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Short report

Emergence of non-choleragenic *Vibrio* infections in Australia

Michelle Harlock, Stewart Quinn, Alison R Turnbull

Abstract

Vibrio infection was rarely reported in Tasmania prior to 2016, when a multistate outbreak of *Vibrio parahaemolyticus* associated with Tasmanian oysters was identified and 11 people reported ill. Since then, sporadic foodborne cases have been identified following consumption of commercially- and recreationally-harvested oysters. The increases in both foodborne and non-foodborne *Vibrio* infections in Tasmania are likely associated with increased sea water temperatures. As oyster production increases and climate change raises the sea surface temperature of our coastline, Tasmania expects to see more vibriosis cases. Vibriosis due to oyster consumption has been reported in other Australian states, but the variability in notification requirements between jurisdictions makes case and outbreak detection difficult and potentially hampers any public health response to prevent further illness.

Introduction

Vibrio species are naturally occurring estuarine and marine bacteria. Approximately a dozen *Vibrio* species are known to cause infections in humans, but four species are responsible for most illness: *V. cholerae*, *V. vulnificus*, *V. parahaemolyticus* and *V. alginolyticus.* Infections may be acquired through consumption of contaminated seafood or exposure to contaminated water.[1] *Vibrio* species are routinely detected in low concentrations in raw seafood, most often with no implications for human health. Most reported foodborne illness comes from Asia and the United States of America,[2] associated with filter-feeding bivalve molluscs. These organisms concentrate bacteria through their filter feeding and are commonly consumed raw. In addition, *Vibrio* species can proliferate post-harvest if strict temperature control is not adhered to.

Outbreaks in Australia

Documented foodborne outbreaks associated with non-choleragenic *Vibrio* are rare in Australia. Prior to 2016, there were two outbreaks recorded, both with an unknown source (Table 1).

In 2016, Tasmania identified a multi-jurisdictional outbreak of *V. parahaemolyticus* involving 11 cases. Case interviews and subsequent traceback of oysters led to the identification of the source oyster lease in Tasmania.[3,4] A rapid trade-level recall was initiated, and the oyster lease closed pending investigation outcomes. This was the first recorded outbreak of *V. parahaemolyticus* from Tasmanian-produced oysters. Almost concurrent with the Tasmanian oyster outbreak, Western Australia investigated cases of locally-acquired *Vibrio parahaemolyticus* that were likely linked to oysters grown in South Australia (Table 1). Individual cases of locally-acquired foodborne vibriosis have been reported from states where *Vibrio* infections are notifiable (Figure 1), with oyster consumption reported frequently in food histories (76%, 22/29 cases, Table 2).

Vibrio infection is not a nationally notifiable disease and foodborne outbreaks possibly go undetected. Currently all *Vibrio* infections are notifiable in Tasmania; but there are varying notification requirements for non-choleragenic vibriosis across other jurisdictions. *Vibrio* species are also potentially under-detected in clinical specimens, but recovery in laboratories can

Table 1: Outbreaks of non-cholera vibriosis recorded in Australia with number of cases and total cases where *Vibrio* species were confirmed from clinical specimens, 2002–2019[a]

Year	Jurisdiction reporting outbreak[b]	Cases (number confirmed)	*Vibrio* species	Suspected vehicle	Source jurisdiction[b]
2002	NSW	2 (1)	*V. parahaemolyticus*	Unknown	Unknown
2005	Tas.	2 (1)	*V. parahaemolyticus*	Unknown	Unknown
2016	Tas.[c]	11 (8)	*V. parahaemolyticus*	Oysters	Tas.
2016	WA[c]	9 (9)	*V. parahaemolyticus*	Oysters	SA
2017	NSW	3 (1)	*V. albensis*	Oysters	Tas.

a Source: OzFoodNet Outbreak Register, provided by the Office of Health Protection and Response, Australian Government Department of Health, on behalf of OzFoodNet. Data extracted on 23 March 2021.

b NSW: New South Wales; SA: South Australia; Tas.: Tasmania; WA: Western Australia.

c Reported by indicated jurisdiction, but multijurisdictional outbreak.

be improved with the use of additional selective media. *Vibrio* is not often included in routine faecal multiplex polymerase chain reaction (Multiplex PCR) kits which are now commonly used instead of bacterial culture.

The Tasmanian situation

Vibriosis notifications in Tasmania are classified as foodborne when *Vibrio* is detected in a faecal specimen or when there is associated gastroenteric illness prior to detection from a blood culture. Non-foodborne infections are generally wound or ear swab detections. From 2003 to 2020, 55 cases of non-choleragenic vibriosis were notified in Tasmania, with 22 foodborne and 32 non-foodborne infections; for one historical case from 2008, the mode of transmission is unknown. Thirty-three vibriosis cases (60%) were acquired in Tasmania. Most of the vibriosis cases were reported from 2016 onwards (78%, 43/55 cases), of which 77% (33/43 cases) were Tasmanian-acquired infections.[i]

Tasmania reported 10 cases of locally-acquired foodborne vibriosis from 2016 to 2020 inclusive (Figure 1). Most cases were males (70%); the median age of cases was 60 years (range 42–83 years). Of the cases, 30% were hospitalised. All case isolates were *Vibrio parahaemolyticus*. Three cases were linked to the 2016 multi-jurisdictional outbreak; one case in 2017 was linked to a recreational harvest of oysters; and six sporadic cases in 2019 were linked to commercially-harvested oysters from various Tasmanian locations. In Tasmania there is a rapid response to foodborne cases of vibriosis that aims to identify the source of the infection and to determine if a broader public health and food regulatory response is required.

There is limited public health action in response to sporadic non-foodborne cases of vibriosis; however, there have been 23 cases of locally-acquired non-foodborne-related vibriosis reported from 2016 to 2020. Most non-foodborne infections were caused by *Vibrio alginolyticus* (17 cases).

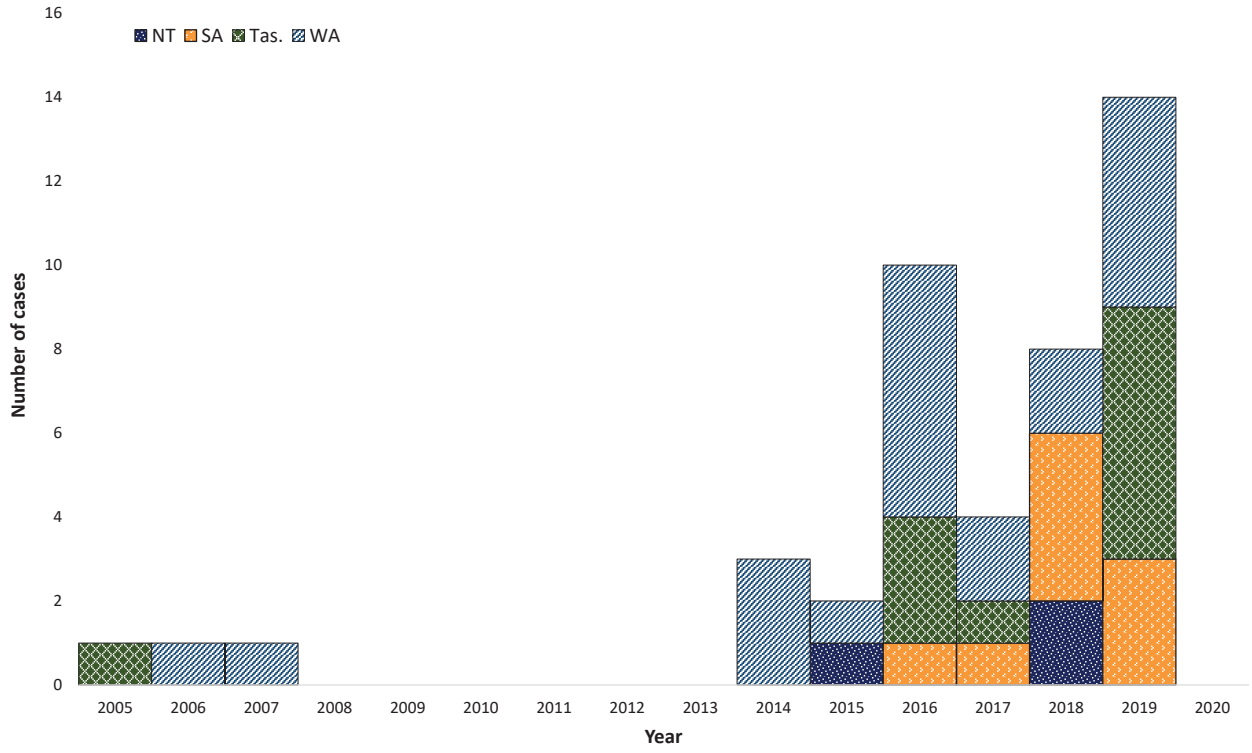
Further characterisation of sporadic foodborne *Vibrio parahaemolyticus* cases beyond speciation was not routine prior to 2016. With the increase in Tasmanian-acquired infections, isolates from human cases and food samples will be referred for whole genome sequencing (WGS) and phylogenetic analysis as required.

Climate factors

Environmental factors can lead to increased amounts of *Vibrio* species in the water column and changes in the prevalence of pathogenic

i Tasmanian Department of Health (unpublished data, accessed on 1 March 2021).

Figure 1: Locally-acquired foodborne cases of *V. parahaemolyticus*, in jurisdictions[a] where *Vibrio* infection/*V. parahaemolyticus* is notifiable, by derived diagnosis year,[b] 2005-2020



a NT: Northern Territory; SA: South Australia; Tas.: Tasmania; WA: Western Australia.

b The year is derived from the earliest date in association with the notification (onset date, specimen date or notification date) that was provided by each jurisdiction. *Vibrio parahaemolyticus* only became notifiable in South Australia in 2016 and data was provided from that year onwards. Cases with an overseas travel history or where travel history was unknown (cases lost to follow up) have not been included.

strains. Numbers are usually highest when water temperatures are 20–30 °C and are mostly not present when temperatures drop below 10 °C.[5]

The Tasmanian outbreak in 2016 occurred during a marine heat wave lasting 251 days, where surface water temperatures were up to 2.9 °C above climatology.[6] Follow-up surveys of *Vibrio* species in oysters from the implicated growing area found *V. parahaemolyticus* in all samples tested, with 20% and 16.6% of samples containing the *tdh* and *trh* virulence genes respectively. A clinical isolate from a case from the 2016 outbreak also contained both these virulence-associated genes.[3]

Climate anomalies have been associated with increasing risk of *Vibrio* infections globally.[1,7–10] Of note are outbreaks associated with cold water areas such as Alaska[11] and more recently New Zealand.[12]

Conclusion – *Vibrio* as an emerging issue for Australia

Australia currently produces 8,824 tonnes of oysters per annum,[13] with significant increases in production expected over the next few years as state and territory governments support development in regional areas. In particular, a large-scale commercial oyster industry is being developed in northern Australia in warm waters.[14] It is likely the combined growth in the oyster industry and climate-related factors will increase the incidence of vibriosis in Australia. As vibriosis is not nationally notifiable, case and outbreak detection are difficult in some states; cases of non-cholera vibriosis are likely

Table 2: Locally-acquired sporadic cases of foodborne *V. parahaemolyticus* reported in jurisdictions where disease is notifiable, with oyster and seafood consumption reported in interviews, 2016–2020[a,b]

Food vehicle	Jurisdiction of origin for oysters	Jurisdiction case notified in[c]				Total
		NT	SA	Tas.	WA	
Ate oysters only	Unknown	0	5	0	0	5
	Tasmania	0	0	6	0	6
	South Australia	0	1	0	1	2
	New South Wales	0	0	0	1	1
	Australia (state or territory unknown)	0	0	0	3	3
Ate seafood which included oysters	Unknown	0	2	0	1	3
	Tasmania	0	0	1	0	1
	Australia (state or territory unknown)	0	0	0	1	1
Ate seafood (unknown if oysters included)	Traceback for seafood unknown	0	0	0	3	3
Unknown food eaten	Not applicable	2	1	0	1	4
Total		**2**	**9**	**7**	**11**	**29**

a Data kindly provided by OzFoodNet sites within Department for Health and Wellbeing, Government of South Australia, WA Department of Health and NT Department of Health.

b Cases associated with a known outbreak are not included in the data.

c NT: Northern Territory; SA: South Australia: Tas.: Tasmania; WA: Western Australia.

to be under-reported. A national discussion to consider *V. parahaemolyticus* infection as a nationally notifiable disease is warranted.

Industry controls are being implemented in Tasmania that aim to minimise the risk of cases and foodborne outbreaks occurring.[15] Similar controls should be considered in other oyster-producing jurisdictions.

Caveats for outbreak data

Outbreaks of suspected foodborne illness are notified to state and territory Health Departments sometimes before a pathogen is identified and, as such, *Vibrio* may be recorded as the etiological agent in an outbreak where it is not itself a notifiable disease in that jurisdiction.

Foodborne outbreak data provided only includes incidents which are reported to, and investigated by, OzFoodNet sites. It is assumed that outbreaks of gastroenteritis are often not reported to health authorities, resulting in under-representation of the true burden of enteric disease outbreaks within Australia. The number of outbreaks and cases of illness reported may differ over time, as these can take time to finalise. At the time of extraction, the OzFoodNet Outbreak Register contained records up to the end of 2019 only. OzFoodNet Outbreak Register data were provided by the Office of Health Protection and Response, Australian Government Department of Health, on behalf of OzFoodNet.

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Author details

Ms Michelle Harlock,[1]

Mr Stewart Quinn,[1]

Ms Alison R. Turnbull,[2,3]

1. Public Health Services, Department of Health, Tasmania

2. Institute of Marine and Antarctic Studies, University of Tasmania

3. Food Safety Research Program, South Australian Research and Development Institute

Corresponding author

Ms Michelle Harlock
Address: GPO Box 125 Hobart, Tasmania 7001
Phone: 03 6166 0667
Email: michelle.harlock@health.tas.gov.au

References

1. Baker-Austin C, Trinanes J, Gonzalez-Escalona N, Martinez-Urtaza J. Non-cholera vibrios: the microbial barometer of climate change. *Trends Microbiol*. 2017;25(1):76–84.

2. Food and Agriculture Organization of the United Nations (FAO), World Health Organization. *Risk assessment tools for Vibrio parahaemolyticus and Vibrio vulnificus associated with seafood*. Rome: FAO; 2020. Available from: https://apps.who.int/iris/handle/10665/330867.

3. Madigan T, Wilson K, Smith G, Turnbull A. *Assessing the occurrence of pathogenic Vibrio species in oysters from Moulting Bay*. (Report No.: 2015-042.) Canberra: Fisheries Research & Development Corporation; 22 March 2017. Available from: https://frdc.com.au/sites/default/files/products/2015-042-DLD.pdf.

4. Tasmanian Government Department of Health. 1st Quarter Communicable Disease Report 2016. [Webpage.] Hobart: Tasmanian Government Department of Health; September 2016. Available from: http://www.dhhs.tas.gov.au/publichealth/communicable_diseases_prevention_unit/1st_quarter_report_2016 .

5. Tantillo GM, Fontanarosa M, Di Pinto A, Musti M. Updated perspectives on emerging vibrios associated with human infections. *Lett Appl Microbiol*. 2004;39(2):117–26.

6. Oliver ECJ, Benthuysen JA, Bindoff NL, Hobday AJ, Holbrook NJ, Mundy CN, et al. The unprecedented 2015/16 Tasman Sea marine heatwave. *Nat Commun*. 2017;8(1):16101. doi: https://doi.org/10.1038/ncomms16101.

7. Martinez-Urtaza J, Bowers JC, Trinanes J, DePaola A. Climate anomalies and the increasing risk of *Vibrio parahaemolyticus* and *Vibrio vulnificus* illnesses. *Food Res Int*. 2010;43(7):1780–90.

8. Baker-Austin C, Trinanes JA, Taylor NGH, Hartnell R, Siitonen A, Martinez-Urtaza J. Emerging *Vibrio* risk at high latitudes in response to ocean warming. *Nat Clim Chang*. 2013;3(1):73–7.

9. Vezzulli L, Colwell RR, Pruzzo C. Ocean warming and spread of pathogenic vibrios in the aquatic environment. *Microb Ecol*. 2013;65(4):817–25.

10. Raszl SM, Froelich BA, Vieira CR, Blackwood AD, Noble RT. *Vibrio parahaemolyticus* and *Vibrio vulnificus* in South America: water, seafood and human infections. *J Appl Microbiol*. 2016;121(5):1201–22.

11. McLaughlin JB, DePaola A, Bopp CA, Martinek KA, Napolilli NP, Allison CG et al. Outbreak of *Vibrio parahaemolyticus* gastroenteritis associated with Alaskan oysters. *N Engl J Med*. 2005;353(14):1463–70.

12. Whitworth J. Increase in vibrio illnesses prompts warning in New Zealand. [Webpage.] Seattle: Food Safety News; 23 June 2019. Available from: https://www.foodsafetynews.com/2019/06/increase-in-vibrio-illnesses-prompts-warning-in-new-zealand/.

13. Mobsby D. *Australian fisheries and aquaculture statistics 2017*. (FRDC Report 2018/134) Canberra: Australian Bureau of Agricultural and Resource Economics and Sciences; December 2018.

Available from: https://www.awe.gov.au/sites/default/files/sitecollectiondocuments/abares/publications/AustFishAquacStats_2017_v1.2.0.pdf.

14. Nowland SJ, O'Connor WA, Osborne MWJ, Southgate PC. Current status and potential of tropical rock oyster aquaculture. *Rev Fish Sci Aquac*. 2020;28(1):57–70.

15. Oysters Tasmania. *Vibrio parahaemolyticus. A guide for Tasmanian Shellfish Growers*. Hobart: Oysters Tasmania; 2019. Available from: https://www.oystersaustralia.org/vibrio.