strait Islander health.⁹ Nationally notifiable diseases are reportable to state and territory health authorities, with data supplied to the National Notifiable Diseases Surveillance System (NNDSS). The NNDSS includes the surveillance of over 70 communicable diseases that present a risk to public health. This system is managed by the Australian Government Department of Health and Aged Care, with oversight provided by the Communicable Diseases Network Australia.¹⁰ The NNDSS assists with the monitoring, detection and control of communicable diseases and informs the coordination of outbreak responses.¹¹

Notifiable diseases disproportionately affect Aboriginal and Torres Strait Islander people accounting for 8.4% of all notifications from 1991–2011, yet Aboriginal and Torres Strait Islander peoples make up 3.8% of the Australian population.^{12,13} Notifications among Aboriginal and Torres Strait Islander populations are likely to be an underestimation, with an evaluation of the NNDSS showing Indigenous status was not reported in 56% of all notifications.¹² Notifiable diseases are also more commonly reported in remote and very remote areas, and socioeconomically disadvantaged populations.¹⁴ Many nationally notifiable diseases are zoonotic and can be transmitted between animals and people. Recent studies of zoonoses within Aboriginal and Torres Strait Islander populations found that they are commonly reported in the north of Australia, remote and outer regional areas, and disproportionately affect young people, with gastrointestinal infections most common.^{7,15}

As the risk of zoonoses sits across multiple health sectors, environmental considerations are an important factor in understanding and preventing disease, including climatic impacts. Australia has four main seasons as defined in western science, including summer (Dec–Feb), autumn (Mar–May), winter (Jun–Aug) and spring (Sep–Nov), with the northern parts of Australia also experiencing the wet season (Nov–Apr) and dry season (May–Oct). Australia's temperatures can reach over 40 degrees celsius with extreme fire weather in the hotter months and less than 0 degrees celsius in the colder months. The wet season also experiences heavy rainfall and humidity, particularly in the north of Australia. Many Aboriginal and Torres Strait Islander communities also have seasonal calendars that are built on generational knowledge and a deep

understanding of the local seasons and weather patterns.¹⁶ Indigenous seasonal calendars include observations and understandings of the interactions between plants, animals, land and sea, as well as weather events. They are commonly used to inform the management of seasonal foods, animal breeding cycles and land and sea management actions that are needed to keep Country healthy.¹⁶

Australia continues to experience changes in weather patterns due to the changing climate, with climate projections showing increasing temperatures and risks of extreme weather events, including fires and heavy rainfall.¹⁷ Particularly in the north of Australia, Aboriginal and Torres Strait Islander communities are disproportionately affected by these weather extremes.¹⁸ Evidence shows that climatic impacts within Australia will further enhance the health inequities and wellbeing disparities that Aboriginal and Torres Strait Islander peoples face. This includes changes in seasonal food availability, impact on animal populations, extreme heat environments and severe weather events such as fires and floods.¹⁸ For example, extreme weather conditions affect food commodities and availability in communities adding to the food insecurity concerns that many families face.¹⁹ However, we do not yet understand the seasonal impacts on zoonotic diseases limiting our ability to prevent them.

This study builds on a national scoping review and data analysis of zoonoses in Aboriginal and Torres Strait Islander populations in Australia^{7,15} by exploring the epidemiology of commonly notified zoonoses over time, from 1996–2021. This study investigates trends and seasonal effects on zoonotic notifications and considers preventative One Health approaches for zoonoses management in Aboriginal and Torres Strait Islander communities.

Methods

Study design

This study was conducted with approval from the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) Research Ethics Committee (EO243-20210406) and was undertaken by an Aboriginal-led and interdisciplinary research team. The data analysis plan was developed with input from three authors (TR, RL and JT) and analysis undertaken by two authors (TR and JT). We utilised the NNDSS database¹⁰ to analyse zoonotic notifications in Aboriginal and Torres Strait Islander populations from 1996–2021. Line listed data were aggregated by yearly quarter using the notification date for the four most common zoonotic notifications. The yearly quarters were defined as; Q1) January, February and March; Q2) April, May and June; Q3) July, August and September; and Q4) October, November and December.

The most common zoonotic notifications specified in the evidence were salmonellosis, campylobacteriosis, cryptosporidiosis and Ross River virus infection.⁷ Salmonellosis is a gastrointestinal infection caused by *Salmonella* bacteria.²⁰ It is commonly transmitted through consuming contaminated food (mainly animal products) and can be transmitted via contact with infected animals or people. Campylobacteriosis is a gastrointestinal infection caused by *Campylobacter* bacteria.²¹ It is transmitted through contaminated foods (animal products) and water, and through contact with infected animals and people. Both salmonellosis and campylobacteriosis are more common during summer and spring months when temperatures are higher.²² Cryptosporidiosis is a gastrointestinal disease caused by *Cryptosporidium* parasites and is more commonly seen in warmer months.^{23,24} These parasites are found in the faeces of

infected species and are transmitted through contaminated water, and via contaminated food or contact with infected animals and people. Lastly, Ross River virus infection is a vector-borne virus that is spread between animals and people via mosquitoes.²⁵ It is more commonly seen in the north of Australia due to the tropical climate and during the warmer months.²⁶

Statistical analysis

Using the annual quarterly data, we performed a descriptive analysis and time series analysis of the most notified zoonoses. Using a time series multiplicative model,²⁷ we examined the trend using linear regression for each disease and their seasonal indices to report the average quarterly change (in percentage) from the trend for each disease. To remove random fluctuations, we applied a 4-period moving average (Supplementary Table 2) to the raw data for each disease before calculating the seasonal indices (Supplementary Table 3). The data was then de-seasonalised (Supplementary Table 2) and we calculated the difference between the trend and de-seasonalised data for each disease to identify the associated years that remained “above” the trend in each quarter.

Steps for the time series calculations have been outlined in the Supplementary Material. A significance level of $\alpha=0.05$ was specified for statistical testing. We presented a summary table and graph of the number of notifications over time and statistical tables for the time series analysis. We then presented the quarters with notifications “above” the trend by over 10 notifications in a table to visualise patterns in increasing notifications.

Results

Overall, there were 28,011 notifications of the four most commonly notified zoonoses within Aboriginal and Torres Strait Islander populations from 1996–2021. Salmonellosis was the most commonly notified ($n=12,272$) followed by campylobacteriosis ($n=8,323$), cryptosporidiosis ($n=4,778$) and Ross River virus infection ($n=2,638$) (see Figure 1 and Supplementary Table 1).

Figure 1 indicated the potential presence of an increasing trend for salmonellosis and campylobacteriosis. There appeared to be a major increase in the notifications of salmonellosis and campylobacteriosis after 2012. An increasing trend appeared to be less apparent for cryptosporidiosis and Ross River virus infection. Regression testing for a linear trend was significant for salmonellosis, campylobacteriosis and Ross River virus infection but not significant for cryptosporidiosis (see Table 1).

Seasonal indices (see Table 1) showed a consistent pattern of an increase in notifications compared to the trend in Quarters 1 (January–March) and 2 (April–June) and a decrease in notifications compared to the trend in Quarters 3 (July–September) and 4 (October–December) for each disease.

Overall, salmonellosis notifications were observed to be 43.4% and 7.2% above the trend in Quarters 1 and 2 respectively, and 38.6% and 11.9% below trend in Quarters 3 and 4, respectively. We noted an increase in campylobacteriosis notifications of 17.6% and 4.7% compared to the trend in Quarters 1 and 2, respectively, and a decrease of 18.4% and 3.9% in Quarters 3 and 4, respectively. Cryptosporidiosis notifications were observed to be 75.9% and 8.8% above the trend in Quarters 1 and 2, respectively, and 59.7% and 25.1% below trend in Quarters 3 and 4, respectively. We noted an increase in Ross River virus infection notifications of 58.9% and 33.8% compared to the trend in Quarters 1 and 2, respectively, and a decrease of 53.1% and 39.6% in Quarters 3 and 4, respectively.

Analysis of the differences between trend and de-seasonalised data indicated that for salmonellosis and campylobacteriosis, notifications that remained “above” the trend across multiple quarters appeared to have primarily occurred in recent years (2014 onwards) (see Table 2). Similarly, campylobacteriosis notifications also presented above the trend across multiple quarters from 1996–1999. We did not identify a pattern in the years that remained “above” the trend for cryptosporidiosis and Ross River virus infection notifications.

Figure 1: Zoonotic notifications in Aboriginal and Torres Strait Islander populations by year from 1996 to 2021.

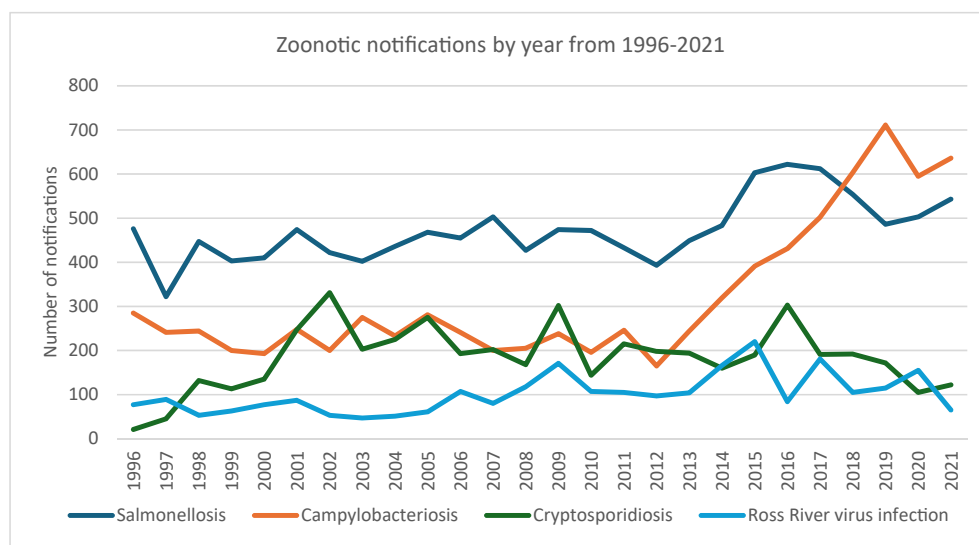


Table 1: Time series analysis results table.

Zoonoses	Trend	Quarter	Seasonal indices
Salmonellosis	T = 100.14 + 0.35 ^a t (p-value for trend=0.011)	Q1 (Jan-Mar)	1.434 (43.4% above trend)
		Q2 (Apr-Jun)	1.072 (7.2% above trend)
		Q3 (Jul-Sep)	0.614 (38.6% below trend)
		Q4 (Oct-Dec)	0.881 (11.9% below trend)
Campylobacteriosis	T = 31.29 + 0.95 ^a t (p-value for trend<0.001)	Q1 (Jan-Mar)	1.176 (17.6% above trend)
		Q2 (Apr-Jun)	1.047 (4.7% above trend)
		Q3 (Jul-Sep)	0.816 (18.4% below trend)
		Q4 (Oct-Dec)	0.961 (3.9% below trend)
Cryptosporidiosis	T = 41.65 + 0.08 ^a t (p-value for trend=0.444)	Q1 (Jan-Mar)	1.759 (75.9% above trend)
		Q2 (Apr-Jun)	1.088 (8.8% above trend)
		Q3 (Jul-Sep)	0.403 (59.7% below trend)
		Q4 (Oct-Dec)	0.749 (25.1% below trend)
Ross River virus infection	T = 15.99 + 0.18 ^a t (p-value for trend=0.004)	Q1 (Jan-Mar)	1.589 (58.9% above trend)
		Q2 (Apr-Jun)	1.338 (33.8% above trend)
		Q3 (Jul-Sep)	0.469 (53.1% below trend)
		Q4 (Oct-Dec)	0.604 (39.6% below trend)

^at: number of quarters since 1996 (Q1 1996 corresponding to t=0)

Discussion

Overall, results show that salmonellosis was the most notified zoonotic disease within Aboriginal and Torres Strait Islander populations from 1996-2021, followed by campylobacteriosis, cryptosporidiosis and Ross River virus infection. For all diseases, there were high increases above the trend in Q1 (Jan-Mar) and less so in Q2 (Apr-Jun), and decreases well below the trend in Q3 (Jul-Sep) and less so in Q4 (Oct-Dec). Both salmonellosis and campylobacteriosis had noticeable increases above the trend in multiple quarters in recent years, signalling a change to the presentation of these diseases within the population. These results can be used to inform community preventative health approaches for animals and people, with a One Health approach likely to be effective due to the multifaceted approach required to address zoonoses. As Indigenous cultures have harnessed holistic approaches to health for many years, the One Health field can benefit from recognising Indigenous practices and knowledges that support healthy environments and connections with wild and domestic animals.

The increases in disease notifications are aligned with the warmer and wetter climates in Australia's summer season (Dec-Feb), and a decrease in notifications over the colder and drier months in Australia's winter season (Jun-Aug). Parasitic and vector-borne diseases (such as cryptosporidiosis and Ross River virus infection) are more commonly seen in tropical areas and in warmer months, with the north of Australia experiencing this climatic pattern.^{24,26} These diseases saw an increase primarily over the wet season in north Australia (Nov-Apr) in which extreme humidity, rainfall and flooding events occur. Bacterial food-borne zoonoses are also more common in hotter weather (over summer and spring) and, therefore, the increase in notifications for salmonellosis and campylobacteriosis over

these months was also expected.²² As zoonotic notifications are disproportionately found in the Northern Territory, Queensland and Western Australia,⁷ the climate may be impacting the transmission and prevalence of zoonoses in these states, particularly in the north. In recent years Aboriginal and Torres Strait Islander communities have faced disproportional impacts of climate change, with increasing temperatures and extreme rainfall recorded.²⁸ These increasing temperatures and risk of extreme weather events are expected to continue,¹⁷ and more work is needed to understand how these changing weather patterns will affect zoonoses presentations within communities.

Additionally, the increasing notifications of zoonoses may be related to the health of the environment that is shared by animals and people. For example, many Aboriginal and Torres Strait Islander families experience inadequate housing, infrastructure, hygiene and sanitation facilities, thus increasing their risk of infectious disease.²⁹ Due to the role animals play in zoonotic disease transmission, the health of animal populations living in close proximity to people is also an important consideration, with many communities experiencing barriers in accessing animal health care and preventative health approaches. Further exploring the connection between Aboriginal and Torres Strait Islander communities and animals would be useful in understanding health risks and informing prevention and management of disease. The incorporation of environmental considerations is also required to inform community One Health approaches, including connection to Country and traditional Indigenous practices that can benefit environmental management.

Limitations

Notification data are largely a representation of disease diagnosis, rather than true disease incidence,¹² and therefore this is a starting point to understanding the true burden of zoonoses within Aboriginal and Torres Strait Islander populations. A limitation of this study was specifying the seasonal impact, as Australian seasons do not entirely align with the yearly quarters; however, we were able to discuss the climatic pattern that may contribute to the changes over time. The NNDSS database also faces limitations in identifying Indigenous notifications, and therefore, these results are likely an under-representation of the true burden of disease.³⁰ Improving the reporting of Indigenous status within the database is required to improve understanding of the true impact of zoonoses and to more accurately inform policies and programs. Similarly, with the limited data available for the other zoonotic notifications present in the database, we did not have the necessary data to perform time series analysis for additional diseases. Notifiable diseases can differ by state and territory, and there have been changes in data collection methods over the study period which may have affected the accuracy of the results. This includes updates to reporting requirements, inclusion of notifiable diseases, and efforts to improve data completeness and timeliness.³⁰ Specifically, the introduction of rapid detection diagnosis for salmonellosis and campylobacteriosis in late 2013 may have contributed to the increased notifications highlighted in this study.³¹

Future studies

This study provides evidence on the trends and seasonal effects of notifiable zoonoses within Aboriginal and Torres Strait Islander populations; however, much work is still needed. The NNDSS database is responsible for collating notifiable disease data in people,

Table 2: Yearly quarters with zoonotic notifications increasing above the trend in Aboriginal and Torres Strait Islander populations from 1996-2021.

	Salmonellosis				Campylobacteriosis				Cryptosporidiosis				Ross infection	River	virus	
Year	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1996																
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Note: Coloured cells represent yearly quarters with notifications above the trend by >10.

yet there are many non-notifiable zoonoses that we do not practice surveillance for in people or animals and, with limited data available, are unable to analyse. Particularly, the zoonoses more closely related to companion animals (dogs and cats), as notifiable zoonotic diseases are commonly related to agricultural animals and wildlife. Due to the large populations and importance of companion animals to Aboriginal and Torres Strait Islander communities,³² further work is needed to explore the transmission, prevalence and impact of zoonoses on both companion animals and people. While this analysis took a national approach, subsequent studies should investigate zoonoses by state and region to further inform management of zoonoses locally; however, improved data completeness is required.

Future studies should consider the seasonal effects of zoonoses at a community level using the local Indigenous calendars which portray differing seasons and are commonly mapped around food availability, animal breeding and the health of the environment throughout the year. Further transdisciplinary research is also needed to understand how to effectively prevent and manage zoonotic diseases within Aboriginal and Torres Strait Islander communities and the

implications of One Health approaches in this context.³³ While One Health is recommended internationally as an effective approach to addressing zoonoses risk, more research is needed to better understand how One Health sits with Indigenous health approaches with a need to recognise Indigenous knowledges that align with One Health.⁸ Additionally, the capacity of current health systems and associated data to inform preventative One Health approaches needs further consideration, including improving data completeness, and increasing communication and collaboration across health sectors to better inform policies and programs.

Conclusion

This paper analysed zoonotic notifications within Aboriginal and Torres Strait Islander populations over time, assessing the trends, seasonal indices and associated climatic impacts. With zoonotic notifications increasing in recent years, further consideration for preventing disease within Aboriginal and Torres Strait Islander communities is needed. Particularly, the impact of climatic effects on

the prevalence of zoonotic disease requires further investigation with the continuing impacts of the changing climate. As the risk factors for zoonotic disease cross multiple health sectors a One Health approach is recommended; however, further work is needed to understand the implications of this approach for Aboriginal and Torres Strait Islander peoples, including recognising the Indigenous knowledges that promote holistic health approaches.

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Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

- Smout F, Schriber L, Speare R, Skerratt L. More bark than bite: comparative studies are needed to determine the importance of canine zoonoses in Aboriginal communities. A critical review of published research. *Zoonoses and Public Health* 2017;64(7):495–504.
- Aung PTZ, Cuningham W, Hwang K, Andrews RM, Carapetis J, Kearns T, et al. Scabies and risk of skin sores in remote Australian Aboriginal communities: a self-controlled case series study. *Public Library of Science Neglected Tropical Diseases* 2018;12(7).
- World Health Organization. *The control of neglected zoonotic diseases: a route to poverty alleviation: report of a joint WHO*. Geneva. 2006.
- Centers for Disease Control and Prevention: National Center for Emerging and Zoonotic Infectious Diseases. *Zoonotic diseases*. USA: Centers for Disease Control and Prevention; 2021 [Available from: <https://www.cdc.gov/onehealth/basics/zoonotic-diseases.html>].
- Food and Agriculture Organization of the United Nations, United Nations Environment Programme, World Health Organization, World Organisation for Animal Health. *One Health joint plan of action (2022–2026): working together for the health of humans, animals, plants and the environment*. Rome, Italy. 2022.
- Riley T, Anderson NE, Lovett R, Meredith A, Cumming B, Thandrayen J. One Health in Indigenous communities: a critical review of the evidence. *Int J Environ Res Publ Health* 2021;18(21):11303.
- Riley T, Lovett R, Cumming B, Meredith A, Anderson NE, Thandrayen J. Data analysis of zoonoses notifications in Aboriginal and Torres Strait Islander populations in Australia 1996–2021: implications for One health. *Front Public Health* 2023;11.
- Hillier SA, Taleb A, Chaccour E, Aenishaenslin C. Examining the concept of One Health for indigenous communities: a systematic review. *One Health* 2021;12:100248.
- Australian Government Department of Health and Aged Care. *Protocol for making a change to the national notifiable diseases list in Australia Canberra, ACT*. 2015 [Available from: <https://www.health.gov.au/resources/publications/protocol-for-making-a-change-to-the-national-notifiable-diseases-list-in-australia>].
- Australian Government Department of Health. *National notifiable diseases surveillance system*. Canberra, ACT: Australian Government Department of Health; 2020 [Available from: <https://www1.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-nndss-casedefs-distype.htm>].
- Australian Government Department of Health and Aged Care. *Surveillance systems reported in communicable diseases Intelligence*. Canberra: ACT; 2016. 2020 [Available from: https://www1.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-surv_sys.htm].
- Gibney KB, Cheng AC, Hall R, Leder K. An overview of the epidemiology of notifiable infectious diseases in Australia, 1991–2011. *Epidemiol Infect* 2016;144(15):3263–77.
- Australian Bureau of Statistics. *Estimates of Aboriginal and Torres Strait Islander Australians*. Canberra, ACT: Australian Bureau of Statistics; 2022 [Available from: <https://www.abs.gov.au/statistics/people/aboriginal-and-torres-strait-islander-peoples/estimates-aboriginal-and-torres-strait-islander-australians/jun-2021states-and-territories>].
- Gibney KBD, Cheng ACP, Hall RF, Leder KP. Sociodemographic and geographical inequalities in notifiable infectious diseases in Australia: a retrospective analysis of 21 years of national disease surveillance data. *Lancet Infect Dis* 2016;17(1):86–97.
- Riley T, Anderson NE, Lovett R, Meredith A, Cumming B. Zoonoses and the Aboriginal and Torres Strait Islander population: a One health scoping review. *PLOS Global Public Health* 2022;2(10).
- CSIRO. *About the Indigenous seasonal calendars*. Canberra, Australia: CSIRO; 2022 [Available from: <https://www.csiro.au/en/research/indigenous-science/Indigenous-knowledge/Calendars/About>].
- CSIRO, The Bureau of Meteorology. *State of the climate 2022*. Canberra ACT. Commonwealth of Australia; 2022. p. 28.
- Green D, Minchin L. Living on climate-changed country: indigenous health, well-being and climate change in remote Australian communities. *EcoHealth* 2014;11(2):263–72.
- Yadav N, Upadhyay RK. Global effect of climate change on seasonal cycles, vector population and rising challenges of communicable diseases: a review. *Journal of Atmospheric Science Research* 2023;6(1).
- Australian government Department of health and aged care. *Salmonellosis*. Canberra ACT. Commonwealth of Australia; 2022 [Available from: <https://www.health.gov.au/diseases/salmonellosis?language=en>].
- Australian Government Department of Health and Aged Care. *Campylobacteriosis*. Canberra ACT. Commonwealth of Australia; 2022 [Available from: <https://www.health.gov.au/diseases/campylobacteriosis>].
- Hall G, Hanigan I, Dear K, Vally H. The influence of weather on community gastroenteritis in Australia. *Epidemiol Infect* 2011;139(6):927–36.
- Australian Government Department of Health and Aged Care. *Cryptosporidiosis*. Canberra ACT. Commonwealth of Australia; 2022 [Available from: <https://www.health.gov.au/diseases/cryptosporidiosis?language=en>].
- Lal A, Cornish LM, Fearnley E, Glass K, Kirk M. Cryptosporidiosis: a disease of tropical and remote areas in Australia. *PLoS Neglected Trop Dis* 2015;9(9):e0004078.
- Australian Government Department of Health and Aged Care. *Ross River virus infection*. Canberra ACT. Commonwealth of Australia; 2022 [Available from: <https://www.health.gov.au/diseases/ross-river-virus-infection?language=en>].
- Jacups SP, Whelan PI, Markey PG, Cleland SJ, Williamson GJ, Currie BJ. Predictive indicators for Ross River virus infection in the Darwin area of tropical northern Australia, using long-term mosquito trapping data. *Trop Med Int Health* 2008;13(7):943–52.
- The Pennsylvania State University. *Applied time series analysis USA*. 2024 [Available from: <https://online.stat.psu.edu/stat510/lesson/5/5.1>].
- Standen JC, Spencer J, Lee GW, Van Buskirk J, Matthews V, Hanigan I, et al. Aboriginal population and climate change in Australia: implications for health and adaptation planning. *Int J Environ Res Publ Health* 2022;19(12):7502.
- Melody SM, Bennett E, Clifford HD, Johnston FH, Shepherd CCJ, Alach Z, et al. A cross-sectional survey of environmental health in remote Aboriginal communities in Western Australia. *Int J Environ Health Res* 2016;26(5–6):525–35.
- Gibney K, Cheng A, Hall R, Leder K. Australia's national notifiable diseases surveillance system 1991–2011: expanding, adapting and improving. *Epidemiol Infect* 2017;145(5):1006–17.

31. May FJ, Stafford RJ, Carroll H, Robson JM, Vohra R, Nimmo GR, et al. The effects of culture independent diagnostic testing on the diagnosis and reporting of enteric bacterial pathogens in Queensland, 2010 to 2014. *Commun Dis Intell Q Rep* 2017;**41**(3):E223–30.
32. Burleigh A, McMahon S, Kiely S. Owned dog and cat populations in remote Indigenous communities in the Northern Territory: a retrospective study. *Aust Vet J* 2015;**93**(5):145–50.
33. Riley T, Meredith A, Anderson NE, Cumming B, Thandrayen J, Lovett R. Undertaking One health research with Australian Aboriginal and Torres Strait Islander

communities: implications of a One health Pilot study. *One Health Cases* 2023; **2023**:ohcs20230031.

Appendix A Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.anzjph.2025.100239>.