Listeriosis

NSW Control Guideline for Public Health Units

Revision history

Version	Date	Revised by	Changes	Approval
1.0	01/07/2012	-	-	-
2.0	02/06/2016	Communicable Disease Branch	Update for consistency with the Listeriosis Series of National Guidelines (SoNG) v1.0 (endorsed Nov 2015, released 6 May 2016), localised for NSW as indicated by [hard brackets].	03/06/2016
2.1	01/01/2017	CDNA	Update to case definition	01/01/2017

1. Summary

Public health priority

High in view of potential severity and potential to mitigate ongoing exposure.

Case management

- respond to notifications of confirmed cases as per local protocols within 1 working day
- enter confirmed cases in jurisdictional Notifiable Diseases Database within 1 working day
- advise [Communicable Disease Branch (CDB)] of case within 1 working day of notification receipt
- provide data to National Enhanced Listeriosis Surveillance Scheme (NELSS) within 1 week of initial notification and update case details within 1 working day of new data receipt.

Contact management

Counsel and disseminate information to those exposed to a suspected common food source.

2. The disease

Infectious agent

Human listeriosis is caused by a single species of Listeria, *Listeria monocytogenes*, which can be further characterised.

Source of human infections

L. monocytogenes survives and multiplies in many non-human niches. Humans are an 'accidental' host, usually becoming infected following the consumption of contaminated food, or in the case of a fetus or newborn, vertically from their pregnant mother.

The sources of food contamination are many and varied as *L. monocytogenes* is widespread in the environment. For example, *L. monocytogenes* may be isolated from soil, surface water, decomposing organic matter, spoiled silage, sewage, commercial food-manufacturing environments, raw foods including vegetables, meats and dairy products and is carried in the gastrointestinal tract of many animals.

Although asymptomatic vaginal and faecal carriage has been reported [1] it is not considered a common source of infection in humans.

Mode of acquisition

Nearly all cases of human listeriosis result from the consumption of *L. monocytogenes* contaminated food [2] and vertical transmission during gestation, or uncommonly, birth or shortly after birth.[1] Listeriosis can be acquired via contaminated food in the hospital or nursing home setting as food is often produced on a large scale for provision to vulnerable populations. The elderly, those with immunocompromising conditions or those whose treatment includes acid-suppressing medications are particularly at risk.[3-5]

Unusual modes of transmission include: nosocomial transmission in the newborn period[1]; zoonotic transmission[6], including via direct contact with the placenta and other birth fluids of infected farm animals, particularly stillborn animals; and laboratory transmission.[7]

The outcome of exposure is highly dependent on the immune status of the host and the dose of organisms ingested.[1]

Incubation period

The incubation period can be up to 70 days after exposure[8] and can vary depending on the form of listeriosis. For invasive listeriosis, the median incubation period is 9 days (range 1–14 days) for central nervous system (CNS) involvement (e.g. meningitis) and 2 days (range 1–7 days) for bacteraemia.[9]

The median incubation period for pregnancy-associated listeriosis is 27.5 days (range 17–67 days).[9]

Infectious period

As horizontal person-to-person transmission generally does not occur this is not relevant to routine public health practice.

Clinical presentation and outcome

Listeriosis can manifest as an invasive or non-invasive infection.

- Invasive listeriosis manifestations include sepsis and/or CNS infection. The onset of meningoencephalitis (which is rare in pregnant women) may be sudden, with fever, intense headache, nausea, vomiting and signs of meningeal irritation, or may be subacute. Delirium and coma may appear early; occasionally there is circulatory collapse and shock.[8]

- Pregnancy-associated listeriosis can result in signs in the mother and the baby. The infected mother may be asymptomatic or have mild influenza-like symptoms. Fetal infection results in

fetal death, spontaneous abortion, stillbirth or neonatal infection. Neonatal infection typically presents as septicaemia or meningitis and is more common when the mother was infected during the third trimester. Late onset neonatal listeriosis (usually presenting as purulent meningitis) generally affects full-term babies who are usually healthy at birth.

- Invasive listeriosis is characterised by a high case fatality rate of 24–52% among non-pregnant adults despite adequate antimicrobial treatment.[6] The case fatality rate varies with underlying diseases. Neurological sequelae can occur.[10]

- Non-invasive listeriosis (food poisoning, also referred to as febrile listerial gastroenteritis) follows the consumption of food with exceptionally high levels of *L. monocytogenes* (>10^6cfu/g). It presents with vomiting and diarrhoea, sometimes progressing to bacteraemia but is usually self-resolving. Non-invasive listeriosis has been observed during a number of outbreaks and is characterised by a short incubation period.[11] Individual cases of this form of listeriosis are not nationally notifiable.

Persons at increased risk of disease

Those at highest risk are generally the immunocompromised (by disease or treatment), elderly, pregnant, newborn and occasionally those who have certain chronic medical conditions (e.g. heart disease, diabetes, liver disease, renal disease, cancer, alcohol dependency) or are medicated (e.g. gastric acid inhibitors).[12-14]

Disease occurrence and public health significance

Although invasive listeriosis is a relatively rare disease, the severity of the disease and the usual involvement of commercially manufactured foods, especially during outbreaks, mean that the social and economic impact of listeriosis is among the highest of the foodborne diseases. [2] The clinical impact appears to be much less for non-invasive listeriosis (febrile gastroenteritis).

Even though exposure to *L. monocytogenes* in food is probably relatively common[15], invasive listeriosis is an uncommon disease. In Australia, the five year mean (2011-2015) was 78 cases per year, with a notification rate of 0.3 per 100,000 population. Approximately equal numbers of cases were notified in males and females.[16]

In the United States, among women of reproductive age (15–44 years), pregnant women had a markedly higher listeriosis risk than non-pregnant women.[17] In Australia, there were 27 pregnancy-related cases between 2010 and 2014. There were 61 listeriosis-associated deaths in Australia between 2010 and 2014, comprising 51 adult and 10 fetal/neonatal deaths.[18]

During recent years, the incidence of listeriosis in most countries has remained constant, with a number of countries reporting declines in the incidence of disease. These reductions likely reflect the efforts in those countries by industry and governments including:

- implementation of good hygienic practice and application of Hazard Analysis Critical Control Points (HACCP) principles to reduce the frequency and extent of *L. monocytogenes* in ready-to-eat (RTE) foods
- improvement of the integrity of the cold chain through processing, distribution, retail and the home to reduce the incidence of temperature abuse conditions that foster the growth of *L. monocytogenes*
- enhanced risk communication, particularly for pregnant women.[19]

Most cases of listeriosis are sporadic, but outbreaks occur. Listeriosis outbreaks recognised and reported in Australia since 2005 are summarised in Table 1.

Table 1 Outbreaks of infection with *Listeria monocytogenes* reported by state/territory and year of onset of the first case, Australia, 2005-2013, OzFoodNet18

Year	Jurisdiction	Setting where food was prepared	Invasive Cases	Deaths reported during the outbreak*	Food implicated
2005	SA	Hospital	5	3	RTE meats: silverside-corned beef
2009	WA	Restaurant	3	0	Cooked chopped chicken
2009	Multijurisdictional	Commercially manufactured	13	4	Chicken wraps
2010	Multijurisdictional	Primary produce	9	2	Melons
2010	Victoria	Commercially manufactured	6	4	Cold meat
2012	NSW/Victoria	Commercially manufactured	3	1	Smoked salmon suspected
2012-2013	Multijurisdictional	Commercially manufactured	34	7	Cheese (brie/camembert)
2013	NSW	Commercially manufactured	3	1	Profiteroles
2013	WA	Commercially manufactured	3	0	Pre-prepared frozen meals

**deaths include fetal deaths*

3. Routine prevention activities

The main strategies for reducing exposure to *L. monocytogenes* are reducing contamination of food products and providing dietary recommendations to high risk groups to avoid potentially contaminated food. There is no evidence of acquired immunity[8] and no vaccine to prevent listeriosis.

Reducing contamination of food products

A wide variety of foods may be contaminated with *L. monocytogenes*, but outbreaks and sporadic cases of listeriosis are predominantly associated with RTE foods.[2] RTE foods include commercially manufactured foods that have a long recommended refrigerated shelf-life and fresh foods that are consumed without further bactericidal treatment, e.g. cooking. Five key factors contribute strongly to the risk of listeriosis associated with RTE foods:

- amount and frequency of consumption of a food
- frequency and extent of contamination of a food with *L. monocytogenes*
- ability of the food to support the growth of *L. monocytogenes*
- temperature of refrigerated/chilled food storage
- duration of refrigerated/chilled storage.[2]

Food Standards Australia New Zealand (FSANZ) has regard to the Codex Alimentarius Commission guidelines[19] in developing national standards for food processing controls. Regular testing programs for high risk foods to limit the maximum levels of *L. monocytogenes* in foods operate in Australian jurisdictions. Packaged RTE foods found to have an unacceptable level of contamination with *L. monocytogenes* may be recalled from sale.[20]

Local and State Government agencies responsible for the enforcement of the food safety standards regulate hygiene practices of food handlers in retail food establishments, including delicatessens and take away food premises, according to FSANZ Standards applied through jurisdictional Food Acts, to ensure the use of appropriate food handling and storage procedures [21]. In the home, temperature control, limiting the length of storage periods and adequate cooking can mitigate increased risk of *L. monocytogenes* contamination.[22]

Reducing exposure by provision of dietary recommendations to high risk groups

People in high risk groups for listeriosis should avoid high risk foods[22], for example:

- cold meats: unpackaged ready-to-eat from delicatessen counters, sandwich bars, etc., and cold meats, packaged, sliced ready-to-eat
- cold cooked chicken: purchased (whole, portions, or diced) ready-to-eat
- pate: refrigerated pate or meat spreads
- salads (fruit and vegetables): pre-prepared or pre-packaged salads e.g. from salad bars, smorgasbords, etc.
- chilled seafood: raw (e.g. oysters, sashimi or sushi), smoked ready-to-eat, ready-to-eat peeled prawns (cooked) e.g. in prawn cocktails, sandwich fillings, and prawn salads
- cheese: soft, semi soft and surface ripened cheeses (pre-packaged and delicatessen) e.g. brie, camembert, ricotta, feta and blue cheese
- ice cream: soft serve
- other dairy products: unpasteurised dairy products (e.g. raw milk).

Dietary advice for people at risk of listeriosis can also be found at:
http://www.foodstandards.gov.au/publications/Pages/listeriabrochuretext.aspx

4. Surveillance objectives

- To promptly investigate all cases
- To detect clusters and outbreaks of disease, so as to enable prompt public health responses
- To identify and control common sources of infection
- To understand the local epidemiology of the disease to better inform prevention strategies.

5. Data management

Notification data

Details of confirmed cases should be entered on [NCIMS] within 1 working day of notification.

Patient-related interview data

[Attempt to interview all cases (or care givers / next of kin where required) using the National OzFoodNet *Listeria* Case Questionnaire (Appendix 3). Attach completed questionnaires to the NCIMS record].

Once received, the [CDB staff] enter enhanced surveillance data on the OzFoodNet NELSS database.[23]

Human isolates and their testing data

Confirm existence of a culture isolate and arrange transfer to jurisdictional reference laboratory for initial and further typing. Typing results should be added to NELSS by [CDB staff] as they become available.

Food and food-related samples and isolate data

During an investigation it may be relevant to collect food from cases. This should be done in consultation with the [NSW Food Authority (NSWFA)].

Routine NELSS data

Routine NELSS data is captured by CDB staff. OzFoodNet routinely analyses and disseminates this information on a fortnightly basis to OzFoodNet sites. Cases are also reported nationally to CDNA via OzFoodNet fortnightly surveillance reports.

Multi-Jurisdictional Outbreak Investigation (MJOI) data

Investigation data from a potential or declared MJOI are handled in accordance with the OzFoodNet MJOI guidelines.

6. Communications

Immediately post-notification

On confirmation of a diagnosis of listeriosis, pathology laboratories and/or clinicians notify jurisdictions by urgent means, e.g. electronic laboratory notification or telephone, to the [local PHU].

The jurisdiction should ensure that the treating doctor is informed of the notification prior to case follow-up.

[Inform CDB via enteric@doh.health.nsw.gov.au of the notification within 1 working day of the diagnosis. Inform cdoncall if an urgent afterhours public health response is required].

OzFoodNet central routine

OzFoodNet central disseminates a fortnightly summary, to stakeholders, with supplemental reports as needed. Cases are also reported nationally to CDNA via OzFoodNet fortnightly surveillance reports.

Laboratory reporting

Laboratory testing results should be communicated back to the investigating PHU and [CDB] for inclusion on [NCIMS] and the NELSS database.

MJOI under consideration or declared

The OzFoodNet MJOI guidelines provide guidance around communications required during a MJOI.

Suspect food under investigation

When a specific food is suspected, the [NSW Food Authority] should be notified. National co-ordination of food recalls and subsequent communication is the responsibility of FSANZ. The National Food Incidence Response protocol exists to outline actions required by food regulators during investigations.

International considerations

The MJOI protocol includes guidance on when notification under the *International Heath Regulations 2005* is required.

7. Case definition

Only **confirmed cases** should be notified. Where a mother and fetus (≥20 weeks gestation)/neonate are both confirmed, both cases should be notified.

Confirmed case
A confirmed case requires either:
laboratory definitive evidence.
OR
Clinical and **epidemiological evidence**.

Laboratory definitive evidence
Isolation or detection of *Listeria monocytogenes* from a site that is normally sterile, including fetal gastrointestinal contents.

Clinical evidence
1. A fetus/neonate where the gestational outcome is one of the following:
   a. Stillbirth
   b. Premature birth (<37 weeks gestation)
   c. Diagnosis (within the first month of life) with at least one of the following:

- Granulomatosis infantiseptica
- Meningitis or meningoencephalitis
- Septicaemia
- Congenital pneumonia
- Lesions on skin, mucosal membranes or conjunctivae
- Respiratory distress and fever at birth

AND
In the absence of another plausible diagnosis

OR

2. A mother has experienced at least one of the following conditions during pregnancy:
   a. Fever of unknown origin
   b. Influenza like illness
   c. Meningitis or meningoencephalitis
   d. Septicaemia
   e. Localised infections such as arthritis, endocarditis and abscesses
   f. preterm labour/abruption

   AND
   In the absence of another plausible diagnosis

Epidemiological evidence
A maternal/fetal pair where one of either the mother or fetus/neonate is a confirmed case by **laboratory definitive evidence** (up to 2 weeks postpartum).

Notes

1. The clinical **and** epidemiological evidence criteria for a confirmed case means that if the mother is a confirmed case by laboratory definitive evidence, then the fetus/neonate is also a confirmed case if they have the defined (fetus/neonate) clinical evidence, and vice versa.
2. Laboratory definitive evidence in a fetus <20 weeks gestation means the mother only is a confirmed case.

Case definitions can be found on the Department of Health's website:
http://www.health.gov.au/casedefinitions

8. Laboratory testing

Case confirmation

Listeria infection is confirmed when *L. monocytogenes* is identified, mostly by culture, from sterile sites (often cerebrospinal fluid or blood), foetus/neonate (including gastrointestinal contents) or associated products of conception (e.g. amniotic fluid, placental tissue).

Listeria infection can also be identified by polymerase chain reaction (PCR) testing of specimens. Where listeriosis has been diagnosed using PCR, the sample should also be cultured to enable definitive characterisation of an isolate.

L. monocytogenes is not routinely sought in stool from sporadic cases presenting with febrile diarrhoea (non-invasive listeriosis), nor in the stool of unaffected persons outside a specific investigation or cluster/outbreak.

Serology is no longer used for the diagnosis of *L. monocytogenes*.

Potential source detection

While non-culture methods for detection of *Listeria* spp. or *L. monocytogenes* in non-human samples (e.g. food and environmental) are often performed in routine testing, an isolate of

L. monocytogenes should be sought as per the Australian Standard for food microbiology current at the time.[24]

When an isolate is cultured from an epidemiologically implicated food or otherwise during a cluster/outbreak investigation, the *L. monocytogenes* therein should be enumerated as per the Australian Standard for food microbiology current at the time.[25]

Isolates of *L. monocytogenes* from relevant non-human detections e.g. implicated foods, recalled foods, samples taken for any purpose during an investigation, should be forwarded to the jurisdictional reference laboratory for further characterisation to help inform attribution.

Organism characterisation

Methods of characterisation are evolving. There is a need for both rapid and definitive methods. Methods in use at any particular time will be decided by PHLN laboratories in consultation with OzFoodNet, jurisdictions and CDNA. All human *L. monocytogenes* isolates are characterised as part of NELSS. Non-human *L. monocytogenes* isolates should also be characterised.

Current methods include molecular serotyping, binary typing, multi-locus variable number tandem repeat analysis, multi-locus sequence typing, pulsed field gel electrophoresis and phylogenetic relatedness based on whole genome sequencing. Classical serotyping is no longer widely used.

Primary testing laboratories should refer isolates to jurisdictional public health laboratories for characterisation in a timely fashion.

Cluster detection, investigation and source attribution

Clusters may become evident from notification details and/or isolate characterisation details as reported by the laboratory. Routine analysis of NELSS data helps identify listeria clusters based on organism characterisation.

9. Case management

Response times

The case investigation should begin within 1 working day following the notification of a confirmed case.

Response procedure

Case investigation

[Note: steps reordered to delineate PHU and CDB functions]

[The PHU should take the following actions]:

- Confirm results of relevant pathology tests, or recommend the tests be done
- [Seek the doctor's permission to contact the case or relevant care-giver, and find out if the case or relevant care-giver has been told what the diagnosis is before beginning the interview]
- [Interview the case/next of kin/care-giver and treating doctor to] complete the National OzFoodNet *Listeria* Case Questionnaire (Appendix 3). Follow up of listeriosis cases can be particularly sensitive; cases may be deceased, and it is sometimes necessary to interview next of kin, or females who may have experienced a miscarriage or stillbirth.
- If appropriate, secure any available residual suspected foods and refer to the NSW Food Authority to arrange collection and testing
- If cases were institutionalised (e.g. in hospital or aged care) for their entire incubation period, or food at the institution is the suspected source of infection:
  - Obtain records (itemised list or menu) of foods served to the case during the exposure period
  - Refer environmental investigation of the institution to the NSW Food Authority
  - If the case was immunocompromised, check whether they had been placed on a 'low listeria diet' on admission (see also Section 12. Special Situations).
- [Update NCIMS records and attached the completed questionnaire]
- Ensure clinical isolates are sent to [ICPMR] for typing
- [Complete a CDONCALL Report (note: if records are up to date, this can be printed/download from NCIMS), and send to enteric@doh.health.nsw.gov.au – if afterhours and urgent response is required, additionally notify cdoncall]
- [Review epidemiological links between cases within the local jurisdiction], assess the possibility of a common source outbreak
- Maintain surveillance for further cases.

[CDB (OzFoodNet Epidemiologists) should take the following actions]:

- Capture case interview information on NELSS
- [Follow-up typing and whole genome sequencing data from ICPMR and MDU, and capture this information on NCIMS and NELSS]
- [Review epidemiological and molecular links between cases, and investigate linked cases in collaboration with PHUs, NSW Food Authority and OzFoodNet representatives in other jurisdictions where appropriate (see also Section 12. Special Situations)].

Case treatment

Antibiotic treatment should be prescribed by the treating physician as per the *Australian Therapeutic Guidelines – Antibiotic.* [26]

Education

The case or relevant care-giver should be provided with advice about the nature of the infection and the mode of transmission (refer to Appendix 1: Listeriosis factsheets).

Pregnant women and known immunocompromised persons should be educated about high risk foods and safe food handling and storage.

Isolation and restriction

Exclusion from childcare, preschool, school or work is not necessary.

Active case finding

Active case finding should be initiated if there is evidence of a cluster of cases or of common exposure to a suspect source. [CDB] should be alerted to any isolation of *L. monocytogenes* in food served to vulnerable populations (e.g. meals on wheels, aged care, hospitals). Refer also to Section 12. Special situations.

10. Environmental and Food evaluation

L. monocytogenes is widely distributed in the environment and is frequently present in raw foods of both plant and animal origin. *L. monocytogenes* can survive and grow over a wide range of environmental conditions such as refrigeration temperatures (including the ability to survive freezing), low pH and high salt concentration and is resistant to a number of disinfectants, especially when organic matter is also present. It can remain viable in dry environments for long periods. This resilience provides a means for *L. monocytogenes* to contaminate and proliferate within food supplies, despite the use of common preservation methods designed to eradicate or limit the replication of other harmful microorganisms. It can persist in food processing environments resulting in post-processing contamination.[27]

Listeriosis is defined as a zoonosis, but direct transmission between ruminants and humans rarely occurs. In most cases of direct zoonotic transmission, the infections are non-life threatening cutaneous infections through contact with infected cattle or after handling of abortive material. However, ruminants, particularly cattle, contribute to amplification and dispersal of *L. monocytogenes* into the farm environment. Dairy farms and dairy processing facilities are frequently contaminated with *L. monocytogenes* compared to other environments, and its subtype populations in the farm environment encompass commonly strains that have been associated with human illness, whether sporadic or epidemic.[6]

Where a specific food has been identified as a suspected source, the [NSW Food Authority should be engaged to investigate] the premises where food was prepared and served to: determine the likelihood of disease transmission in that setting.

All *L. monocytogenes* isolates from foods subject to recalls should be forwarded to jurisdictional reference laboratories for further characterisation. *L. monocytogenes* isolated from foods implicated by cases should also be forwarded. A subset of jurisdictional food and environmental isolates should also be characterised on a regular basis.

[Food service managers in NSW Health facilities will routinely test food samples for *Listeria* and are required to notify their local PHU and the NSW Food Authority if *L. monocytogenes* is detected in food. Food is not sterile and *Listeria* bacteria are commonly found in food without ever causing harm. No action is required by the PHU unless there is a related case, or the food was ready-to-eat and served to patients. If there is reason to believe that a food contaminated was served to inpatients who are at higher risk for disease (e.g. because of underlying immune suppression or pregnancy), then the PHU should contact relevant clinicians (e.g. oncologists, immunologists and obstetricians) to inform them of the incident and remind them to consider listeriosis as a diagnosis in patients with consistent symptoms. Because there is no specific preventative action for people already exposed, direct contact with the patients is not useful].

11. Contact management

Identification of contacts

Person to person transmission does not usually occur, so identifying contacts is not usually relevant for listeriosis.

12. Special situations

Community Outbreaks

[Local PHU, CDB (OzFoodNet) and NSW Food Authority work in partnership to investigate and control outbreaks. PHUs and CDB are responsible for undertaking the epidemiological investigations of cases, and the NSW Food Authority (in collaboration with local councils) conducts environmental investigations, including traceback of implicated foods, where appropriate].

Jurisdictional outbreak

If two or more cases occur (other than maternal and fetal paired cases) that are epidemiologically linked e.g. common food source or common setting, or microbiologically linked (by typing), investigation should include the following:

- look for common source of infection
- test any available suspected foods
- characterisation of further related non-clinical *L. monocytogenes* isolates should be performed to confirm the outbreak and demonstrate whether case isolates and food isolates are indistinguishable
- investigate the source of any foods found to be positive for *L. monocytogenes* to determine at what point they became contaminated
- recall contaminated food if necessary through referral to food authorities
- in some outbreak settings, active case finding and investigation of non-invasive listeriosis (such as acute febrile gastroenteritis) may be warranted – for non-invasive febrile gastroenteritis, the median incubation period is around 24 hours (range 6 hours – 10 days).[9]

Multi-jurisdictional outbreak

When an outbreak is multi-jurisdictional as defined in the OzFoodNet MJOI guidelines, PHUs, food CDB, NSWFA and jurisdictional reference laboratories collaborate on the outbreak investigation. The investigation is conducted in accordance with the MJOI guidelines.

Facilities such as hospitals, long term care facilities and aged care facilities

A heightened level of concern is required for cases residing in a facility for all or part of their incubation period. Food served at the facility should be suspected until investigations determine otherwise. A single case in a facility may be sentinel for an outbreak and should trigger a thorough investigation of the source due to the vulnerability of facility populations, and be immediately reported to the facility's manager and medical health officer. For hospitalised patients that are immunocompromised, determine whether the hospital has a 'low listeria' diet, and whether the case had been placed on such a diet when admitted. If the hospital does not have a 'low listeria' diet, discussions should be held with the hospital's dietician, infection control and catering teams to implement such a diet and a mechanism for triaging patients into these diets when admitted.

When an outbreak occurs in a facility, PHU, CDB, NSWFA and reference laboratories of the relevant jurisdictions collaborate on the outbreak investigation in conjunction with the facility. Any epidemiologically implicated foods should be sampled and sent for laboratory testing.

Vulnerable infant populations

If a cluster of listeriosis associated with a susceptible infant population occurs, PHU staff should ensure that the facility's infection control procedures are reviewed and an investigation conducted to determine the likelihood, place, source and means of disease transmission – which will most probably be other than via food.

13. References and additional sources of information

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14. Appendices

Appendix 1: Listeriosis factsheet

Appendix 2: Listeriosis Case Investigation Checklist

Appendix 3: Listeriosis Disease Investigation form