Australian Government
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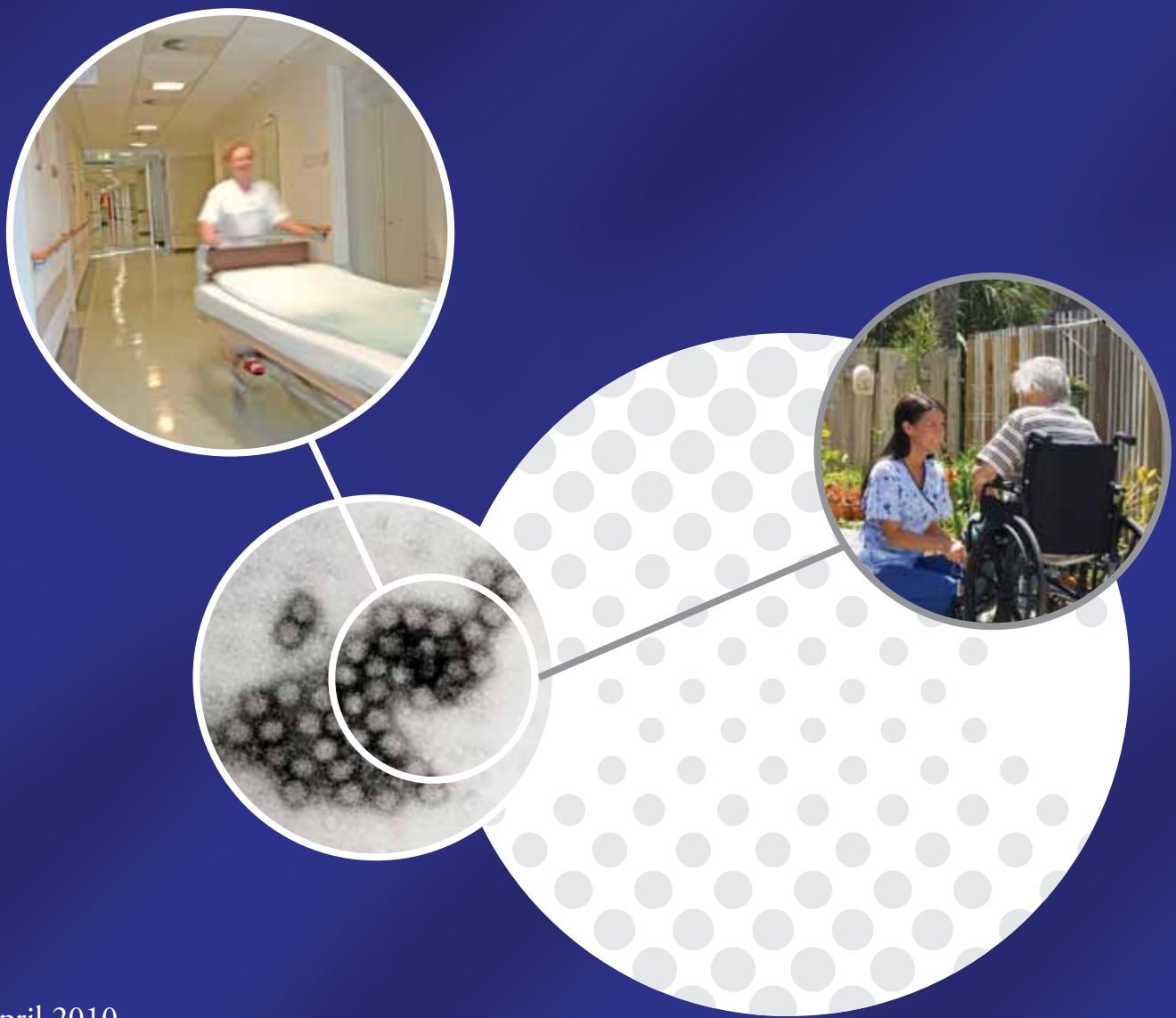
Communicable Diseases network AUSTRALIA

Guidelines for the public health management of **gastroenteritis outbreaks** due to norovirus or suspected viral agents in Australia



Endorsed April 2010

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Steering committee membership and terms of reference

The Communicable Disease Network Australia (CDNA) formed a working group in 2005 in order to develop national guidance regarding outbreaks of norovirus and suspected viral gastroenteritis, in response to increasing reports of outbreaks. These *Guidelines* are designed to complement existing state and territory guidelines.

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Disclaimer

These *Guidelines* are provided to assist public health units investigating outbreaks of norovirus and suspected viral gastroenteritis.

These *Guidelines* capture the knowledge of experienced professionals, build on past research efforts, and provide advice on best practice based upon the best available evidence at the time of completion.

The *Guidelines* are necessarily general and readers should not rely solely on the information contained within these *Guidelines*. The information contained within these *Guidelines* is not intended to be a substitute for advice from other relevant sources including State and Territory guidelines on the subject. These *Guidelines* are intended for information purposes only.

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Contents

Preface

Purpose of the *Guidelines*

The purpose of the *Guidelines for the public health management of gastroenteritis outbreaks due to norovirus or suspected viral agents in Australia* (the *Guidelines*) is to provide national best practice guidelines for staff of public health units.

They are written to help in identifying, preventing, defining and managing outbreaks of suspected viral illness, particularly those due to norovirus. They will assist in the investigation and management of outbreaks and are designed to guide investigations from the time a report is received, through the initial investigation to the control and clean-up phases. The Guidelines also identify educational opportunities.

Target audience

Staff of public health units, health departments and infection control practitioners will use these Guidelines. Extracts of Guidelines may also be useful for managers of aged-care facilities and other institutions and facilities affected by outbreaks.

Institutions are particularly affected by outbreaks of viral illness. For the purpose of the *Guidelines*, 'institutions' are taken to mean an organisation, society or community setting where people come together for long or short periods of time, on a one-off or ongoing basis – for example, a school, a cruise ship or an aged-care facility. The *Guidelines* are not specific to one particular setting or institution; the principles are applicable to any setting, although outbreaks may be more difficult to manage in certain institutional settings.

Preparation of *Guidelines*

The *Guidelines* have been prepared under the auspices of the Communicable Diseases Network Australia (CDNA). CDNA is a subcommittee of the Australian Health Protection Committee (AHPC), which is a subcommittee of the Australian Health Ministers' Advisory Council. CDNA consists of directors of communicable disease surveillance from State, Territory and Federal health departments, along with other expert members. The Norovirus Guidelines Working Group was formed by CDNA to develop these *Guidelines*. This group consisted of public health and laboratory representatives with support from the Australian Government Department of Health and Ageing (DoHA).

Topics covered

Recommendations in these *Guidelines* were derived from evidence-based literature and research and also from local and international documents specifically developed for norovirus and viral gastroenteritis.

The *Guidelines* make recommendations for:

- defining cases and outbreaks (Chapter 6)
- criteria for starting an investigation (Chapter 7, Section 7.2)
- outbreak investigation (Chapter 7)
- outbreak management (Chapter 8).

The attached appendices may be modified and used in specific outbreak settings. They include:

- links to further web-based sources of information about norovirus (Appendix 1)
- a public fact sheet (Appendix 2)
- information about collecting clinical specimens in an outbreak (Appendix 3)
- a summary of cleaning and disinfection procedures to use or forward to institutions and general practitioners to assist in outbreak control (Appendix 4)
- details of the management of norovirus outbreaks in aged-care facilities (Appendix 5).

Help for aged-care facilities

Appendix 5 has been specifically written to address the *Management of norovirus outbreaks in aged-care facilities*. The section includes detailed information on infection control measures, specimen collection and an illness register. This appendix has been designed to enable aged-care facilities to identify and self-manage outbreaks using the resources available as well as referring to any internal policies that they may already have in place.

Gastrointestinal illness in institutions is notifiable in some states and territories, as is suspected foodborne or waterborne illness. In this instance, aged-care facilities will need to report the outbreak to their local public health unit. Managers of aged-care facilities may at any time contact their local public health unit if needed, even if the outbreak is not notifiable in their jurisdiction. Aged-care facilities should also be encouraged to inform the state office of DoHA (aged care section) within their jurisdiction about the outbreak.

Using the *Guidelines*

The *Guidelines* should be used as a:

- reference for Public Health Unit (PHU) staff
- basis for education / training
- resource during outbreaks.

Chapter 1: Introduction

1.1 Norovirus

Norovirus is an infectious virus. It is recognised as a leading cause of acute gastroenteritis worldwide, and is the most common cause of outbreaks [1]. Noroviruses are highly infectious and are mainly spread from person to person [2]. In addition, aerosolised vomit can result in widespread environmental contamination and facilitate spread of the disease. These features contribute to widespread and intractable outbreaks in semi-closed environments such as planes [3]. Outbreaks have been reported in a variety of settings including hospitals, cruise ships, schools, prisons and childcare centres. In Australia, norovirus outbreaks are most commonly reported in Aged-care facilities (ACF), healthcare facilities and childcare centres [4]. These outbreaks can have an impact on our economic and social system as well as placing a major burden on the heath system.

1.2 History

In 2002, a surge of gastroenteritis outbreaks on cruise ships, aged care and healthcare facilities in the United States (US) and Europe was attributed to a new virus strain [5]. Australian health authorities also experienced a surge in reported outbreaks, which continues and is recognised as an emerging public health issue. Similarly, in 2006 and 2007, Australia experienced further surges of outbreaks due to new strains of norovirus known as GII.4, which were also reported in other countries [6, 7].

The exact reasons for these global increases in norovirus infections are not well understood. However, it is likely that predominance of these strains is due to the regular genetic shift that occurs in viruses, along with strain-based differences in virulence that can result in the global spread of viruses [8-11].

1.3 Detecting norovirus

The development of Reverse Transcription-Polymerase Chain Reaction (RT-PCR) diagnostic tests in the 1990s has improved the detection of norovirus infection. This has allowed for rapid detection of sporadic cases and outbreaks. Development of sensitive molecular techniques has demonstrated that these viruses are genetically diverse, with new strains frequently replacing predominant ones. Recent improvements in diagnostic techniques have changed the understanding of the clinical significance and epidemiology of this virus. In particular, diagnostic pathology laboratories are now commonly testing for norovirus using Enzyme-Linked Immunosorbent Assay (ELISA) antigen tests.

1.4 Managing norovirus

The virus cannot be cultured in the laboratory, which means that gathering evidence on the effectiveness of control measures has been difficult. It is not clear how long the virus survives in the environment, the infectivity of post-symptomatic shedding or the best use of chemical agents for disinfection.

Most of the guidelines available on norovirus and viral gastroenteritis are written specifically for management of norovirus outbreaks in ACFs, hospitals and cruise ships. Consequently, there is very little information provided specifically for managing outbreaks in other settings such as schools, sporting events and camps. Nevertheless, the principles outlined in Chapter 8 on cleaning and disinfection, handwashing, exclusion of affected people and isolation or cohorting of infected patients are applicable to all settings and should guide decision making in all circumstances.

Chapter 2: Background

2.1 Characteristics of norovirus

2.1.1 History

Gastroenteritis, that was probably due to norovirus, was first described by Zahorsky in 1929 as 'winter vomiting disease'. However the agent was not identified until 1972, when virus particles were first visualised by electron microscopy (EM) in faeces obtained from an outbreak. The outbreak had occurred in 1968 at a school in Norwalk, Ohio, US, with a high attack rate of illness among students and teachers. The illness was characterised by nausea, vomiting and diarrhoea with duration of illness of 12–24 hours [12].

In Australia, the first confirmed norovirus outbreak occurred in 1978 and was associated with oyster consumption [13]. The outbreak affected people across Australia, and norovirus was confirmed as the cause by visualisation of virus particles in patients' faeces by EM and immuno-EM [13, 14]. This outbreak was one of the first recorded foodborne outbreaks of norovirus [13].

The discovery of the virus through EM was important because this was the first virus detected that was specifically associated with cases of acute gastroenteritis. For decades the role of the virus as a causative agent has been hampered by the insensitivity of microbiological diagnostics. It cannot be grown in cell culture and there is no small animal model. The only alternative is to test on human volunteers [12]. Since the 1970s, the viruses were known as 'Norwalk-Like Viruses' (NLV) and 'Small Round Structured Viruses' (SRSV). The early names of these viruses were determined by the location where each strain was detected (e.g. Hawaii, Norwalk) or by their physical appearance as visualised with EM [15, 16].

In 2002, norovirus became the official genus name, following further investigation of the viral taxonomy by sensitive molecular techniques. Improvement in diagnostic techniques has allowed for rapid recognition of the causative agent in outbreaks and has changed the understanding of the clinical significance and epidemiology of this virus [17].

2.1.2 Virology

Noroviruses (family Caliciviridae, genus *Norovirus*) are a genetically diverse group of single stranded ribonucleic acid (RNA), non-enveloped viruses. The RNA genome of the virus consists of approximately 7700 nucleotides (excluding the polyadenylated tail) and includes three open reading frames. The virus when visualised by EM is 26 to 34nm in diameter; small, round, with an amorphous surface and ragged outer edge (Figure 1). The open reading frame (ORF) 1 encodes for non-structural polyproteins including a helicase, protease and RNA-dependent RNA polymerase. ORF 2 encodes a viral capsid protein and ORF 3 a small structural protein [18].

Figure 1: Electron microscope picture of norovirus particles

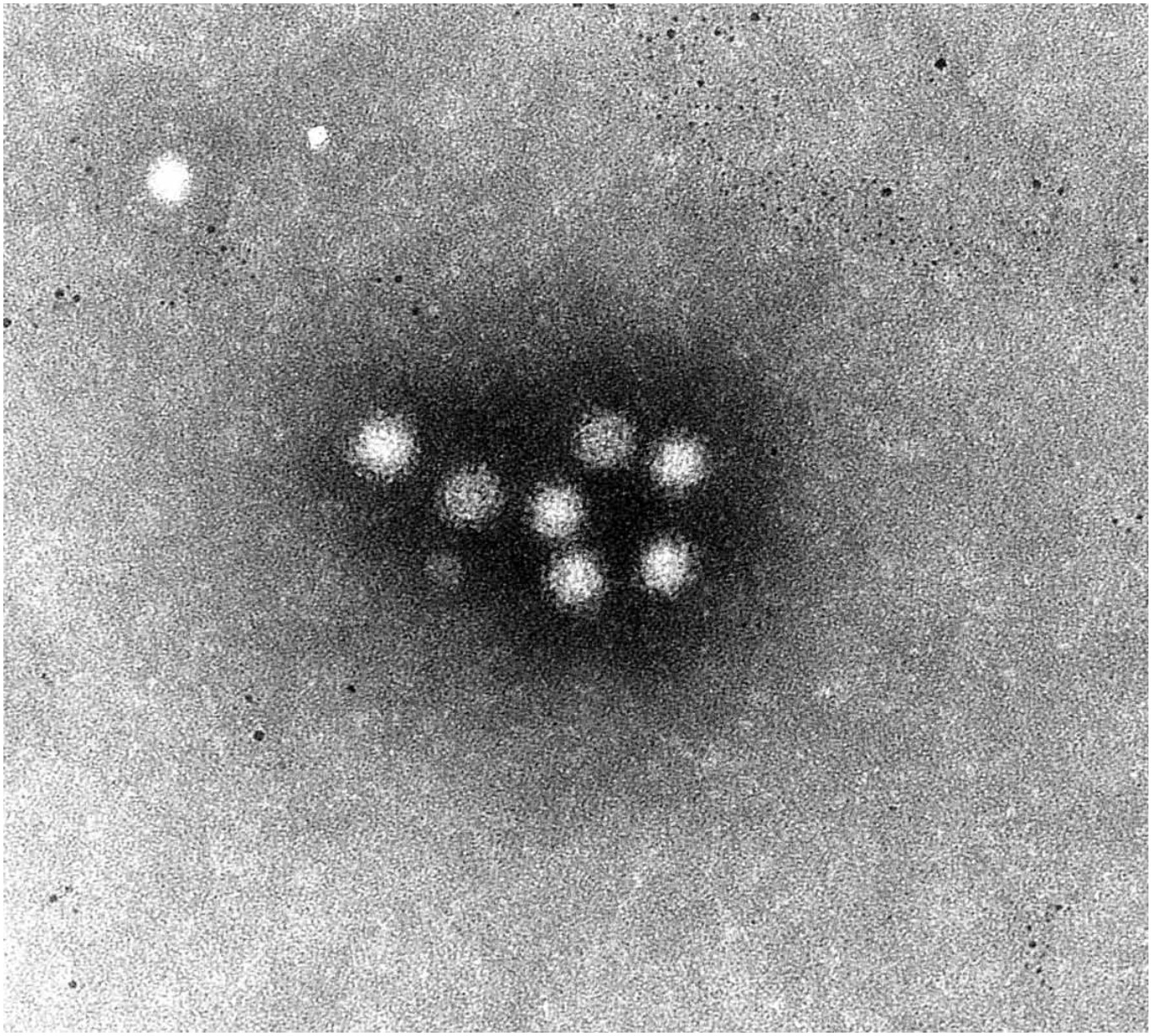


Image courtesy of John Marshall

2.1.3 Taxonomy

Norovirus is one of four genera within the Caliciviridae. The other three genera are *Lagovirus*, *Vesivirus* and *Sapovirus*. Sapovirus and Norovirus are the only two genera that cause gastroenteritis in humans. Noroviruses are currently classified into five genogroups designated GI to GV. GI, GII and GIV strains infect humans while the GIII and GV are detected in pigs, cattle and mice. Genogroups I and II are more commonly known to infect humans and cause outbreaks of acute gastroenteritis [19]. Genogroups comprise a range of genetically and antigenically diverse strains which can be further divided into genotypes or genetic clusters on the basis of sequence analysis. There are currently:

- eight genogroup I (GI) genotypes: GI includes Norwalk virus, Desert Shield virus and Southampton virus.
- 19 genogroup II (GII) genotypes: GII includes Bristol virus, Lordsdale virus, Toronto virus, Mexico virus, Hawaii virus and Snow Mountain virus.
- two genogroup III (GIII) genotypes.

An example of GIV is Ft. Lauderdale virus [17].

2.1.4 Molecular epidemiology

Although a large number of norovirus strains co-circulate in the community at the same time, individual strains have dominated worldwide in recent years [20]. The genogroup II strain more commonly causes outbreaks of gastroenteritis, with genogroup II, genotype 4 (GII.4) the predominant strain that has circulated globally in recent years. Outbreaks in 2006–07 due to new variants of the GII.4 have been reported by health agencies globally [7]. Recent increased activity has been reported in Hungary, Germany, Japan and the US [21]. New variants within GII.4 coincided with high levels of outbreak reporting worldwide in 1996, 2002 and 2004 [11, 22, 23].

A review of norovirus outbreaks in the US between 2000 and 2004 found GII.4 strains occurred more frequently in semi-closed environments (such as buses or aeroplanes) than other strains [22]. Settings where these strains were more commonly detected included health care facilities, schools, childcare centres and cruise ships. Person-to-person transmission occurred more frequently than did outbreaks involving food [22].

2.1.5 Symptoms

Noroviruses cause an infection of the digestive tract which presents with acute onset of diarrhoea, abdominal cramps, nausea and vomiting. Vomiting is more common among children while a greater proportion of adults experience diarrhoea. Systemic symptoms such as fever, headache, myalgia, malaise and abdominal pain can also occur [24].

The median incubation period is classically 32 hours, with a range of 24–48 hours, but can extend outside this range (12–50 hours). Symptoms usually resolve within 24–48 hours but may range from 12–72 hours [25]. However, in some people symptoms can last longer than previously thought, particularly among the elderly and in young children, as well as among transplant recipients and the immunosuppressed, such as people on immunosuppressive therapy, or ill with immune-modulating diseases (e.g. HIV) [17, 26].

The illness is usually self-limiting (resolves without treatment) and recovery is complete without any serious long-term sequelae. However, more severe clinical disease can be seen in the elderly and those with other underlying disease, such as cardiovascular disease, renal transplant recipients and those on immunosuppressive therapy [17]. Severe complications can be seen in these settings, with decreased potassium levels, increased C-reactive protein and creatine phosphokinase [26]. Deaths may occur among ACF residents due to aspiration or exacerbation of other chronic diseases [4, 27].

2.2 Epidemiology

Each year in Australia, there are an estimated 1.8 million (95% Credible Interval 1.4–2.3 million) cases of norovirus infection, making it the most common cause of gastroenteritis [28]. Norovirus occurs throughout the year, but is more common from late winter to early summer [29, 30]. A study in Melbourne found a seasonal trend observed for norovirus cases. Prevalence was highest during spring (September–November) and summer (December–February) [31]. However, epidemic strains of norovirus may result in outbreaks that do not follow usual seasonal patterns [32].

Norovirus is endemic in Australia and affects all age groups. An analysis of sera collected from a sample of patients admitted to Alice Springs Hospital in 1977, 1984 and 1986 found that 96% of sera from patients over two years of age and 70% of sera from patients up to two years showed the presence of norovirus antibodies suggesting exposure occurs at a young age [33].

Although norovirus infections occur in all age groups, they can be more severe in the very young and elderly, resulting in hospitalisation. A study in the Netherlands identified several risk factors associated with norovirus infection [34]. McIver describes similar risk factors for norovirus infection [18]. These included:

- contact with persons or household members with gastroenteritis
- being in semi-closed environments, such as buses or airplanes, with people ill with gastroenteritis
- visiting or working in a health care facility during an outbreak
- contact with areas contaminated by vomiting and/or faeces
- consumption of contaminated food, by poor food-handling hygiene or cultivation of filter-feeding shellfish in contaminated environments.

2.2.1 Transmission

Norovirus transmission occurs through a variety of routes but is primarily person-to-person spread by the faecal-oral route, contact with contaminated surfaces and transmission via aerosolised vomit. Aerosolisation of vomit can result in contamination of surfaces such as furniture and carpets so that outbreaks spread via environmental contamination. Aerosolised vomit containing norovirus may also be inhaled and swallowed. It is unlikely that infection occurs via the respiratory tract as there is no evidence that the virus replicates in respiratory mucosal cells [35, 36]. Transmission may also occur through consumption of contaminated food, particularly oysters and shellfish, or water [24, 37].

The spread of infection during outbreaks is facilitated by the specific characteristics of the virus. A low infectious dose, coupled with the ability of the virus to be transmitted from contaminated environments or infected persons, allows for many people to be affected, as shown by spread among contacts and household members [2]. Similarly, the virus is stable in the environment and survives high levels of chlorine, freezing and heating to 600C, making it difficult to eliminate from contaminated water, food and surfaces [38]. Prolonged viral shedding in asymptomatic people increases the risk for secondary transmission and is of concern among healthcare workers and food handlers, even when symptoms have resolved [24]. Strain diversity and lack of long-term immunity contribute to the facilitation of transmission and potential for outbreaks [17, 39].

Outbreaks occur in a variety of settings but are more common in environments where people are in close quarters, such as in ACFs, hospitals, schools, ships and restaurants. In these settings, people may be at greater risk of person-to-person transmission. Infected food handlers are often suspected as the source of foodborne outbreaks and can contaminate food prior to consumption [40]. Food items that are ready-to-eat and require handling but no cooking such as salads, sandwiches and bakery products are at greatest risk of being contaminated [24, 41-43]. Foods can also be infected with norovirus prior to preparation via faecal contamination. Shellfish, in particular oysters, are filter feeders that concentrate microorganisms from

contaminated water. Outbreaks of oyster-associated norovirus infection have occurred even where oysters have been grilled [44] or steamed, probably due to inadequate cooking [45, 46]. Contaminated raspberries have also been implicated in outbreaks, as have other fruits, pastry glazes and icing [47, 48]

Waterborne outbreaks of norovirus have also been reported and include contaminated well water, ice, lake water, drinking water and swimming pool water [49-54]. Waterborne norovirus outbreaks occur when sewage contaminates the water that is either used as a drinking water supply or unintentionally consumed during recreational activities. Norovirus is resistant to chlorine in the presence of organic matter [55] and higher levels of chlorine may be required for contaminated water supplies [56].

2.2.2 Immunity

Exposure to norovirus usually occurs in childhood, with antibody prevalence rising to greater than 50% by the fifth decade of an individual's life. It appears that individuals develop short-term immunity following infection and immunity is strain specific. The genetic variability in circulating norovirus indicates that individuals are likely to be repeatedly infected during their lifetime [57]. Short-lived immunity may explain in part the high attack rates in all age groups in an outbreak. There is evidence suggesting susceptibility to norovirus infection to be based on histo-blood group antigens [58].

2.2.3 Period of shedding and infectivity

Previous human volunteer studies have found that viral shedding in stools coincided with onset of illness and did not extend more than 72 hours after the onset of the first symptom. However, viral RNA has been detected using molecular techniques for up to three weeks after onset of illness [59, 60]. Studies have shown prolonged viral shedding and duration of illness due to norovirus infection, and demonstrated that excretion of virus occurred after cessation of symptoms and in infected individuals with no clinical symptoms [24, 61, 62]. A study in Victoria examined clinical symptoms and norovirus excretion among elderly residents during an outbreak of gastroenteritis at an ACF. The study found that acute symptoms lasted 3–4 days and the median excretion time for norovirus was 8.6 days [60]. Viral excretion was not related to clinical symptoms or the appearance of stools [60]. Similarly, a study of the natural history of calicivirus in the Netherlands found that norovirus occurred in all age groups, clinical symptoms lasted a median of 5 days and stool samples were positive by PCR for norovirus up to three weeks after the of onset of illness [25].

Prolonged viral shedding, either symptomatic or asymptomatic, has implications for transmission. While asymptomatic food handlers may be important in spreading disease, the significance of viral excretion in the absence of symptoms is unclear [24]. Marshall et al. suggest that excretion of norovirus by people who are asymptomatic may act as a significant potential infectious reservoir in the community [61].

Viral shedding is greatest during the acute illness and the amount of virus excreted decreases rapidly with recovery. Viral shedding in stools is greatest over the first 24–48 hours. *There is no evidence that infected food handlers and health care workers should be excluded from the workplace for longer than 48 hours after cessation of symptoms (see Chapter 8).*

Chapter 3: Surveillance and reporting

3.1 National surveillance

In Australia, norovirus infection in individual patients is not notifiable in any state or territory. This means that national statistics are not available for the number of patients infected with norovirus each year. State and territory health departments vary in their requirements and mechanisms for reporting norovirus outbreaks or outbreaks of gastroenteritis and when outbreaks should be investigated.

For specific reporting requirements regarding outbreaks, please check with your state or territory health department.

3.1.1 State and territory surveillance

Although norovirus and viral gastroenteritis are not nationally notifiable diseases some states and territories have their own list of additional notifiable diseases. Norovirus may be notified locally, as some states and territories record one or more of the following conditions that are statutory notifications for their jurisdiction:

- gastroenteritis in an institution
- foodborne or waterborne illness in two or more related cases
- food poisoning
- gastrointestinal illness cluster.

In states and territories where only foodborne or waterborne illness is notifiable, norovirus outbreaks will not necessarily be reported unless the medical practitioner suspects the source to be contaminated food. It can be very difficult to determine the mode of spread of gastroenteritis without a proper epidemiological investigation, and as a precaution it is advisable to report outbreaks if in doubt.

Managers of institutions may also report outbreaks to health departments, while seeking advice on infection control issues. It will be at the discretion of the PHU how they wish to proceed with the report or investigation. Other states and territories receive notifications of norovirus outbreaks if the outbreak is in an institution or there is a cluster of gastrointestinal illness. In some jurisdictions public health services are regionalised, meaning that the medical officers, laboratories or hospitals are required to notify the PHU of suspected outbreaks.

3.1.2 Objectives of surveillance

The objectives of surveillance and the level of detail in the information collected are different at state and territory levels. However, there are specific objectives that are relevant to surveillance for gastroenteritis outbreaks possibly due to norovirus and other viral agents. The objectives of surveillance of outbreaks are to:

- ensure prompt identification and management of outbreaks that will enable rapid implementation of control measures, particularly those with a food- or waterborne route of transmission
- improve understanding of the epidemiology of gastrointestinal agents such as norovirus
- monitor the effectiveness of current control measures and to provide an evidence base for public health policy, such as these *Guidelines*.

3.1.3 Objectives of reporting

A PHU may receive reports of suspected outbreaks of norovirus from individuals and agencies other than those obliged to notify under local public health acts (mandatory reporting requirements which may differ between states and territories). Reports may come from ACF, childcare centres, schools, restaurant patrons, attendees at private and public functions where food is served, passengers on coaches, trains and cruise ships among others. These reports may or may not provide a trigger for a public health response. However, it is important to establish early if the reported outbreak is due to norovirus and if the mode of transmission is person-to-person or foodborne, as investigation processes may be different. In person-to-person spread, infection control measures are more effective if instituted early [63]. On the other hand, foodborne transmission requires a rapid epidemiological investigation including analytical studies and microbiological testing of suspected food items. Investigations and management of the outbreak may depend on the resources available within a PHU.

3.2 National data collection and reporting

OzFoodNet—an initiative of the Australian Government—was established in 2000 to determine the burden and causes of foodborne disease in Australia [64]. OzFoodNet collects and summarises national data on the causes of outbreaks of foodborne illness and gastroenteritis, including those caused by viral agents. Data are available on outbreaks of norovirus transmitted by food, water and infected persons. These data are collated and reported quarterly and an annual report is published in the national journal *Communicable Diseases Intelligence* [4]. These data are the most comprehensive that exist on norovirus outbreaks in Australia. It is important to interpret outbreak data with caution, as norovirus is not notifiable and changes in reporting may bias results over time. This can make assessment of trends difficult and data may change over time as new information about outbreaks is reported [65].

Chapter 4: Current trends in Australia

As mentioned in section 2.2, each year in Australia there are an estimated 1.8 million cases of norovirus infection, making it the most common cause of gastroenteritis [28].

4.1 Reported outbreaks

In Australia, norovirus outbreaks caused by *person-to-person transmission* have been reported in a variety of settings. Institutional outbreaks are by far the most commonly reported and have been described in childcare centres [66], youth refuges, school outings and camps [67], restaurants [68], ACF and hospitals [69-73]. Outbreaks have also been reported in other settings. From 1999–2003, three confirmed norovirus outbreaks were reported on cruise ships visiting Sydney [74].

The number of norovirus outbreaks reported to OzFoodNet varied from 19–772 per year from 2000–08. In total, there were 2923 norovirus outbreaks affecting 86570 people during this nine year period. States and territories reported that 75% (2196/2923) of outbreaks of norovirus were spread from person-to-person and 22% (649/2923) were of unknown mode of transmission. Only 2.7% (78/2923) were foodborne or suspected foodborne transmission. Norovirus was confirmed as the cause of 57.4% (2196/3824) of outbreaks spread from person-to-person. In total, most suspected person-to-person outbreaks occurred in ACF (69%), hospitals (19%), childcare centres (3%) and other institutions (3%). Due to the mild self-limiting nature of norovirus gastroenteritis, these figures are a significant underestimation of the true burden of norovirus infections in Australia.

The first reported norovirus *foodborne outbreak* associated with the consumption of locally produced oysters was in 1978 [13, 14]. Consumption of *raw oysters* as the likely vehicle of transmission in subsequent norovirus outbreaks has been reported in the Northern Territory (NT) [75], Queensland (Qld) and New South Wales (NSW) [76].

Orange juice was reported as the vehicle for norovirus transmission affecting approximately 25,000 passengers on domestic airline flights in 1991 (Pers. Comm. T Stewart, 2007). Norovirus was detected in the orange juice well after the conclusion of the outbreak. The outbreak ceased when the juice was withdrawn from sale. Public health investigation identified some potential sources of contamination at the processing plant where contamination could have occurred [77].

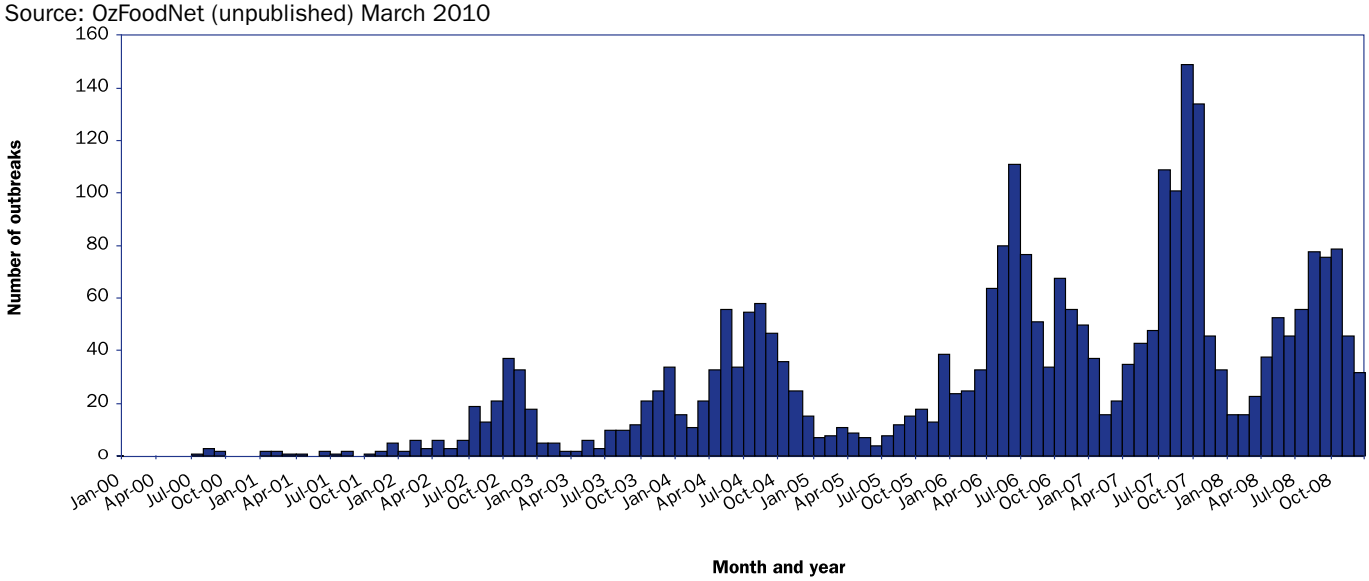
Between 2002 and 2004, consumption of raw and cooked imported *oyster* meat from Japan was associated with norovirus illness in outbreaks in the NT, Western Australia (WA) and Qld [44]. In the 2003 gastroenteritis outbreaks that occurred in WA and the NT, norovirus was detected in clinical specimens in two of the outbreaks and suspected as the cause of the third. At the time of the investigations, epidemiological and trace-back evidence implicated the oysters as the likely source of infection even though virological testing did not detect norovirus. However, oyster meat from the NT outbreak was tested the following year and was positive for norovirus. At the same time as the outbreaks in 2003, New Zealand (NZ) reported three outbreaks of confirmed norovirus associated with imported oyster meat from Korea, which was followed by a further large outbreak in 2006 [78]. The outbreaks resulted in the Australian Quarantine and Inspection Service restricting imports of oysters from certain growing areas in Japan and Korea [44]. Oyster-associated outbreaks of norovirus from oysters grown in Australia, particularly NSW, continue to occur, although infrequently [79, 80].

A large outbreak of norovirus in 2003 was associated with *ready-made foods* prepared by a catering company. The investigation suggested that contamination of food had occurred by ill food handlers [81]. Similarly, salmon- and egg-filled sandwiches and bakery items were implicated in two norovirus outbreaks that were related to preparation of food that required considerable handling. Food handlers with gastroenteritis worked while symptomatic in both outbreaks [79].

Norovirus as the causative agent in waterborne outbreaks is uncommon in Australia. There has been one report described that suggests norovirus was the cause of an outbreak that was linked to drinking *contaminated water* at a caravan park in NSW [82].

Figure 2: Number of outbreaks due to norovirus spread by different modes of transmission in Australia, by month of onset of first case, 2000–08

Source: OzFoodNet (unpublished) March 2010



4.2 Strains implicated in recent outbreaks

The predominant strain circulating in Australia has been GII. Outbreaks in south-eastern Australia from 1980–96 reported the GII strain. Conversely, a study of norovirus in central Australia from 1995–97 identified a predominance of GI strains [33].

A new variant of the GII strain, GII.4, was associated with a sudden increase in norovirus outbreaks in Europe and the US, which has since spread globally. A GII.4 variant designated US95/96, which caused global epidemics in 1995 and 1996 was later identified in Australia. This strain was associated with a large number of outbreaks reported in NSW in 1997 and 2000. Similarly, in 2002 an increase in norovirus outbreaks was reported across Europe, the US and Australia. The predominant strain was Farmington Hills and the majority of strains collected in NSW between 2001 and 2002 were related to the Farmington Hills cluster. A norovirus GII strain termed 'Hunter' was first identified in NSW in 2004 and caused significant outbreaks in 2004 and 2005 [23].

The variant GII.4 has been responsible for large outbreaks, usually person-to-person spread, in Australia. The sudden increase in outbreaks in 2004 and 2006–7, mainly spread from person-to-person, occurred in ACF and hospital settings [4, 6]. Genotyping showed that the outbreaks were associated with the emergence of new variant strains, in particular GII.4 strain that had spread worldwide [6, 7, 83]. A study by Bull et al. demonstrated that GII strains isolated in Australia mirror the strains identified in the Northern Hemisphere during similar time periods [23].

Chapter 5: Laboratory diagnosis

5.1 Available diagnostic tests

Diagnostic testing available for norovirus includes EM, RT-PCR and ELISA tests. Tests performed will depend on what is available in laboratories in each state and territory.

RT-PCR is regarded as the preferred diagnostic method. It is commonly used and a result can be provided within 24 hours. However, RT-PCR testing requires skilled technicians and specialised facilities.

EM is not widely used in laboratories in Australia, as sensitivity is limited because the virus can be present in low numbers and may be missed by microscopy. Despite this, EM can be a useful diagnostic tool where specimens are negative by RT-PCR and antigen detection.

ELISA kits allow for rapid detection of the virus in faecal specimens, although they are less sensitive than RT-PCR. However, their ability to detect a range of genotypes, availability of results within 24 hours, ease of use and cost effectiveness make them useful as an initial tool for confirming norovirus as the aetiology in outbreak settings [23, 84].

Serology is not diagnostically useful because antibody presence does not always correlate with protection from re-infection [18, 85].

5.1.1 Determining the strain

Genotyping using polymerase and capsid sequences is the universal method used for determining the strain of norovirus. The Health Protection Agency of the United Kingdom (UK) manages a norovirus database for polymerase and capsid gene sequences and epidemiological data (see the United Kingdom's Health Protection Agency website: <http://www.hpa.org.uk> and search for 'Norovirus Molecular Epidemiology Database'). The database may be searched by entering 'polymerase gene sequences' and it is planned to add a search facility for 'capsid sequences' [85].

Because PCR testing varies in sensitivity by genogroup, there is a need for national collaboration to identify the optimal primers, protocols and reference reagents to better define the epidemiology of norovirus in Australia.

5.2 Types of specimens to be collected

Submitting clinical specimens is an important part of an outbreak investigation because knowing the causative pathogen can help to determine control measures. Specimens should be collected as soon as possible after symptoms begin, preferably during the symptomatic phase of the illness. However, positive results from RT-PCR tests have been detected in asymptomatic individuals and in some cases 10 days after onset of illness.

5.2.1 Faeces

Faeces are the most suitable specimens to collect, as norovirus can be detected in faeces by the three diagnostic tests commonly used.

Faeces should also be tested for bacterial, parasitic and other viral pathogens that cause gastrointestinal illness to exclude these pathogens as the causative agent. However, where patients' illnesses are consistent clinically with norovirus and the outbreak has occurred in a setting commonly affected by norovirus, norovirus tests should be conducted first. If detected there is no need to conduct further testing of faecal specimens for other pathogens.

5.2.2 Vomitus

Norovirus can be detected in vomitus, but this should only be collected after consultation with nominated laboratories. The yield of virus is better from faeces than vomitus, making it preferable to obtain faecal specimens. If testing by RT-PCR or by antigen detection, faeces are the preferred specimens.

5.2.3 Food, environmental and water

Detection of norovirus in food samples is technically difficult, expensive and is not routinely performed in laboratories. There has been some success testing molluscs by two methods: macerating the shellfish flesh or by depurating the shellfish in water and then concentrating the water for examination [44, 86]. If there is strong epidemiological evidence linking a suspected food to the outbreak it may be possible to test food samples. Testing of foods is usually only warranted where the implicated food is widely distributed and may be the cause of geographically dispersed outbreaks. Given the complexity of testing food, it is inappropriate to test foods contaminated by food handlers that have caused localised point source outbreaks.

If PHUs or other agencies involved in an outbreak investigation decide that it is important to confirm the presence of viruses in food, they will need to discuss with laboratories in their jurisdiction about the collection of appropriate food samples. Similarly, where investigators suspect waterborne or environmental contamination, it is important to discuss collection of environmental and water samples with the laboratory. In general, it is best to ensure that duplicate samples are collected and at least one sample sent to a laboratory that is skilled at testing these technically difficult samples for noroviruses.

Chapter 6: Outbreaks and case definitions

6.1 Outbreak criteria

Defining an outbreak assists those responsible for managing the outbreak to decide whether an outbreak may be occurring, and to report it as early as possible to a PHU and other responsible authorities. The PHU will need to verify that the report does constitute an outbreak, which should be based on more cases occurring than would be expected in a defined time period. If a decision cannot be made as to whether the occurrence of cases represents an outbreak at the time the report or notification is received, additional information will need to be collected. The clustering of cases by time, person and place may signal the possibility of an outbreak.

A *case definition* is a set of criteria for determining who should be classified as a case. The outbreak management team forms a case definition once an outbreak has been declared. The case definition includes four components:

1. well-defined clinical symptoms (with or without laboratory confirmation)
2. information relating to time (timing of onset of symptoms)
3. persons affected
4. the place or location where the outbreak has or is occurring.

The case definition should be established early in the outbreak and may be revised or updated during the course of the investigation. Case definitions are important to allow early identification of cases and implementation of control measures and limiting the risk of transmission.

The definitions of what constitutes an outbreak and an outbreak-related case may differ for norovirus spread from person-to-person as opposed to that due to contaminated food or water. The definitions are only intended to be used as a guide and will vary according to the cause of the outbreak.

6.2 Definition of a clinical case

Outbreaks can be defined initially on clinical diagnosis and subsequently confirmed by laboratory diagnosis once an outbreak has been declared and faecal specimens have been collected for testing. An outbreak is decided based on the initial clinical symptoms of cases, which allows for early detection and therefore a rapid public health response. Key indicators of a norovirus outbreak may be the sudden onset of vomiting or diarrhoea amongst a group of people and a rapidly rising attack rate.

In the early 1980s, Kaplan developed clinical and epidemiological criteria for norovirus outbreaks, as diagnosis of norovirus in the laboratory was very insensitive. Kaplan proposed that outbreaks of gastroenteritis could be identified as norovirus if they met the four criteria listed in Box 1 [87].

Box 1: Kaplan's criteria for a clinical case definition for suspecting that an outbreak is due to norovirus

- vomiting in >50% of affected persons
- mean (or median) incubation period of 24–48 hours
- mean (or median) duration of illness of 12–60 hours
- no bacterial pathogen isolated in stool specimens

A recent re-evaluation of Kaplan's criteria confirmed a high specificity (99%) and moderate sensitivity (68%) in distinguishing confirmed outbreaks due to bacteria from those caused by norovirus. This recent calculation is in line with the original estimations [87]. Kaplan's criteria can be used early in an outbreak to define cases. However, it is necessary to obtain faecal specimens for laboratory testing to exclude bacterial aetiology and to confirm the diagnosis of norovirus. In particular, it can be difficult to estimate the incubation period of illness where person-to-person transmission is suspected.

6.3 Definition of an outbreak

A small percentage of people have gastrointestinal problems for other reasons, particularly in ACFs, making it difficult to determine if the level of illness initially reported in a 'suspected outbreak' is above the normal 'background level'. The outbreak definitions are intended to be sensitive for identifying gastrointestinal outbreaks. They should be used as a guide and a PHU will need to decide if a report truly represents an outbreak based on information collected. Generally, the mode of transmission is considered unknown at the commencement of an outbreak investigation and a general definition should be used.

6.3.1 Gastroenteritis outbreak caused by person-to-person transmission

In general, a practical definition for an outbreak suspected to be caused by person-to-person spread is 'two or more associated cases of diarrhoea and/or vomiting in a 24 hour period' (excluding cases which have a known cause, e.g. bowel disease, alcohol, or pregnancy).

Alternatively, an outbreak can be defined as 'two or more cases of diarrhoea and/or vomiting in a defined time frame in a setting that is prone to outbreaks of norovirus, such as hospitals or ACFs.'

A study of norovirus outbreaks in health care settings in the UK used a broad clinical outbreak definition and considered cases to be part of the same outbreak if they occurred within seven days of each other [88].

6.3.2 Gastroenteritis outbreak caused by foodborne or waterborne transmission

Foodborne or waterborne outbreaks may be defined as 'two or more associated cases of diarrhoea and/or vomiting caused by the consumption of common source of food or water within a specified time frame'. Often it is difficult to identify if contaminated food or water are the vehicle of infection until epidemiological or microbiological investigations have been conducted.

6.4 Definition of a case

What constitutes a *case* is usually defined once an outbreak of gastroenteritis has been declared. Separate definitions may be used for suspected and confirmed cases.

6.4.1 Suspected case of norovirus

A person from the population at risk (e.g. institution, community group, restaurant patron) with clinical symptoms from a defined time period, characterised by:

1. three or more loose stools or bowel movements in a 24 hour period that are different from normal **AND/OR**
2. two or more episodes of vomiting in a 24 hour period.

People reporting these symptoms who have a known alternative cause for their illness, such as bowel disease, excessive alcohol intake or pregnancy, should not be considered suspected cases.

For the purpose of control in the early part of an outbreak, suspected cases are regarded as potentially infectious until proven otherwise (i.e. alternative pathogen demonstrated to have caused illness) or until 48 hours has elapsed after resolution of symptoms.

6.4.2 Confirmed case of norovirus

Confirmed cases of norovirus infection must meet the suspected case definition above along with a positive laboratory test from one of the following definitive diagnostic tests:

1. detection of human norovirus by antigen detection
2. detection of human norovirus by Nucleic Acid Assays (NAAs)
3. visualisation of norovirus by EM.

Chapter 7: Outbreak investigation

The public health response to outbreaks of norovirus is determined by state or territory legislation, local reporting requirements and available resources. Public health agencies will seek to determine the nature of the outbreak to define their role in the investigation.

In institutional outbreaks that are suspected to be person-to-person spread, it may be more appropriate for the facility to manage the outbreak with advice or support from the PHU or Environmental Health Officers (EHO), as required. On the other hand, public health agencies will need to rapidly investigate and manage outbreaks of food- or waterborne disease, as intervention can reduce human illness, and they can have important policy implications for government.

7.1 Assessment of a suspected outbreak

Notifications or reports of an outbreak received by a PHU will need initial assessment. This may be done by public health nurses or public health officers. *Initial information* collected should include:

- the time the outbreak began
- the total number of cases and unaffected people to calculate the proportion of people affected
- symptoms and duration of illness
- type of outbreak setting
- if food is implicated
- results of any laboratory tests that may have been done.

A key means of assessing the initial features of an outbreak is to assemble a simple *line-list*. A line-list records the basic details about each suspected case. This includes:

- the time and date of when the illness began
- duration of illness
- information on key symptoms
- whether laboratory tests have been conducted
- any key exposures related to illness.

The use of a line-list continues throughout an investigation of an outbreak, but is particularly important in the *initial phase* to allow proper characterisation of the outbreak. From the line-list, it is possible to:

- develop an epidemic curve to determine if the outbreak is suggestive of a point-source or person-to-person spread
- review symptoms and duration of illness to determine if the illness is consistent with norovirus
- follow up and review any initial laboratory tests that may have been conducted
- develop a preliminary case definition for cases in the outbreak to assist with counting further infections
- review information available, in particular the type of outbreak setting, characteristics of cases and attack rate of illness.

7.2 Criteria for starting an investigation

When to start an investigation on a suspected outbreak of norovirus will be determined by the:

- type of outbreak setting
- number of affected persons
- severity (morbidity, e.g. hospitalisation and mortality history) of cases
- suspicion of a foodborne source.

Two or more cases of diarrhoea and/or vomiting in a 24 hour period in an institution or among a group of people who shared a common exposure or food source should be suspected as constituting an outbreak and an assessment or investigation commenced. An outbreak of infectious gastroenteritis, such as that caused by norovirus, is often diagnosed presumptively on clinical grounds from characteristic epidemiological features. In fact, the PHU may choose not to investigate person-to-person outbreaks, but focus on providing advice on infection control measures. Outbreak surveillance in Australia shows that ACFs and hospitals are the leading setting for norovirus outbreaks, which are mainly ascribed to person-to-person transmission. On the other hand, PHUs will investigate suspected foodborne norovirus outbreaks. Norovirus outbreaks transmitted by contaminated food should not be ruled out if an outbreak occurs in an institution.

7.3 Action when outbreaks are detected

There should be clear processes for action where outbreaks are detected. Levels of investigation can range from a case series and site inspection to large analytical epidemiological studies involving collection of information on hundreds of patients and people who do not have gastroenteritis (controls).

The steps and the order in which an outbreak is investigated may differ depending on the nature of the outbreak. Public health agencies can use the flow chart in Figure 3 as a guide to investigating outbreaks.

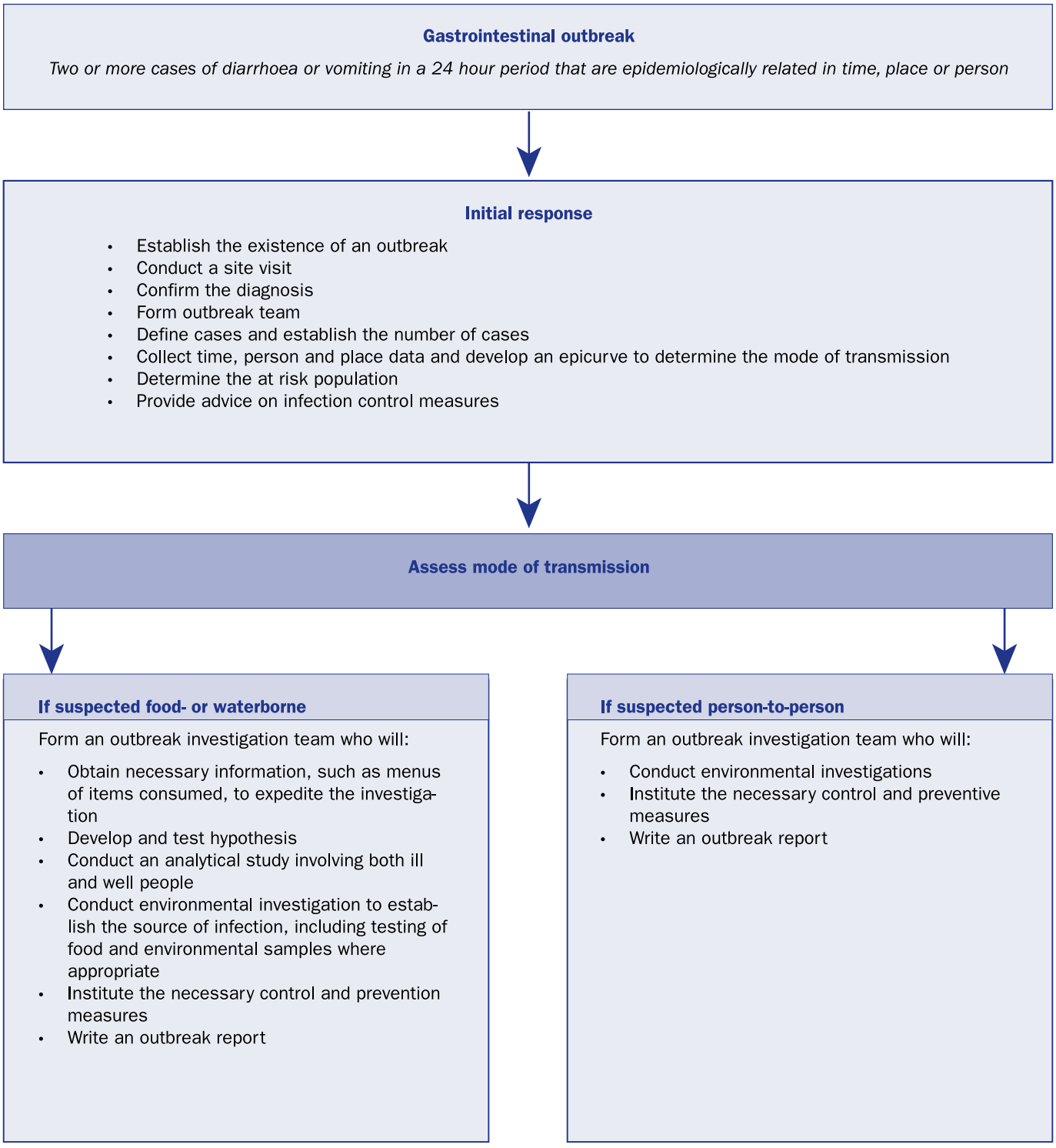
In any reported outbreak, preliminary collection of information such as data on time, person and place, number of cases and the identification of the ‘at risk population’ is important in order to determine the mode of transmission and severity of illness. It is also important to confirm the diagnosis where possible as this has implications on the management of the outbreak.

A further investigation may not be needed for each outbreak, especially if the outbreak appears typical for person-to-person spread. In outbreaks where the clinical or epidemiological picture suggests a bacterial agent or where morbidity or mortality is concerning or suggestive of a common food source, further investigation may be indicated. An investigation may also be necessary if there is an ongoing suspected source of infection or the investigators have a hypothesis that they may want to test.

In both person-to-person and foodborne outbreaks, EHO play an important role in the investigation and management of norovirus outbreaks. Their role may involve the following:

- Investigate the outbreak and identify the source of illness, in collaboration with the PHU.
- Facilitate the collection of specimens (both environmental and clinical) for transport to a laboratory and subsequent testing.
- Provide advice on control and preventive measures.
- Inspect the premises to review environmental health and infection control concerns.
- Consider whether formal action under legislation is appropriate in the event of food being identified as the source of the outbreak.

Figure 3: Flow chart – Investigation and management of gastroenteritis outbreaks



7.3.1 Initial response

Establish existence of an outbreak

Following review of line-list information regarding a suspected outbreak, public health agencies need to decide whether an outbreak is actually occurring. This can sometimes be difficult to decide, particularly for community-wide outbreaks, as it is difficult to determine the background rate of gastroenteritis. In determining whether an outbreak is occurring, it is important to consider what constitutes the population at risk, which should include the total number of cases and unaffected people, including staff.

Conduct site visit

A site visit by an EHO may be useful and can be decided locally, in conjunction with the institution and depending on the situation. A site visit may assist with specimen collection, ensuring infection control measures are in place and inspecting the kitchen facilities to rule out foodborne contamination.

Confirm a diagnosis

Public health agencies should discuss with the institution what specimens have been collected, the laboratory they were sent to and any available results. If specimens have not been collected, investigators should advise the institution about collecting specimens and the type of testing to be requested.

For optimal detection of norovirus in faecal specimens using ELISA tests, it is necessary to collect at least six samples from individual patients in outbreak settings [89]. For PCR-based testing, three or more specimens are necessary to have adequate sensitivity to confirm norovirus. Where a public health agency is conducting a major investigation, it is best if multiple specimens are collected and sent to a reference laboratory. This is particularly important if there is a need for more advanced testing, such as gene sequencing.

PHU staff should liaise with the laboratory regarding specimen collection and transport. The laboratory should be advised as early as possible that specimens will be arriving. A request form must be completed by a medical officer and if possible a copy of the results should be sent to the public health agency, and a copy going to each case's treating medical officer.

For outbreaks in institutional settings, it may be easier for affected people to see their general practitioner and to submit a faecal specimen for testing to a specified laboratory. The treating medical practitioner should liaise with the PHU as to the type of testing required. The PHU will need to confirm with the institution and the laboratory about the number of clinical specimens to be taken in a given outbreak.

Once public health agencies confirm that norovirus is the causative agent of an outbreak, it is important that they communicate the results back to people and institutions that are affected. There is no need for further collection of faecal specimens once norovirus is confirmed as the cause of an outbreak, unless the nature of cases' illness changes. For more information on collecting faecal specimens during outbreaks see Appendix 3.

As norovirus is predominantly spread directly from *person-to-person* and is highly infectious, the major emphasis will be placed on infection control rather than investigation into outbreaks of suspected viral gastroenteritis. Instituting immediate infection control measures is a priority in managing person-to-person outbreaks and should not be delayed while waiting for laboratory confirmation. The ability to respond to an outbreak will depend on the nature of the institution or setting of the outbreak. Hospitals are likely to have dedicated Infection Control Practitioners (ICP) and will probably manage the outbreak. On the other hand, institutions such as some ACFs, childcare centres, schools and others are less likely to have ready access to technical assistance in relation to infection control and will look to public health agencies for advice. For more information on infection control in relation to norovirus see Chapter 8.

Key features of outbreaks that might indicate *foodborne transmission* are where many people become ill at the same time indicating a common exposure, or where a common event involves a meal. However, with norovirus outbreaks it can be difficult to distinguish between person-to-person and foodborne transmission due to the highly infectious nature of the virus [2]. For foodborne outbreaks of norovirus there may be considerable numbers of secondary cases. Epidemiological data and microbiological evidence will give an indication of the true number of foodborne cases [90].

Most foodborne norovirus outbreaks are likely to originate from infected food handlers contaminating ready-to-eat foods with faeces or vomit during harvesting, transport, preparation or serving. In Australia, foodborne norovirus outbreaks are most likely to occur because of food handlers preparing or serving food while symptomatic. Many states and territories have their own 'protocols' or 'guidelines' document for investigating outbreaks of foodborne illness. Details in the documents will vary considerably; some jurisdictions will have information on very general principles whereas others will have more detail. Nevertheless, the steps outlined below are intended as a general guide and public health agencies may refer to local documents as well as these.

Form an outbreak management team

Public health agencies should form an Outbreak Management Team (OMT) to investigate and manage all aspects of a suspected foodborne outbreak of norovirus. The team may include a variety of personnel, including public health nurses, medical officers, public health officers, epidemiologists, laboratory scientists, infection control nurses and EHOs. If the outbreak is in an institution, a representative of that institution may also be part of the team. The OMT team leader, who is usually an epidemiologist or public health officer, should clearly define the roles and responsibilities of team members, along with activities required to investigate and contain the outbreak.

Formulate a case definition

The case definition may be reviewed and updated during the course of the investigation. A sensitive case definition should be developed initially so it will capture most of the cases, while recognising there will also be some false positives, i.e. cases which are not truly cases. As more information becomes available during the investigation, the case definition can be expanded or refined to ensure that the definition is as specific as needed. The working case definition should be appropriate and fit the criteria described in Chapter 6.

Case finding

Appropriate clinical specimens should be collected from cases, including ill staff, in order to confirm a diagnosis and identify the causative agent. Refer to Appendix 3 on specimen collection and notifying the laboratory about the outbreak. An attempt should be made to identify additional persons who meet the case definition. It may be possible to obtain a guest list or list of attendees from functions, social events or patron booking details if a food premises or restaurant is the place where exposure occurred.

Conduct hypothesis generating interviews

Public health staff should conduct hypothesis generating interviews of cases to obtain food histories to identify a potential food vehicle or source of infection that may be associated with the illness and can guide further investigation.

Determine source of infection

To determine if the outbreak is related to contaminated food at the source or at the point of service by an infected food handler, food handlers should be asked about gastrointestinal illness prior to and during the outbreak. They should also be asked about their role in food preparation before and during the outbreak, particularly if they were ill at the time. It may be necessary to collect faecal specimens from food handlers, especially if they are ill with gastrointestinal symptoms at the time of the investigation. Information should also be obtained about people vomiting in the food premises prior to the first onset date of illness in a case.

Initiate environmental investigation and food sampling

It is essential that an EHO inspects catering or food premises if an outbreak of suspected foodborne gastroenteritis has occurred. Public health agencies may refer to local guidelines and consult with environmental health or local government if a site visit or food testing is to take place. The EHO may assist public health agencies in their investigation by carrying out the following activities at the site visit:

- sampling of suspect foods and the environment
- obtaining a copy of the menu or list of foods that were served
- collecting information on the preparation, storage and distribution of cooked food
- assessing potential for cross contamination from raw to cooked foods
- checking for illness among staff and staff absenteeism records
- interviewing food handlers
- reviewing and reinforcing general hygiene issues and food control systems
- implementing control measures where necessary.

In food- or waterborne outbreaks, it is important to collect samples of the suspected vehicle of infection in consultation with environmental health, local government and the public health laboratory. This is particularly true for norovirus, which is extremely difficult to detect in non-clinical specimens.

Carry out trace-back of food products

Food production and distribution has become increasingly complex, which requires multiple agencies to collaborate to identify the origins of foods during outbreak investigations [64]. Trace-back is where food safety agencies follow the production and distribution chain of a food to identify where it was grown, processed, packaged, transported and sold at retail. *Trace-back* of foods is usually only required where foods have become contaminated well before the point of food preparation. For example, Australian and New Zealand outbreaks due to norovirus-contaminated oysters were shown to have originated from Japan and Korea, requiring international trace-back [44, 78]. The main aim of trace back is to determine the source and distribution of the implicated food item and identify potential sites of contamination along the food chain. External agencies are likely be involved in the trace-back, at local, national and international levels [64].

Analytical study

An analytical epidemiological study may be necessary to test a hypothesis or a range of hypotheses. The study uses a comparison group that enables quantitative statistical associations between exposure and illness to be calculated. Case control and cohort studies are the two most frequently used epidemiological study designs in a foodborne outbreak investigations. For more information on how to conduct analytical studies in foodborne disease outbreaks see information provided by:

- the World Health Organization <http://www.who.int/foodsafety/publications/foodborne_disease/fdbmanual/en/index.html>
- the Centers for Disease Control and Prevention in the United States <http://www.cdc.gov/foodborneoutbreaks/>.

7.4 Monitoring the outbreak

Ongoing surveillance during the outbreak is conducted to identify new cases and update the status of existing cases. In an institutional outbreak caused by person-to-person transmission, a representative from the institution will update the initial line-list with new information and send it to the PHU. Changes in the outbreak control measures may be indicated from review of these data. If new cases continue to be identified and the nature of the illness changes then a new organism causing infection or a different mode of transmission must be considered. In foodborne investigations, it is critical to continue to monitor for cases to ensure that the contamination has been removed and there is no longer a risk to public health.

7.5 Declare that the outbreak is over

The point at which an outbreak can be declared over depends on the nature of the outbreak. The OMT should decide when an outbreak is over.

There appears to be no consistency as to when an outbreak of norovirus should be declared over. One recommendation is that outbreaks in residential facilities can be said to be over when seven days have elapsed since resolution of symptoms in the last case. Others have recommended declaring that an outbreak is over when two incubation periods for the organism have passed since the end of symptoms in the last case.

As a general guide, norovirus outbreaks can be declared over if no new cases have occurred in 72 hours from the onset of symptoms of the last case. Although norovirus has been detected in faeces many weeks after a person has recovered, it is not known if that person remains infectious [59, 60].

7.5.1 Communication

Once the outbreak has been declared over, all individuals and agencies involved in the investigation should be notified that the outbreak is over.

7.5.2 Prepare report

Details of the investigation should be documented to include investigation management, findings and recommendations. Files should be created to store copies of laboratory and other results, copies of all minutes of meetings and other communications and any other documentation specific to the investigation, including evidence such as photographs secured during the investigation. A summary report of the outbreak should be completed and distributed to stakeholders on an ‘as needed’ basis.

7.5.3 Organise debrief

A debrief will provide the opportunity to identify strengths and weaknesses in the outbreak investigation and provide information to improve the management of similar investigations in the future. All members of the OMT and others who assisted with the response to the outbreak should be involved.

Chapter 8: Infection control

8.1 Standard precautions

Following *standard infection control precautions* can minimise the risk of norovirus outbreaks caused by person-to-person transmission in any institution or group setting or by an infected food handler. This requires a basic level of hygiene measures that can be implemented in any setting, regardless of whether a person is infectious or not.

Standard precautions are work practices required to achieve a basic level of infection control. They include:

- hand hygiene and cough etiquette
- the use of personal protective equipment (PPE)
- the safe use and disposal of sharps
- routine environmental cleaning
- incorporation of safe practices for handling blood, body fluids and secretions as well as excretions [91].

Although standard infection control precautions are intended for use in healthcare settings, the principles can be applied to other institutional and group settings.

In order to reduce the risk of food handling related to norovirus infection and consequent outbreaks, it is essential to maintain *food hygiene standards*. These include:

- attention to hand hygiene
- prevention of gross contamination during food preparation
- provision of adequate handwashing facilities for food handlers
- ensuring that food handlers do not work while they have symptoms of gastroenteritis.

In addition to standard precautions for outbreak management, it is recommended that additional contact, droplet and air-borne precautions are adopted to minimise the dissemination of the infectious agent to other people, staff, visitors or volunteers. The use of infection control precautions in health settings and ACFs should be consistent with the *Australian Guidelines for the prevention and control of infection in healthcare* (2010) NHMRC.

Person-to-person outbreaks in semi-closed environments are usually difficult to control because the infectious dose of norovirus is small, infected people excrete large numbers of viable virus particles and widespread environmental contamination occurs [38, 92].

Norovirus outbreaks in *institutional settings* may generate public concern and media interest and may cause severe illness and even result in deaths where cases have severe underlying illnesses. There is limited published evidence to guide best practice in management of outbreaks in specific settings, other than ACFs, cruise ships and hospitals.

The public health action for different settings may vary but regardless of the type of outbreak setting, three important control measures should be applied in the management of all outbreaks:

- cleaning and disinfection
- regular handwashing
- exclusion and cohorting of ill people.

The objective of public health management of norovirus outbreaks is to interrupt transmission and prevent further cases. In outbreaks that are spread from *person-to-person*, public health management will be needed to institute immediate infection control measures. Control measures are most effective if implemented within three days of identification of the initial case [63]. On the other hand, public health management of *foodborne* outbreaks will involve identifying and removing the potential food vehicle or source. In all cases of viral gastroenteritis it is important to provide public health advice to minimise secondary spread [93].

8.2 Key measures for controlling outbreaks

The most important generic measures to be implemented in an outbreak setting are described below. *These are recommendations only and may need to be varied according to the circumstances and type of setting for each outbreak*. Some settings, such as hospitals, are likely to have access to PPE, whereas other settings may not. Nevertheless, the basic principles which support these recommendations can be applied to the management of institutional and community based outbreaks.

8.2.1 Hand hygiene

Transmission of norovirus is usually person-to-person by the faecal-oral route and by contact with contaminated environmental surfaces [92]. Cross-contamination by hands can assist in further propagating norovirus in outbreak settings. Studies have shown that fingers contaminated with norovirus could sequentially transfer virus to up to seven clean surfaces as well as from contaminated cleaning cloths to clean hands and surfaces [38].

Hand hygiene is an effective means of preventing further cases of gastroenteritis [92]. Intervention studies have shown that effective handwashing can reduce absenteeism due to gastroenteritis and environmental contamination with norovirus [92]. Hands must be washed with soap and water wherever possible, or decontaminated using an alcohol-based hand rub or gel before and after contact with any person in an outbreak setting and after activities that may result in personal exposure to viruses.

Hand hygiene should be routinely carried out in healthcare facilities in accordance with Hand Hygiene Australia's *Five moments for hand hygiene (*Hand Hygiene Australia: www.hha.org.au):

1. before touching a patient
2. before a procedure
3. after a procedure or body fluid exposure risk
4. after touching a patient
5. after touching a patient's surroundings.

Where an outbreak has occurred, it is vital that there is a high level of compliance with this guidance. During outbreaks, staff members, visitors and patients should give additional attention to effective handwashing.

Washing and drying

Hands should be washed systematically by rubbing all surfaces of lathered hands vigorously with a mild liquid handwash for 10–15 seconds under running water. A review by the World Health Organization (WHO) on hand hygiene found that water temperature does not appear to be a critical issue for handwashing. Although their review was based on limited evidence, it seems that time and friction when washing hands are more important aspects than temperature [94].

When washing is complete, thoroughly rinse hands under running water and then pat dry using a disposable paper towel, a single clean cloth towel or a fresh portion of a roller towel to prevent recontamination. If elbow or foot controls are not available a paper towel or the used towel should be used to turn taps off to prevent the risk of cross infection.

Alcohol-based preparations

Soap and water should be used wherever possible when washing hands during outbreaks. Skin disinfectants formulated for use without water (e.g. 70–80% alcohol-based solutions) can be used to decontaminate hands when handwashing facilities are not available. However, they do not replace the importance of handwashing with soap and water during outbreaks. Alcohol preparations are not useful if hands are visibly contaminated with body fluids, faeces or vomit. Hands should then be washed as soon as appropriate facilities are available.

Because norovirus cannot be cultured, the efficacy of alcohol-based preparations against this virus is difficult to determine. Studies have shown that alcohol-based hand rubs containing 60% alcohol can reduce the infectivity titres of three non-enveloped viruses (rotavirus, adenovirus and rhinovirus) by 3 to 4 logs. Other non-enveloped viruses, such as hepatitis A and enteroviruses require 70–80% alcohol to be reliably inactivated. The inactivation of non-enveloped viruses is influenced by temperature, the ratio of disinfectant to virus volume and protein load.

When various 70% alcohol solutions were tested against a surrogate of norovirus, ethanol with 30 minute exposure had demonstrably superior virucidal activity compared to the others. Solutions containing alcohol may be expressed as a percentage by weight, which is not affected by temperature or as a percentage by volume, which may be affected by temperature and other variables. Alcohol concentrations in antiseptic hand rubs are usually expressed as a percentage by volume. Alcohol solutions containing 60–80% alcohol are effective, with some studies reporting contradictory findings with higher concentrations being less potent [94]. Handwashing formulations that combine compounds such as ethanol with quaternary ammonium compounds and organic acids, may be more efficacious against these non-enveloped viruses [95].

Alcohol-based hand rubs should not be removed from clinical settings or patient care areas during an outbreak, rather hand washing should be promoted above the use of alcohol-based hand rubs during an outbreak.

8.2.2 Personal protective equipment

In outbreak settings, appropriate personal protective equipment (PPE) should be used if possible in each setting of potential norovirus transmission to minimise infection risk. Splashing of faeces or aerosols from vomiting has the potential of suspending norovirus in the air and falling onto food or surfaces. Hand hygiene should be carried out at all times, particularly after removing PPE to minimise spread of viruses [96].

Gloves

Disposable gloves should be worn if having direct contact with ill persons and when it is likely that hands will be contaminated with faeces or vomit. Hands must be washed before and after using disposable gloves, which should be single use only [96]. If gloves are not available, it is essential that hands be washed immediately after any contact with ill and well people during an outbreak.

Masks

Noroviruses are highly infectious and a small number of particles in aerosolised vomit can cause infection. A mask (surgical type, fluid repellent paper filter mask) should be worn when there is potential for aerosol dissemination. This may occur when attending a vomiting person or cleaning areas or surfaces that are visibly contaminated by vomit or faeces. Surgical face masks provide sufficient protection against droplet transmission of noroviruses. During outbreaks, staff attending vomiting patients or cleaning areas contaminated by vomit or faeces should use surgical masks or other respiratory protection to prevent infection, as this can significantly reduce subsequent illness in staff [63].

Gowns

Protective, impermeable gowns or plastic aprons should be worn if potential exists for splashing, splattering or spraying of vomit or faeces. Impermeable gowns and plastic aprons will protect clothing and skin from contamination with faeces and vomit. Ideally, aprons will be single use that can be disposed of, although reusable plastic ones can be washed with detergent and water between uses. If the items have been visibly contaminated with faeces or vomit a bleach solution should be used to decontaminate (see section 8.2.3). Protective clothing contaminated with faeces or vomit should be removed as soon as possible and disposed of without generating aerosols (see section 8.2.5).

Eyewear

Protective eyewear such as face-shields or goggles should also be worn where the potential exists for splashing, splattering or spraying of vomit and faeces. Reusable goggles should be washed with detergent and water between uses. Visible contamination with faeces or vomit should first be washed off with soap and water, followed by cleaning with bleach solution (see section 8.2.4).

8.2.3 Environmental cleaning

Prolonged outbreaks in semi-closed settings suggest that norovirus survives well in the environment and can spread via environmental surfaces. A continuation of outbreaks on consecutive cruise ship trips has demonstrated environmental persistence and led to recommending the need for extensive disinfection measures [97]. In another study on repeated outbreaks in cruise ships, illness was associated with sharing bathrooms and having a cabin mate who vomited. Contaminated shared bathrooms and environmental contamination were implicated in the transmission of infection. Subsequent outbreaks were prevented by frequent and thorough bathroom cleaning and rapid cleaning of contaminated rooms [98]. These reports confirm the need for a comprehensive and responsive cleaning and disinfection program during as well as at the end of an outbreak. This section details information on cleaning and disinfection during outbreaks of viral gastroenteritis, with further information contained in Appendix 4.

Chemical agents

There is no direct evidence to support the use of particular chemical agents for environmental disinfection as there is no viral culture system available for norovirus. Previous studies have used the feline calicivirus (FCV) as a surrogate for norovirus because of their relatedness. It is known that FCV is inactivated by heat at 60°C and by sodium hypochlorite (bleach) at 1000 parts per million (ppm) (0.1%) but not by ethanol. A study found that FCV was completely inactivated when exposed to 1000 ppm freshly reconstituted granular hypochlorite (dichloroisocyanurate) or 5000 ppm hypochlorite solution. Quaternary ammonium product, detergent and ethanol did not completely inactivate the virus [99]. Quaternary ammonium compounds perform as low level disinfectants and are ineffective against norovirus because they act by disrupting viral envelopes, and norovirus are non-enveloped virus particles.

There has been debate on how well data on inactivation of FCV reflects efficacy against norovirus because of the different physio-chemical properties between the two viruses. Nevertheless, as there is little data to support the efficacy of chemical agents and based on what is known about FCV, most local and international guidelines on norovirus recommend the use of hypochlorite at

1000 ppm. Household bleach comes in a variety of strengths ranging from 2–5% sodium hypochlorite solution as indicated on the product label.

Details for diluting bleach to obtain a 1000 ppm solution are in Appendix 4. In order for bleach to be effective at a concentration of 1000 ppm (0.1%) it needs:

- sufficient time to kill the virus – at least 10 minutes contact time
- environmental surfaces to be free of vomit or faeces or any other organic matter
- dilution of bleach to made up fresh, just before using.

Cleaning equipment and agents

Bleach should be applied to hard, non-porous, environmental surfaces at a concentration of 1000 ppm. However, cleaning with bleach should be preceded where possible with a neutral detergent clean, the detergent providing a surfactant to release oils and bio-burden to enable penetration of the chemical. Detergents used for environmental cleaning should remove soil or dirt, suspending this in water, to be followed by rinsing the area free with little or no residue. Neutral pH detergents are best for environmental cleaning because they are less likely than acid or alkali detergents to damage metals such as stainless steel or to cause skin irritation [91].

Where possible, cleaning equipment such as cloths should be disposable and discarded immediately after use in each patient area in a leak proof plastic bag. Heat disinfection (pasteurisation to 60°C) has been used successfully under laboratory conditions and may be useful for items that cannot withstand bleach. It is important in the process of terminal cleaning of an area for the cleaner to use PPE (gown, gloves and a surgical mask) to prevent the cleaner becoming infected with norovirus. Transfer of infection to the cleaner has been implicated when carpets have been steam cleaned. Public health agencies should advise agencies cleaning an affected facility to use appropriate PPE for cleaning.

Environmental surfaces

To assist in preventing transmission in an outbreak setting, frequently touched environmental surfaces such as door handles, bathroom taps, lift buttons, washrooms, phones and tables should be cleaned more frequently than the routinely recommended daily cleaning. Particular attention should be paid to toilet seats, flush handles, wash-hand basin taps and toilet door handles. These should be cleaned at least twice a day as well as after any high usage times. Surfaces should be cleaned using detergent and warm water. A bleach solution diluted to 1000 ppm may be used to disinfect surfaces that are visibly soiled. The manufacturer's recommendations for use and occupational health and safety instructions should be followed when using bleach.

Terminal cleaning of an affected area, unit or section should be carried out 72 hours after resolution of symptoms in the last case. This takes into account the period of maximal infectivity of 48 hours plus the average incubation period of 24 hours for any newly infected individuals [100]. However, it may be unrealistic to wait for return of formed stools in all cases. At minimum, terminal cleaning should not be carried out until at least 72 hours after onset in the last case and 72 hours since uncontrolled vomiting or diarrhoea with contamination of the surrounding environment. Terminal cleaning should involve cleaning of all surfaces, furniture, bedding, equipment and items in contact with ill persons with detergent and water, followed by wiping with a bleach solution. Alternatively a combined detergent/sodium hypochlorite solution can be used as a one-step terminal clean. Terminal cleaning should be carried out before an outbreak is declared 'over' (see section 7.5).

8.2.4 Cleaning up vomit or faeces

Vomit can produce aerosols suspended in the air and fall onto food or surfaces. If a person vomits in a public area, all people should be removed from the vicinity and the area cleaned immediately. Persons cleaning vomit or faeces should wear gloves, apron and a mask. Paper towels should be used to soak up excess vomit and faeces and disposed of in a leak proof plastic bag. The area should be cleaned with detergent and warm water using a disposable cloth, and discarded into a leak proof plastic bag. The area should be disinfected with bleach solution, if not subjected to damage by bleach.

Splash incidents

If there has been exposure to faeces or vomitus on body parts other than the hands, the area should be washed with soap and water if on the skin, with water if the eyes are splashed and if in the mouth, the body fluid should be spat out and the mouth rinsed several times with water [101].

Carpets

Carpets that have been soiled by faeces or vomit are difficult to disinfect. Bleach is not generally recommended as prolonged contact is required and carpet is usually not bleach resistant. Soiled carpets should be cleaned with detergent and warm water and then steam cleaned. Vacuum cleaning carpets has the potential to recirculate norovirus and is not recommended. However, if necessary, the use of separate ducted systems or HEPA-filtered devices may be considered for each area. The cleaner should use PPE (gown, mask and gloves) to prevent norovirus infection. Repeated outbreaks of norovirus have occurred even when carpets have been steam cleaned.

Soft furnishings

Soft furnishings that may be damaged by bleach should be cleaned with detergent and warm water and if possible steam cleaned. If mattresses have been contaminated they should also be steam cleaned. Contaminated pillows should be laundered in the same way as linen (see section 8.2.5). However, if they are covered with an impermeable cover, pillows should be cleaned with detergent and warm water followed by wiping with a bleach solution.

8.2.5 Laundry

Gloves should be worn when handling soiled linen. PPE may be required if there is potential for contamination by way of splashing, spraying or splattering of faeces or vomit. Soiled linen or clothing should be removed immediately and placed in a collection bag or leak proof plastic bag. There should be minimal handling of soiled linen or clothing to prevent generating further aerosols. Contaminated linen, blankets or clothing should be washed as usual in detergent for the maximum washing cycle. Used non-disposable mop heads should be laundered in a hot wash. Exposed personal effects (e.g. wall hangings etc.) should preferably be hot-washed through the laundry and bleach cleaned where possible.

Where an outbreak becomes protracted or is difficult to contain, consideration should be given to outsourcing laundry services to allow high quality cleaning of the laundry. If an external laundry service is used by the institution they should be informed about the outbreak so they can take necessary precautions to avoid infection.

In an aged care or health care setting, linen should be placed in a leak proof bag or alginate bag at the point of generation. Soiled linen should not be left on the floor or in corridors. The practice of hosing off gross soiling from clothing and linen prior to laundering is not recommended.

8.2.6 Food

Only catering or kitchen staff should have access to the kitchen at any time; this is particularly important during an outbreak. Ill people should not take part in food handling duties and should not return to their usual food handling duties until 48 hours after their symptoms have ceased. All appliances, work benches and equipment need to be effectively sanitised (refer to manufacturer's instruction). Communal dining areas should be closed during an outbreak. If this cannot be carried out, the areas need to be sanitised after each use. All utensils, cutlery, crockery and glassware are to be washed in the usual manner with detergent and hot water. Dispose of any exposed food, that is, food that has been handled by an infected person or food that may have been exposed to someone vomiting in close proximity.

8.2.7 Exclusion

Ill people should be sent home immediately and excluded from child care, preschool, school or work for 48 hours after all symptoms have stopped. Maximum viral shedding probably occurs 24–48 hours after exposure; therefore it is a reasonable and accepted recommendation that workers be excluded for 48 hours after symptoms have stopped. As viral excretion can persist for days it is not practical or of benefit to require clearance of norovirus from stools before a person returns to work.

There is very limited data about the how infectious the virus is during post-symptomatic shedding because of the lack of laboratory assays to measure norovirus infectivity [102]. However, the load shed in the post-symptomatic phase is lower than the load shed in acute illness, and the evidence for spread in these individuals is not as good as the evidence for spread during symptomatic illness [59]. Better information on the duration of viable viral shedding and of the incidence of asymptomatic shedding of viable virus would enable more evidence-based recommendations for exclusion of workers.

8.2.8 Isolation and cohorting

An attempt should be made to separate ill people from well people ('cohorting'), especially if the outbreak setting is in a semi-closed environment and people are required to live in a household-like situation sharing the same facilities. However, there should be limited moving around of norovirus-infected people. In such settings, common areas should be closed off in an outbreak situation. If this is not possible, unwell people should not use common areas. If unwell people must share a room with others, strict handwashing and PPE procedures should be in place for anyone entering that room. If possible, separate toilet facilities should be allocated for affected people. If possible, ill people should be restricted to their room and for 48 hours after resolution of symptoms. This measure is intended to prevent susceptible individuals from becoming infected as norovirus immunity is known to be strain specific and short-lived.

If the outbreak is confined to one area, people in that area should avoid contact with people in unaffected areas. There should be dedicated people to look after ill persons and they should not be involved in food preparation. If dedicated people are not available, they should observe strict handwashing and use of PPE procedures when moving between ill and well people or affected and unaffected areas.

8.2.9 Visitor restriction and signage

In an attempt to limit the further spread of infection, visiting affected areas should be restricted during the period of an outbreak. Whether restrictions to visiting pertain only to the affected area, or to the whole facility, depends on whether affected and unaffected areas are separate enough to prevent further spread of infection. If limited visiting is permitted, visitors entering a facility where there is an outbreak should be made aware of the risk of transmission and infection; this may be done by placing signs at all entrances to the facility (see Appendix 5). Restriction of non-essential services to the institution should be recommended. Visitors should wash their hands on arrival and when leaving the facility. Visitors experiencing any symptoms of gastroenteritis should be advised not to visit the institution until 48 hours after cessation of symptoms. Consideration should be given to restricting visitors from bringing food into the facility.

8.2.10 Closure

In some outbreaks that are difficult to control and where there is significant ongoing risk of infection by periodic renewal of the susceptible population, such as cruise ships and camps, it may be necessary to close the facility until it can be cleaned and disinfected properly. However, this decision will have to be made on a local level in conjunction with the facility, the public health agency, local government and environmental health.

8.3 Training

It would be beneficial for all institutions, community settings and food establishments at risk of norovirus outbreaks to provide a specific program of education and training for staff about management of such outbreaks. This could be incorporated in induction training programs and also be carried out at times of an outbreak occurring. Workplace education could include the following:

- cleaning and disinfection procedures
- isolation of affected persons
- transfer of ill persons
- exclusion of ill people
- importance of correct hand hygiene covering all hand surfaces for adequate duration, using the appropriate product and carried out at appropriate times
- personal hygiene, proper glove use and correct food handling practices for food handlers
- transmission of viral gastroenteritis and infection control procedures.

Staff should be able to identify the early signs of an outbreak and be prepared and know how to manage the outbreak and also how to minimise the risk of infection to themselves. The local public health agency can provide advice to institutions that are experiencing an outbreak and arrange for assistance from EHO. Equipment, staff and resources must be identified and accessible at all times.

During an outbreak, regular promotion of hand washing is recommended. In order for people to wash their hands during an outbreak they must have access to water, handwash (preferably liquid, not cakes of soap) or alcohol-based hand rubs or gels and disposable paper towels or single cloth towel. Where possible, institutions need to have access to PPE and staff need to be trained in how and when to use them. Training on cleaning procedures is important. If a vomiting incident occurs in any public area, including restaurants, staff members need to know how to clean and disinfect the area correctly to prevent further transmission through environmental contamination and aerosolisation of vomit. Employers should ensure that employees are properly trained in food safety as it relates to their assigned duties.

Management should support the recommendation that staff should not return to work for 48 hours after diarrhoea or vomiting stops. Staff should not feel compelled to return to work earlier for fear of losing their employment or due to staff shortages. This is particularly important where staff have a role in handling or preparing food. Many foodborne outbreaks of norovirus are the result of people working while they have symptoms of gastroenteritis.

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Appendix 1: Further sources of information on norovirus

Australian guidelines and websites

Australian guidelines for the prevention and control of infection in healthcare – NHMRC (2010)

Guidelines for the management of gastroenteritis in residential care facilities, Communicable Diseases Prevention Unit, Department of Health and Human Services, Tasmania
http://www.dhhs.tas.gov.au/__data/assets/pdf_file/0005/8924/ManagementofGastroenteritisinResidentialCareFacilities07.pdf

Norovirus information for health professionals, Health Department Western Australia
http://www.public.health.wa.gov.au/3/609/3/norovirus.pm

*Guidelines for the investigation of gastrointestinal illnes*s, Department of Human Services, Victoria, 2004
http://www.health.vic.gov.au/ideas/diseases/gas_ill_index

Information pack for gastroenteritis in an institution, Department of Health, New South Wales, 2005
http://www.health.nsw.gov.au/resources/publichealth/infectious/diseases/pdf/gastro_pack.pdf

Guidelines for the management of infectious gastroenteritis in aged-care facilities in South Australia, Communicable Disease Control Branch, Department of Health, South Australia, January 2005
www.health.sa.gov.au/pehs/publications/gastro-aged-care-jan05new.pdf

Guidelines for the management of outbreaks of gastroenteritis in residential care facilities, Communicable Disease Control Directorate, Department of Health, Western Australia, January 2008, http://www.public.health.wa.gov.au/cproot/1072/2/10479%20final%202.pdf

Gastro-Info gastroenteritis kits for aged care, Australian Government Department of Health and Ageing, 2008, http://www.health.gov.au/internet/main/publishing.nsf/Content/ageing-publicat-gastro-kit.htm

Guidelines for the investigation of foodborne disease for local government environmental health officers, Communicable Disease Control Branch, Department of Health, South Australia, November 2006
www.dh.sa.gov.au/pehs/Food/eho-guidelines-nov06.htm

Guidelines for managing suspected norovirus outbreaks in residential care facilities, The State of Queensland, Queensland Health, April 2008.
http://www.health.qld.gov.au/ph/Documents/cdb/nov_rcf_guidelines.pdf

Staying healthy in child care: preventing infectious diseases in child care, 4th edition
National Health and Medical Research Council, Australian Government, December 2005, reprinted 2006
http://www.nhmrc.gov.au/publications/synopses/ch43syn.htm

Infection control guidelines for the prevention of transmission of infectious diseases in the health care setting, Australian Government Department of Health and Ageing, January 2004
http://www.health.gov.au/internet/main/publishing.nsf/Content/icg-guidelines-index.htm

International guidelines and websites

Guidelines for the management of norovirus outbreaks in hospitals and elderly care institutions, Ministry of Health, New Zealand, April 2008
http://www.moh.govt.nz/moh.nsf/0/7E38D595764289E6CC256EA700735F14

Vessel Sanitation Program website, Department of Health and Human Service, Centers for Disease Control and Prevention, Atlanta, US Public Health Service
www.cdc.gov/nceh/vsp

Various gastrointestinal guidelines, Health Protection Scotland website
http://www.hps.scot.nhs.uk/giz/guidelines.aspx

Viral gastroenteritis norovirus – guidelines for environmental cleaning and disinfection of norovirus, Michigan Department of Community Health, updated 1/5/2009
www.michigan.gov/documents/Guidelines_for_Environmental_Cleaning_125846_7.pdf

Appendix 2: Public fact sheet on norovirus gastroenteritis

This information is for staff in institutions or Public Health Units to distribute to the public.

What is norovirus gastroenteritis?

Norovirus gastroenteritis is diarrhoea and vomiting caused by a virus in the digestive system. There are many viruses that can cause gastroenteritis but norovirus is one of the most common. It often occurs as outbreaks where many people get sick at the same time. Common names used for gastroenteritis due to norovirus are 'gastric flu' or 'stomach flu', 'winter vomiting' and 'viral gastro'.

What are the symptoms?

Common symptoms of viral gastroenteritis include nausea, diarrhoea, vomiting and abdominal cramps. Other symptoms may include headache, chills, low grade fever, muscle aches and tiredness. The illness often begins suddenly and symptoms last between 24–48 hours.

How are noroviruses spread?

Noroviruses are usually spread from one infected person to another. Noroviruses are often associated with outbreaks where people are in close living spaces, such as Aged-care facilities, hospitals, cruise ships and community sporting events. There are different ways in which people become infected:

- eating food or drink that is contaminated with norovirus. This can occur in two ways:
  - when the food may become contaminated during growing or processing, especially oysters
  - when a person who is ill prepares food for other people.
- touching surfaces or objects contaminated with norovirus and then putting their hands in their mouth
- having direct contact with another person who is infected (for example, caring for someone who is ill)
- small particles of vomit settle on people or food in the same room and result in infection.

When do symptoms begin?

Symptoms of vomiting, nausea and diarrhoea usually begin 24–48 hours after ingestion of the virus, but they can appear as early as 12 hours after someone is exposed to the virus.

Are noroviruses contagious?

Yes, noroviruses are highly contagious. People infected with norovirus can spread the virus from the day they start to feel ill to at least 2 days after diarrhoea or vomiting stops.

Who gets norovirus?

Anyone can become infected with norovirus. There are many different strains of norovirus which makes it difficult for a person's body to develop long-lasting immunity. Therefore, you can get norovirus more than once during your lifetime.

Is there any treatment available?

No specific medication or antibiotics exists for norovirus infection and there is no vaccine available.

When people are ill with diarrhoea or vomiting they should drink plenty of fluids to prevent dehydration. People with severe symptoms or dehydration should seek medical advice.

How can norovirus infections be prevented?

There are some simple measures to prevent infection:

- Wash hands with soap and water after using the bathroom and changing nappies.
- Wash hands with soap and water before eating, or preparing food for oneself or others.
- Do not prepare food for others while you have gastroenteritis, or for at least 2 days after diarrhoea or vomiting stops.
- Immediately remove and wash clothing or bedding that may be contaminated with diarrhoea or vomit.
- After an episode of vomiting or diarrhoea, clean the area with detergent and warm water and then disinfect contaminated surfaces with household bleach diluted to 1000 parts per million (ppm). (Note: Bleach may damage soft furnishings.)
- People who are ill with norovirus or suspected viral gastroenteritis should be excluded from child care, school or work for a minimum of 48 hours after diarrhoea or vomiting stops.

Finally, it is very important that people thoroughly wash their hands even after symptoms have stopped. Handwashing has been shown to reduce a person's risk of both spreading and catching gastroenteritis.

Where can you find out more?

Contact your state or territory health department for more information.

Appendix 3: Collection of clinical specimens in an outbreak

This information is to assist staff in institutions or treating medical officers how to manage specimen collection in the event of an outbreak of gastroenteritis.

Advice can be sought from the laboratory or Public Health Unit (PHU) about the collection and transportation of specimens for testing, along with how many samples to collect and what tests should be requested.

Specimen collection for bacterial, viral and parasitic pathogen detection should begin immediately an outbreak of gastroenteritis is suspected. *This is important as the aetiology (microbiological cause) can guide the response*.

Specimen collection

In outbreaks, the PHU may organise for specimens to be collected and sent to a particular laboratory. In other circumstances, treating doctors may collect and send specimens to their normal laboratory.

The following guidance applies to collecting specimens during outbreaks:

- Faecal specimens are preferable for detecting viruses and other causes of gastroenteritis. Vomit samples should only be collected after consultation with the laboratory or PHU. (Collection and storage of vomit specimens are the same as those for faecal specimens).
- Specimens should be collected in an appropriate sterile laboratory container. If one is not available, then cases should be advised to use a clean disposable container. Collect approximately 10–20 ml of faeces in a jar.
- To collect faecal specimens:
    - Place a disposable container inside the toilet before use by the patient.
    - Use a disposable spoon or spatula to collect faeces from linen, incontinence pads or bedpans.
- It is preferable that specimens are collected while the person has diarrhoea, as maximal virus shedding usually occurs 24–72 hours after exposure.
- Where possible, give the laboratory prior notice if an increased number of specimens will be submitted from cases of gastroenteritis that are part of an outbreak.
- Collect specimens from at least six ill people or consult with the PHU and laboratory as to the number of samples required.
- Staff collecting specimens should wear personal protective equipment where possible, particularly gloves and possibly masks and gowns. It is important that staff wash their hands thoroughly after collecting specimens.

Storage and transportation

- Store specimens in the refrigerator at 4˚C. If a fridge is not available a chilled ice chest can be used. Do not use a food refrigerator for storing specimens.
- Specimens should be transported to the laboratory as soon as possible. During transportation specimens should remain bagged and sealed and kept on ice or in a refrigerated container.
- Ensure that each specimen is accompanied by a specimen request form. It should be noted on the form that the specimens are from patients in an outbreak. Each request form and specimen should be marked URGENT and clearly labelled with all patient details, including a brief description of the outbreak in the clinical notes field and a reference number for the outbreak.

Specimen testing

In general, all specimens should undergo standard bacterial testing and testing for viral pathogens, particularly norovirus. The following tests should be requested for faecal specimens:

- microscopy, culture and sensitivity (MC&S)
- viruses, particularly norovirus
- parasites.

If the outbreak has occurred in a setting where norovirus outbreaks are common, it may be appropriate to test specimens only for norovirus in the first instance.

Appendix 4: Cleaning and disinfection

This information is to assist Public Health Units and staff in institutions to manage cleaning and disinfecting when there is an outbreak of norovirus.

General guidelines for cleaning and disinfecting

The following general guidance applies to cleaning areas soiled with faeces or vomit during an outbreak. The environmental surfaces need to be cleaned free of vomit or faeces using a neutral detergent and warm water prior to disinfecting with bleach solution.

Clean soiled areas

1. Isolate the area where a vomiting or diarrhoea incident has occurred.
2. Wear disposable gloves and a mask.
3. Absorb and remove as much of the vomit/faeces as possible with disposable paper towels or disposable cloths.
4. Discard the disposable paper towel or cloth into a leak proof plastic bag.
5. Clean soiled areas with detergent and warm water using a disposable cloth and discard immediately into a leak proof plastic bag.
6. Discard used gloves and apply clean gloves before disinfecting the soiled areas.

Disinfect soiled areas

1. Use freshly-made bleach solution and follow manufacturer's instructions for appropriate dilution and use (see below for dilution instructions).
2. Wipe the area with bleach solution with disposable paper towels or a disposable cloth.
3. Dispose of gloves and mask in a leak proof plastic bag.
4. Wash hands thoroughly using soap and water and then pat dry using a disposable paper or single cloth towel. If water is unavailable, decontaminate hands using an alcohol-based rub or gel.

Preparation of disinfection solution

Household bleach comes in a variety of strengths of the active ingredient—hypochlorous acid—and you can find this information on the product label.

Table 1. Recipes to achieve a 1000 ppm (0.1%) bleach solution

Original strength of bleach		**Disinfectant recipe**		**Volume of bleach in a standard 10 litre bucket**
%	**Parts per million**	**Parts of bleach**	**Parts of water**	
1	10,000	1	9	1000 ml
2	20,000	1	19	500 ml
3	30,000	1	29	333 ml
4	40,000	1	39	250 ml
5	50,000	1	49	200 ml

Note:

- When a disinfectant is required for cleaning, the manufacturer's recommendations for use (usually written on container) and occupational health and safety instructions (in workplace handbook on OH&S for hospitals) should be followed.
- Gloves should be worn when handling and preparing bleach solutions.
- Protective eye wear needs to be worn in case of splashing.
- Bleach solution should be made up daily.
- Bleach should be used mainly on hard, non-porous surfaces.
- Bleach can damage textiles and are corrosive to metals.
- **Sufficient time is required to kill the virus – at least 10 minutes contact time.**

Appendix 5: Management of outbreaks in aged-care facilities

This information is designed to assist aged-care facilities (ACFs) in the event of an outbreak of suspected viral gastroenteritis and provides guidance on early identification, prevention and control. It has been specifically written for the management of norovirus outbreaks in ACFs.

Outbreaks of gastroenteritis are common and therefore a serious concern for the aged care industry. Gastroenteritis in facility residents is associated with increased hospitalisation and mortality and causes significant disruption to staffing. Norovirus is the leading cause of gastroenteritis in ACFs and is readily transmitted from an infected person to other persons.

In an outbreak of gastroenteritis in an ACF, it is critical to institute immediate infection control measures, even before obtaining laboratory confirmation of diagnosis.

The following information is included:

Appendix 5.1 For Public Health Units

- Brief guidance notes for Public Health Unit (PHU) staff on possible approaches that may be taken in managing presumed Norovirus outbreaks in aged-care facilities.
- Sample of an outbreak risk assessment matrix to assist decision making regarding level of response required.

Appendix 5.2 Guidance for managing suspected norovirus outbreaks in aged-care facilities

- Summary protocol for staff in ACFs for managing outbreaks.

Appendix 5.3 Initial report template

- Sample template for reporting an outbreak when it is first recognised.
- Can be used by the facility for self-reporting, or as an interview template by PHU staff.

Appendix 5.4 Outbreak management checklist

- Summary checklist for ACF to assess key outbreak management activities.

Appendix 5.5 Self audit check list

- Detailed checklist of infection management and outbreak control measures for ACF to use as a self audit tool.

Appendix 5.6 Line-list

- Line-list for ACF to use in an outbreak to record details of patients affected with gastroenteritis.

Appendix 5.1 Principles for Public Health Units

Outbreaks of viral gastroenteritis occur commonly in ACFs. Australian health departments have existing protocols and practices for managing these. There are variations in the level of direct involvement by different PHUs and also by the same Unit at a given time, as guided by availability of resources and other competing workload demands.

The purpose of these *Guidelines* is not to suggest a standardised, one-size-fits-all type of an approach. Rather, they are offered to assist PHUs in further developing and refining their operational protocols. The remaining components of this Appendix are included more for the purpose of aiding staff in ACFs through provision of concise protocols and key tools for outbreak management. Again, individual PHUs will have their own tools which would replace the suggested templates here as appropriate.

Table 2 on the next page depicts three tiers of PHU-response levels for managing outbreaks of norovirus or suspected viral gastroenteritis in institutions. Such classification may be useful in making explicit decisions about the level and type of response that will be offered for these outbreaks. This may be as a general 'standard' approach or may be varied, depending on the requirements of a specific outbreak or during a particular time period. For example, while the standard level of response of a particular PHU might be Level III, during a busy season it may only be feasible to carry out a Level II response on a routine basis unless there are particular concerns.

Table 2: PHU-response levels for managing norovirus or suspected viral gastroenteritis outbreaks in institutions

Issue		Level I Information dissemination	Level II Passive supervision	Level III Active supervision
1	**Initial response**			
1.1	Initial telephone discussion	Public Health Officer (PHO)	PHO	PHO
1.2	Information pack distribution	Yes	Yes	Yes
1.3	Initial checklist	Prepared & submitted by facility	Prepared & submitted by facility	PHU by telephone
2	**Pathology**			
2.1	Specimen testing	Arranged by ACF—usual arrangements	Arranged by ACF—usual arrangements	Arranged by PHU at Reference Laboratory
2.2	Tests to be requested	MCS, OCP, NoV	MCS, OCP, NoV	MCS, OCP, NoV
2.3	Specimen pick-up arrangements	Arranged by ACF—usual arrangements	Arranged by ACF—usual arrangements	• ACF delivers to Reference Laboratory, or • Taxi, or • EHO pick-up
2.4	Results	Facility informs PHU	Facility informs PHU	PHU receives & informs facility
3	**Site visits**			
3.1	Carrying out site visits to affected institutions	If specific concerns	• If specific concerns • Consider Council EHO	PHO & EHO visit if possible (modified depending on risk assessment)
4	**Follow-up**			
4.1	Daily line-listing	Facility keeps for internal records	Facility submits to PHU	Facility submits to PHU
4.2	Follow-up contact	Only by ACF if have issues	By PHO if no feedback received in 2 days	Daily by PHO
4.3	Follow-up duration	Only if required by ACF	Until end of outbreak	Until end of outbreak
5	**Data management**			
5.1	Data collation	ACF for own records	PHU keeps hard copies & updates summary data	PHU on electronic daily follow-up templates
5.2	OzFoodNet summary	PHU based on initial check-list	PHU based on all available data	PHU based on all available data

Note: PHO – Public Health Officer; ACF – Aged-care Facility; PHU – Public Health Unit;
MCS – Microscopy, Culture, Sensitivity; OCP – Ova, Cysts & Parasites; NoV – Norovirus
EHO – Environmental Health Officer

Table 3 assists in flagging specific outbreaks that may require a higher level response. It is based on the subjective assessment of a number of key factors during an initial interview by PHU staff. For each factor (category), a 'level' is indicated (1–3), which are then added up to give a total score. The total score then gives an indication of the overall alert level for the outbreak at the time of initial reporting. Thus, an outbreak with a high alert level might warrant more direct involvement from the PHU than would otherwise be the case.

Table 3: PHU-response risk assessment matrix for managing norovirus or suspected gastroenteritis outbreaks in institutions

CATEGORY		**ALERT LEVEL**			**Score**
		1 (Low)	**2 (Medium)**	**3 (High)**	
1	Facility has previously managed similar outbreaks in liaison with PHU	In past year, without major concerns	In past couple of years, without major concerns	None or major concerns about way outbreak managed	
2	Promptness of outbreak reporting	Immediate (within 1 day)	Intermediate (within 2–3 days)	Delayed (longer than 3 days)	
3	Receptivity to/ease of communicating public health advice (impression over telephone)	Easily understood	Some difficulty communicating	Major issues in communicating	
4	Proportion of staff affected at time of reporting	Nil (or <10%)	Low (or 10–19%)	Moderate to high (or >20%)	
5	Food handling staff affected	Nil	After other cases	Around onset of outbreak	
6	Facility has Infection Control Practitioner support	Easily accessible	Not easily accessible	None	
7	Promptness of implementing public health advice generally	Very prompt	Intermediate	Delayed	
8	Ease of implementing cohorting (staff, residents, areas of facility)	Readily achieved	Achieved with some difficulty	Difficult/impossible to implement adequately	
9	Ease of implementing appropriate cleaning measures	Readily achieved	Achieved with some difficulty	Difficult/impossible to implement adequately	
10	Separation of food handling and cleaning duties	Normal practice	Promptly instituted	Difficulty or delay in instituting	
	Total score:				

Table 3 continued

Instructions				
a)	Scoring:	• Assign alert level score (1–3) for each category (row) • Add the alert level numbers for a total score • Possible score range: 10 (lowest) to 30 (highest)		
b)	Overall alert score:	Low	Intermediate	High
		10–16	17–23	24–30
c)	Additional considerations:	*Consider assigning a 'High' score regardless if:* • Number of High alerts (3's) = 3 or more • Category 5 (food handling staff) score = 3 • Other overall concerns		

Appendix 5.2 Guidelines for managing suspected norovirus outbreaks in aged-care facilities

What is viral gastroenteritis?

Viral gastroenteritis is a common cause of diarrhoea and vomiting. Other symptoms may include nausea, stomach cramps, fever, headache and muscle aches. It takes about 24– 48 hours for symptoms to develop and the illness may last a day or two. The illness causes embarrassment, and disruption to normal activities, and can be serious in the very young or the very old. However, it generally settles without further problems, and other than maintaining a good fluid intake there is no specific treatment.

Outbreaks can occur in aged-care facilities, childcare centres, restaurants and hotels.

How is gastroenteritis spread?

Viral gastroenteritis is highly infectious. It can be spread in the following ways:

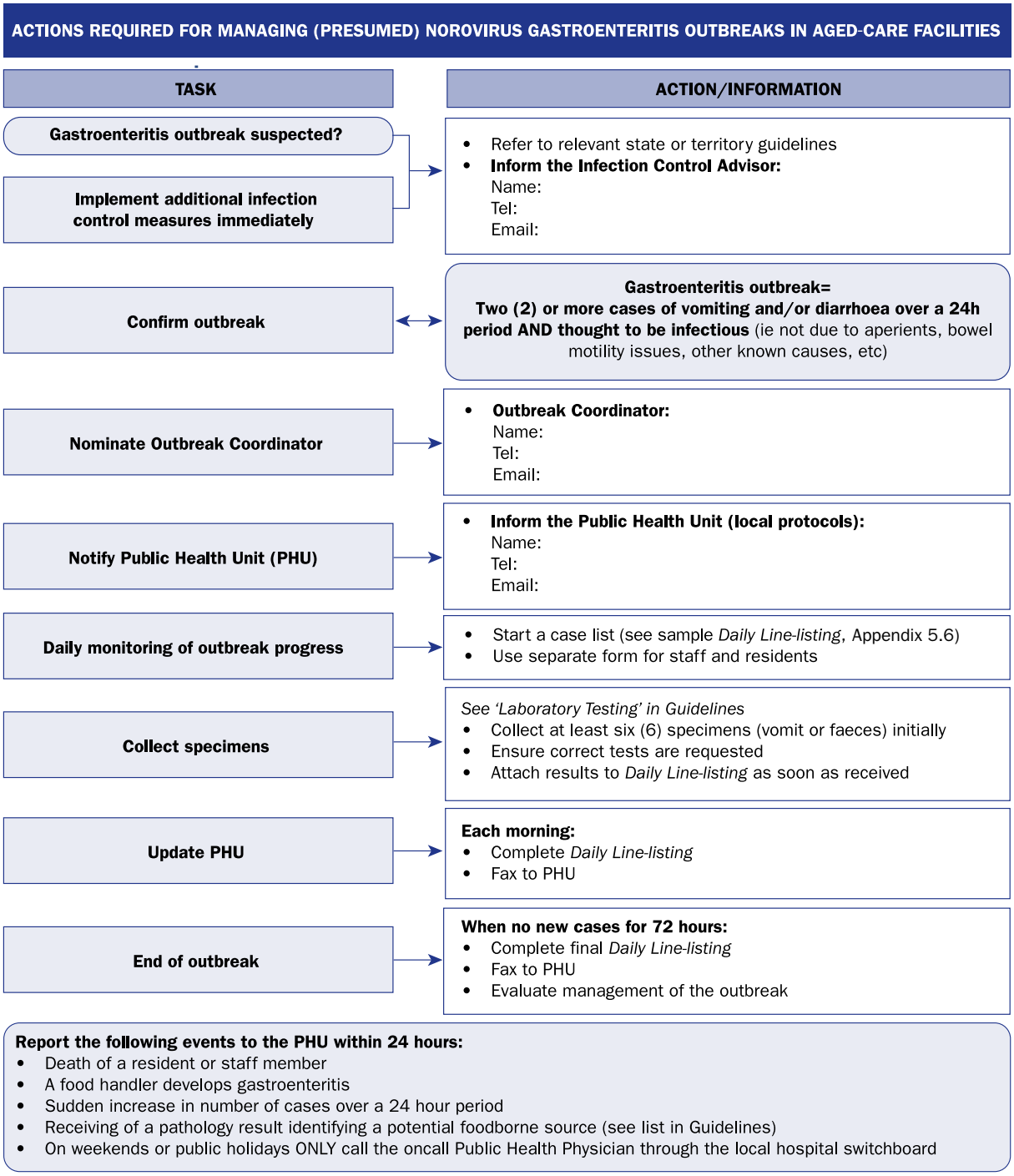
- by person-to-person contact (for instance when the virus is on people's hands)
- by airborne spread. (When a person vomits, large amounts of virus particles pass into the air in invisible droplets and can be passed on to other people in the same room)
- by swallowing contaminated food or drink.

Someone with viral gastroenteritis is potentially infectious while they have the symptoms and for at least 48 hours after the symptoms have stopped (longer in the elderly).

Anyone who has had diarrhoea and vomiting for more than 24 hours should be seen by a doctor. The diagnosis of viral gastroenteritis is normally made on the basis of symptoms and through the testing of faeces or vomit.

The onset of vomiting in a number of people over a period of 1–3 days suggests that the infection is spreading within the establishment. The following specific actions should be implemented to stop the spread of infection.

Figure 4: Flow chart to guide aged-care facilities actions for managing (presumed) norovirus gastroenteritis outbreaks



Recognising an outbreak

A gastroenteritis outbreak is defined as two or more cases of vomiting or diarrhoea over a 24 hour period, not counting non-infectious causes (e.g. use of aperients, known bowel problem, etc.). Recognising an outbreak helps institute measures that control the spread of infection.

Reporting to the Public Health Unit

The local Public Health Unit (PHU) should be notified as soon as an outbreak is recognised, and within 24 hours. They will provide further guidance and support in investigating the outbreak as appropriate. Sometimes a site visit will be carried out by the PHU. Unless specified otherwise, the PHU will need to be provided with a daily line-listing (see template in section 5.6) of ill residents and staff, as well as information about any significant developments (e.g. results of laboratory testing, need for hospital admissions, deaths associated with the outbreak etc.).

Laboratory testing

It is important to identify the cause of the gastroenteritis, as some pathogens can indicate foodborne gastroenteritis (Table 4). Samples of diarrhoea/vomit need to be obtained from all new cases until samples from six people (residents or staff) have been collected. These samples should be labelled and dated, and then kept in the fridge (not the freezer) until collected by the pathology courier. A specimen collection form needs to be completed to accompany the specimens to the laboratory.

Table 4: Pathogens that can cause gastroenteritis

Some specific intestinal infections that may indicate food-borne gastroenteritis (if detected, inform PHU immediately):	
• *Salmonella* • *Campylobacter* • *Clostridium perfringens* • *Listeria*	• Shiga toxin-producing *E. coli* (STEC) • *Staphylococcus aureus* • *Bacillus cereus*

Isolation/cohorting

Ideally patients should be nursed in a single room with adjoining bathroom facilities. However, residents should not be moved around the facility to reduce the risk of further spreading the infection. If several patients have the same pattern of infection or are known to be carriers of an outbreak organism then '*cohort nursing*' may be appropriate. Cohort nursing involves one nurse or group of nurses exclusively caring for the identified cases, while other nurses care for the well patients. Staff working in the affected area should not be relocated to other areas until the outbreak has ceased. Staff from other areas should be discouraged from visiting the restricted area.

People are generally considered to be infectious for at least 48 hours after their symptoms have ceased; the elderly may be infectious for a longer period. The recommended time for isolation of residents and restriction of usual functions of the facility (see below) is for 72 hours after symptoms have settled in the last case. A thorough terminal cleaning needs to be carried out after this time prior to return to normal activities.

Restriction of admissions and ward closures

New residents should not be admitted to the affected ward/unit area until all cases have been free of symptoms for 72 hours. The entire facility may be considered 'infected' if the wards or units are not sufficiently separated to prevent the spread of infection.

Transfer of residents

Residents should not be transferred from the facility to other hospitals and institutions during an outbreak unless this is required for their clinical care. If any resident needs to be transferred, the receiving facility must be informed beforehand of the outbreak (e.g. clearly state 'suspected norovirus' or 'current norovirus outbreak at the facility' and talk to the infection control staff or receiving area at the hospital beforehand). Residents of the facility requiring norovirus-related hospital review or admission can be received back during the outbreak, to be cared for with the usual outbreak-related precautions.

Staff training

- Ensure that infection control practices are included in the orientation program for all new employees.
- Ensure that all staff are aware of the outbreak and their role in containing it.
- Ensure that all general practitioners looking after residents in the facility are informed about the outbreak as well as the required precautions.
- Schedule compulsory in-service education on infection control to all staff members.
- Ensure workplace information and training programs form part of the orientation program for new employees and are regularly repeated for all staff.
- Ensure that all staff are aware that should a resident require transfer to hospital for any reason, the hospital staff need to be advised of the existence of the outbreak prior to transfer.

Exclusion of staff

Staff are reminded to report if they have any signs or symptoms of gastroenteritis themselves. Staff should not come to work if they are unwell, and are to be excluded until 48 hours after their symptoms have ceased. Also remind medical practitioners and volunteers of this requirement.

Staff handwashing practices

Handwashing is considered the most cost effective and simple method of preventing the spread of infection. For detailed description of best practice in hand washing please see *Handwashing and personal hygiene, infection control in the health care setting* at: <http://www.health.gov.au/internet/main/publishing.nsf/content/2804E9F9B95357F7CA256F190003B4DA/$File/part3a.pdf>

Encourage staff handwashing by:

- choosing handwashing products that are pleasant and easy to use.
- ensuring adequate supplies of handwashing products and paper towels.
- ensuring that handwashing facilities are close to resident care areas.
- making handwashing part of the culture of the organisation.
- ensuring that handwashing is adequately resourced.
- providing instruction on the use of alcohol-based gel.

Staff personal protective equipment

Personal protective equipment should be available for all staff:

- Gloves should be worn whenever there is a risk of exposure to body substances to the carer's hands.
- Plastic aprons or gowns should be used whenever there is a risk of contamination of the carer's skin or clothing by body substances.
- Masks and protective eyewear (e.g. face shields or goggles) should be worn whenever there is a risk to the carer of airborne exposure to body substances such as after vomiting.

For details please see *Personal protective equipment, infection control in the health care setting* at: <http://www.health.gov.au/internet/main/publishing.nsf/content/2804E9F9B95357F7CA256F190003B4DA/$File/part3a.pdf>

It is important that staff thoroughly wash their hands after removing protective equipment, as studies have shown that lack of hygiene after using gowns, masks and gloves can spread viruses.

Closure of common areas

Access to common areas such as the dining room and day room should be restricted until all unwell residents are symptom free for 72 hours. If the areas within the facility are not suitably separated to prevent the possible spread of infection, then the common areas should either be closed altogether or, if this is impractical, their use should be restricted to well residents only. Unwell residents should be served meals in their own rooms or at a second sitting.

Relatives/visitors

- Advise unwell visitors not to visit their relatives.
- Advise visitors not to visit 'the affected area' until further notice (e.g. until all residents in that area are symptom free for 72 hours or the outbreak is declared over).

- Whether restrictions to visiting pertain only to the affected area, or to the whole facility depends on whether the wards/units are separate enough to prevent further spread of infection.
- If units are suitably separate, visitors to non-affected areas of the facility may be able to continue to visit but they should be advised to wash hands on arrival and before leaving.
- Advise non-essential visitors (e.g. visiting therapists, hairdressers, activity staff, etc.) not to visit during the outbreak.
- Visiting restrictions may need to be lifted in particular circumstances, such as imminent death of a resident. In such an event, visitors may be instructed in infection control and given suitable protective equipment, such as a mask and gloves.

Cleaning

- Clean the rooms of well residents first.
- Clean then disinfect all potentially contaminated areas (as described below).These areas include: toilets, showers, dirty utility/pan rooms, chairs, bedside tables, floors, handles, handrails, phones and any surface exposed to hand contact.
- First clean the potentially contaminated areas with detergent and hot water. Organic matter, such as faeces or vomit, will inactivate sodium hypochlorite (bleach) so prior cleaning is essential.
- Then disinfect these areas using the freshly made disinfectant solution.
- Bleach requires direct contact with surfaces for a minimum of 10 minutes.
- Bathrooms/toilets should be cleaned twice daily and when visible soiling occurs.
- Wipe down hard surfaces (e.g. handrails) using bleach solution twice daily during outbreak.
- Shower chairs to be wiped down using bleach solution between residents during the outbreak.
- Soft furnishings or metal surfaces which might be damaged by a hypochlorite solution should be cleaned with detergent and then left to dry thoroughly.
- Detachable mop heads should be laundered in a hot wash and left to air dry after use.
- Non-disposable mop heads should be laundered in a hot wash.
- Hypochlorite solution is used for disinfecting. Use either hospital-grade disinfectant mixed at a ratio of 50/50 with water (5000 ppm), or freshly constituted household bleach solution (1000 parts per million). For further information, see Appendix 4.

Cleaning up vomit and faeces

- Spills should be attended to immediately.
- If someone vomits in a public place, remove all others from the vicinity.
- Wear appropriate personal protective equipment (see above section).
- Use paper towels to soak up excess liquid and place in plastic bag.
- Clean the soiled area with detergent and hot water using a disposable cloth.

- Disinfect the soiled area with the freshly made disinfectant solution.
- Dispose of used items as per facility protocol for ‘clinical waste’.
- Close the area for at least 1 hour.
- Wash hands thoroughly (see above section).

Care of cleaning materials

Durable gloves should be worn during cleaning procedures. All cleaning equipment should be washed with detergent and warm water, rinsed and left to air dry, and then stored in a designated area. All remaining diluted cleaning products should be disposed of after use. Colour coding of various items of cleaning equipment is considered the most effective method of restricting equipment to individual areas of a facility e.g. reception, common areas (blue), toilets/bathrooms/dirty utility rooms (red), food service areas (green).

Linen

In order to prevent transmission of infection to staff, soiled linen/clothing should have minimal handling prior to laundering.

- Used linen should be bagged at the point of generation and promptly removed from patient care areas.
- Wet/visibly soiled linen should be placed in plastic lined linen bags.
- Linen bags should not be overfilled.
- Linen/clothing should not be rinsed or sorted in patient care areas.
- All soiled linen/clothing should be put through hot wash/hot dry cycles.

It is important to alert laundry staff or laundry contractors that the facility is experiencing an outbreak of gastroenteritis. All staff handling or cleaning soiled linen during an outbreak should use protective equipment to prevent infection.

Outbreak over

The outbreak may be considered over when all cases have been free of symptoms for 72 hours. Notify the PHU for closure of the outbreak.

Appendix 5.3 Template for an initial report of a suspected outbreak of gastroenteritis

Date/time: _____ Public Health Officer: _____

Contact details:

Person notifying outbreak: _____ Position: _____

Telephone number: _____

Name of facility: _____

Address: _____

Facility Manager / Director: _____

Telephone number: _____ Fax number: _____

Email address: _____

Description of facility:

Total number of residents: _____ Total number of staff at facility: _____

Age range of residents: _____

Number of units / wings in facility: _____

Name of Unit	No. of residents	Long term / Short respite

Type of staff member	No. employed by facility	No. agency staff
Cleaner		
Kitchen		
Nurse		
Care assistant		
Other (specify)		

Name of Agency/Agencies _____

Demographics of outbreak at time of notification:

Does the facility have an opinion as to the likely cause of the outbreak (e.g. viral or food-borne)? _____

Date/time of onset of first case of diarrhoea/vomiting: _____

Residents:

Total number of residents affected so far: _____

Date	No. of residents who became unwell on that day	Location (e.g. wing / unit / room no.)

How many ill residents are in single rooms? _____

How many ill residents are in shared rooms? _____

How many rooms have ensuites? _____

How many ill residents are high dependency? _____
(e.g. are incontinent or have dementia)

Staff:

Total number of staff members affected so far: _____

Date	No. of staff who became unwell on that day	Type of staff (e.g. cleaner, kitchen, nurse, carer)	Employee or agency	Location where mostly work (e.g. wing / unit / room no.)

Number of visitors / family members reporting ill (if known): _____

Symptoms:

Presenting pattern of symptoms (including number of cases if available):

Diarrhoea only:		Abdominal cramps only:	
Vomiting only:		Bloody diarrhoea:	
Diarrhoea AND vomiting:		Other:	

Clinical management of ill residents / children:

Date/time: _____ Public Health Officer: _____

Number of residents / children seen by a doctor: _____

Name of doctor(s): _____

Number of faecal specimens collected: _____ Date(s) collected: _____

Name of pathology firm(s): _____

Results if known: _____

Number of residents hospitalised: _____

Number of residents died (if any) as result of outbreak: _____

Number of staff seen by a doctor: _____

Food preparation:

If food is prepared on premises – is there a central kitchen? _____

Does the kitchen employ dedicated food prep / service? _____

Are any meals prepared by external contractors? ☐ Yes ☐ No

– If Yes: business/company name: _____

Address: _____

Phone: _____ Contact person: _____

Do all areas of the facility receive food prepared from the same source? _____

Do staff members eat the same food as the residents? ☐ Yes ☐ No

Common exposures:

Has there been a group function within the five days preceding the onset of the first symptoms? ☐ Yes ☐ No

If so, number of people exposed:

Residents: _____ Staff: _____ Visitors: _____

Appendix 5.4 Outbreak infection control checklist

1. Inform ☐

- Report outbreak to PHU and Department of Health and Ageing.
- Inform staff, residents and visitors of the outbreak.
- Provide handouts about gastroenteritis.
- Put up advisory notices.
- Advise visitors not to attend (especially young children, the immuno-compromised or any with gastroenteritis symptoms).
- Ask visitors to report any symptoms to staff.
- Advise visiting general practitioners and other health staff.

2. Handwashing ☐

- Ensure that all residents have their hands washed after going to the toilet, before meals and after any episode of diarrhoea or vomiting.
- Ensure all staff and visitors wash their hands before and after all resident contact.
- Ensure sufficient soap and/or alcohol-based hand rubs or gels, and hand-drying facilities are available.

3. Additional infection control measures ☐

- Train staff in additional contact precautions.
- Provide sufficient gloves, gowns, aprons, masks, goggles, face shields and ensure that they are easily accessible.
- Ensure cleaning and other relevant staff members are aware of the correct cleaning procedures and the importance of handwashing.
- Ensure catering staff members are aware of the precautions required in food service area and the importance of handwashing.

4. Cohorting ☐

- Allocate dedicated staff to care for unwell residents.
- Separate well residents from unwell residents for at least 72 hours after resolution of symptoms (cohort nursing; avoid moving residents around during an outbreak).
- Allocate dedicated staff to clean affected areas.
- Do not allocate catering staff members to care for infected residents or to clean affected areas.

5. Restrict movements ☐

- Close off dining room and common areas.
- Suspend communal activities, excursion, visiting programs to the facility.

6. Exclude sick staff ☐

- Exclude staff with gastroenteritis for at least 48 hours after resolution of symptoms.

7. Cleaning ☐

- Implement additional cleaning procedures, including: increased cleaning requirements; correct use of sodium hypochlorite; cleaning of body fluid spills.
- Instruct cleaning and other relevant staff about correct cleaning procedures and the importance of handwashing.
- Ensure catering staff are aware of the precautions required in food service area and the importance of handwashing.

8. Linen ☐

- Instruct staff about precautions required when handling soiled linen.
- Ensure adequate numbers of linen containers and leak proof bags.
- Ensure laundry staff are aware of the correct laundering procedures and the importance of handwashing.

9. Transfers ☐

- Avoid transferring residents to other institutions while the outbreak is in progress; if a transfer is necessary, ensure receiving institution is notified of the outbreak.
- Restrict admissions of new residents until outbreak is over.

10. Reporting, pathology testing ☐

- Report outbreak to Public Health Unit (PHU) promptly; follow PHU advice.
- Update PHU (Daily Line-Listing) regularly and if there are any 'sentinel events' (*see Figure 4 in these Guidelines*).
- Ensure laboratory testing has been organised.

Appendix 5.5 Self audit / Site visit check list for aged-care facilities

Date/time: _____ Public Health Officer: _____

1. Contact details:

Person notifying outbreak: _____ Position: _____

Telephone number: _____

Name of Facility: _____

Address: _____

Facility Manager / Director: _____

Telephone number: _____ Fax number: _____

Email address: _____

2. Laboratory testing

- Are specimens of diarrhoea/vomitus being collected from affected residents / staff? ☐ Yes ☐ No

3. Isolation / cohorting

- Is a plan of the facility showing location of ill residents obtainable? ☐ Yes ☐ No
- Have the identified cases been cohorted (grouped) as recommended? ☐ Yes ☐ No
- In what way have residents been cohorted? _____
- Have nursing staff been dedicated to the cohorted ill residents? ☐ Yes ☐ No
- If cohorting is not possible, have dedicated nurses been allocated to only work with ill residents? ☐ Yes ☐ No
- Are residents being 'isolated' until 72 hours after symptoms have ceased? ☐ Yes ☐ No
- Have residents been advised not to visit the affected ward / area? ☐ Yes ☐ No
- Is management aware of the need to restrict admissions? ☐ Yes ☐ No

4. Staff training

- Have all staff been notified of the outbreak? ☐ Yes ☐ No
- Have all staff been reminded of the importance of effective handwashing? ☐ Yes ☐ No
- Do staff regularly attend in-service training on infection control? ☐ Yes ☐ No

If yes, how often is this training provided? _____

- Is this training compulsory? ☐ Yes ☐ No
- Are infection control training programs part of the orientation program for new employees? ☐ Yes ☐ No

- Are staff encouraged to accept responsibility for decreasing the transmission of infectious organisms? ☐ Yes ☐ No
- What strategies are in place to check that staff are compliant with infection control recommendations? _____
- Do staff on all shifts know to advise Hospital staff of the outbreak prior to transferring a resident to hospital ED or an outpatient appointment (even if the illness is unrelated to the outbreak)? ☐ Yes ☐ No

5. Exclusion of affected staff

- Is the staff exclusion period of 48 hours being strictly adhered to? ☐ Yes ☐ No

6. Hand washing:

Are the following available:

- Facilities for handwashing in all areas? ☐ Yes ☐ No
- If not, what measures have been taken to address this?

- Liquid soap dispensers? ☐ Yes ☐ No
- Are soap dispensers disposable and not refillable? ☐ Yes ☐ No
- If refillable, is there a cleaning procedure? ☐ Yes ☐ No
- Paper towel / air drier? ☐ Yes ☐ No
- Plastic-lined waste bin with lid in all areas where affected residents are nursed? ☐ Yes ☐ No
- Is hand disinfection (e.g. 60–80% alcohol solution handrub) available? ☐ Yes ☐ No
- Are the taps elbow-operated? ☐ Yes ☐ No
- Are the residents' hands being washed after each episode of diarrhoea and vomiting? ☐ Yes ☐ No

7. Protective apparel:

- Are gloves readily available to all staff? ☐ Yes ☐ No
- Are gloves being worn when there is a risk of exposure to staff of contact with blood/body fluids? ☐ Yes ☐ No
- Are plastic aprons / gowns available to protect the staff member's clothing during exposures? ☐ Yes ☐ No
- Are plastic aprons / gowns being worn to protect the staff member's clothing during exposures? ☐ Yes ☐ No
- Are masks available when there is a risk to the staff member of airborne exposure to body substances such as after vomiting? ☐ Yes ☐ No
- Are masks being worn when there is a risk to the staff member of airborne exposure to body substances such as after vomiting? ☐ Yes ☐ No

- Are the aprons, gloves and masks being changed between residents? ☐ Yes ☐ No
- Are the bins for the disposal of aprons, gloves and masks near to the residents' rooms? ☐ Yes ☐ No
- Are staff washing their hands after removing protective apparel? ☐ Yes ☐ No

8. Closure of common areas

- Have the use of common areas been appropriately restricted? ☐ Yes ☐ No
- Are common areas being closed for 1 hour after episodes of vomiting? ☐ Yes ☐ No

9. Relatives / visitors

- Have visitors been advised of the outbreak, and of the visiting restrictions? ☐ Yes ☐ No
- Have visitors been advised not to visit if they are unwell? ☐ Yes ☐ No
- Have non-essential therapists been advised not to visit? ☐ Yes ☐ No
- Is relevant signage posted in all areas? ☐ Yes ☐ No
- Have essential visitors been advised to wash their hands when entering and when leaving the ward / unit and after contact with each resident? ☐ Yes ☐ No
- Are visitors given advice regarding the safe preparation and transportation of food they might bring in to the facility? ☐ Yes ☐ No

10. Routine cleaning

- Are rooms of well residents cleaned first? ☐ Yes ☐ No
- Are bathrooms / toilets cleaned twice daily and when visible soiling occurs? ☐ Yes ☐ No
- Are handrails in corridors and common areas and door handles in residents room cleaned and then disinfected twice daily with the recommended bleach solution? ☐ Yes ☐ No
- Are commode / shower chairs cleaned after individual resident use? ☐ Yes ☐ No
- Is a general clean followed by disinfection with the recommended bleach solution, being carried out for all hard surfaces? ☐ Yes ☐ No
- Is the bleach solution being discarded within 24 hours of constitution? ☐ Yes ☐ No

11. Care of cleaning materials

- Is all cleaning equipment colour coded, common areas (blue), toilets / bathrooms/ dirty utility rooms (red), food service areas (green)? ☐ Yes ☐ No
- Are disposable gloves worn during cleaning? ☐ Yes ☐ No
- Are mops heads detachable and washed and left to air dry after use? ☐ Yes ☐ No
- Are buckets washed and dried after use? ☐ Yes ☐ No

- Is equipment stored in cleaning cupboard / room? ☐ Yes ☐ No
- Are all remaining diluted cleaning products disposed of after use? ☐ Yes ☐ No

12. Cleaning up vomit and faeces

- Is there a policy / procedure for cleaning spills? ☐ Yes ☐ No
- Are staff aware of the policy / procedure for cleaning spills? ☐ Yes ☐ No
- Is bleach being used after spills / vomit / diarrhoea have been cleaned up? ☐ Yes ☐ No
- Are utility rubber gloves used for cleaning? ☐ Yes ☐ No
- Are spare mop heads available? ☐ Yes ☐ No
- Are plastic bags available for contaminated waste? ☐ Yes ☐ No
- Are disposable cloths / old rags / paper towel available to wipe up bulk spills? ☐ Yes ☐ No

13. Linen

- Is used linen bagged at the point of generation? ☐ Yes ☐ No
- Is wet / visibly soiled linen placed in plastic lined linen bags? ☐ Yes ☐ No
- Is the plastic bag dissolvable? ☐ Yes ☐ No
- Are linen bags being overfilled? ☐ Yes ☐ No
- Is linen / clothing being rinsed or sorted in resident care areas? ☐ Yes ☐ No
- Is soiled linen removed from resident care areas promptly? ☐ Yes ☐ No
- Is all soiled linen / clothing being put through hot wash / hot dry cycles? ☐ Yes ☐ No

Appendix 5.6 Line-list for recording case details in an outbreak of gastroenteritis in an aged-care facility

[Please record details of all cases for monitoring progress of the outbreak and record keeping purposes.]

Facility name: _____

Facility Manager: _____

Telephone no.: _____

Email: _____

Total number of residents at facility: _____

Total number of staff at facility: _____

Case name	Date of birth	Sex (M/F)	Staff (S) or resident (R)	Date/time illness began	Date/time illness ceased	Diarrhoea (Y/N)	Vomiting (Y/N)	Hospitalised (Y/N)	Died (Y/N)	Faecal specimen collected (Y/N)	Faecal specimen result

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