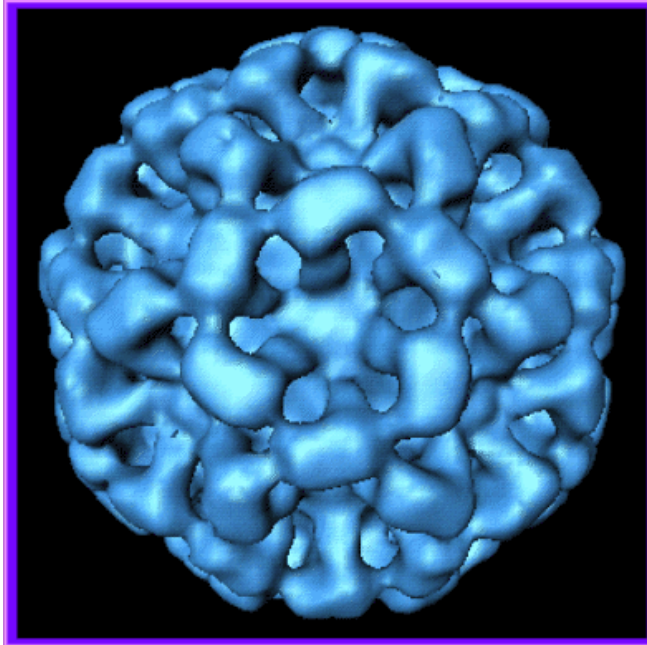


Guidelines for the Management of Norovirus Outbreaks in Hospitals and Elderly Care Institutions

April 2008



Foreword

Outbreaks of norovirus gastroenteritis are being increasingly recognised in the community and within hospitals and elderly care facilities in New Zealand [1-3]. Outbreak management has been defined as: 'the process of anticipating, preventing, preparing for, detecting, responding and controlling outbreaks in order that health and economic impact is minimised' [4]. These guidelines have been developed to standardise the approach of public health services, managers and health care workers of hospitals and elderly care facilities in New Zealand to both the investigation and control of institutional norovirus outbreaks. This document draws on similar guidelines produced in the United Kingdom [5, 6] and the United States [7] and where possible, provides an evidence-based approach.

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Picture: Composite reconstruction of Norwalk virus recombinant capsids using cryo-EM at 22 Angstroms resolution. Reference: Dr B V Prasad, Baylor College of Medicine, Houston, Texas.

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1. Introduction

1.1 Burden of illness in New Zealand

Noroviruses (formerly known as Norwalk-like viruses (NLVs) or small round structured viruses (SRSVs)) cause significant morbidity in New Zealand. Although illness is generally of short duration (less than 60 hours) [8] outbreaks are common and often explosive. An estimated 53,000 cases of norovirus infection occur in New Zealand annually [9] and in 2006, seven deaths were reported.

An outbreak is defined as: 'an epidemic limited to localised increase in the incidence of a disease, e.g., in a village, town or closed institution' [10]. An outbreak is more simply defined as 'two or more cases of illness linked to a common source' [4]. An outbreak of norovirus should be suspected where one patient or resident shows signs of gastroenteritis. Outbreaks of norovirus gastroenteritis are being increasingly recognised in the community and within hospitals, hotels, elderly and child care facilities in New Zealand [1-3]. Outbreak data reported via the national notification system (EpiSurv) and pertaining to confirmed outbreaks of norovirus in elderly care facilities and hospitals are shown in Table 1.

Table 1. Norovirus outbreaks* in NZ Hospitals and Elderly Care Facilities, 2007

Outbreak setting	Elderly care facilities (rest home and continuing care)	Hospital (acute care)	Total
Number of outbreaks	127	18	145
Number of laboratory confirmed cases*	995	418	1413
Number of probable cases†	3283	466	3749
Total number of cases	4278	884	5162
Number of deaths	10	0	10

*at least one case norovirus positive

† clinically compatible illness and epidemiologically linked to at least one confirmed case

Source: ESR, Porirua. Outbreaks reported to EpiSurv in the 2007 calendar year.

1.2 The importance of outbreaks in institutional settings

Institutional outbreaks involving hospitals and elderly care facilities are important. Table 1 shows that elderly care facilities accounted for over 85% of all institutional outbreaks reported during 2007. Protracted outbreaks of norovirus infection have been reported in elderly care settings [3, 11-14]. Hospital and nursing home residents represent high-risk populations for the transmission of gastrointestinal illness [15, 16]. The residents are likely to be relatively immunosuppressed and experience a more complicated clinical course. Outbreaks spread through person-to-person transmission among residents and patients and are complicated by enclosed living conditions and immobility [7]. In nursing

homes faecal incontinence and reduced mental function may also present challenges to outbreak control. An outbreak occurring in an Auckland elderly care institution in 2002 over a three-week period involved 106 cases with an attack rate among staff and residents of 66% and resulted in one death.

1.3 Clinical features of norovirus infection

Gastroenteritis caused by norovirus is characterised by acute onset of nausea (81%), vomiting (54%), abdominal cramps (72%) and diarrhoea (85%) [17]. Some cases suffer from vomiting alone [18]. Vomiting is more common in the young and diarrhoea more common in adults [7]. Constitutional symptoms including fever (51%), rigors, muscle and joint pain and headache are also common.

Data from New Zealand outbreaks estimate that the incubation period for illness is 10-50 hours (median 32 hours) and duration 2-171 hours (median 36 hours) [17]. It is likely that viral excretion precedes the onset of illness by several hours [19]. Asymptomatic infection has been documented with one third of those infected in one volunteer study [20]. Asymptomatic infection important in outbreaks involving infected food handlers [21]. Viral excretion in stools persists well beyond the symptomatic phase of illness. Immunity following infection is short-lived and antibody levels correlate poorly with the risk of future norovirus infection [7].

2. Routes of transmission and risk of infection

2.1 Routes of infection

Genogroup I and II noroviruses are pathogenic only in humans. Faecal-oral spread is the primary mode of transmission although airborne spread through aerosolised vomit [22-24] and spread via fomites has been documented [25, 26]. Norovirus is often introduced by an index case who is a food handler, other staff member, new resident or short-term visitor to an institution. On occasion, asymptomatic carriage by staff with sick family members has caused large norovirus outbreaks [21]. Contaminated water supplies should also be considered as a possible source of infection.

Noroviruses are environmentally hardy, withstanding heating to 60°C, freezing and chlorine concentrations of up to 10 parts per million [7]. One norovirus outbreak among carpet layers was thought to have been due to occupational exposure while removing carpet at a hospital some 13 days since the last case there [25]. In an institutional setting a major risk of transmission is associated with environmental contamination with norovirus. In particular door handles appear to be efficient vectors for viral transfer with one study suggesting that at least 14 people could be contaminated one after the other by touching a contaminated door handle [27].

2.2 Risk of infection

Noroviruses are highly infectious. The infectious dose is thought to be very low, possibly as low as one viral particle, the ingestion of which has been estimated to result in a 21% probability of infection in a susceptible individual [28]. The stools of cases typically contain 10^9 viral particles per ml during the diarrhoeal phase of illness [7].

3. Virology and laboratory confirmation

Noroviruses are non-enveloped, single stranded RNA viruses belonging to the human *Caliciviridae* family [29]. They are non-culturable and diagnosis is based on nucleic acid testing. New Zealand has facilities for laboratory identification and genotyping of noroviruses. Testing of stools and some types of food are available. Testing can be arranged by contacting the local Public Health Service. Samples are tested using an RT-PCR method [30] by ESR laboratories in Auckland and Porirua and subsequently genotyped in Porirua. Electron microscopy and serology are not available for diagnostic purposes in New Zealand.

3.1 Collection of clinical specimens

In all cases where clinical or environmental sampling is envisaged this should first be discussed with the local public health unit and ESR public health laboratory (Auckland and Christchurch) or environmental virology laboratory staff (Porirua). Samples should be collected in outbreaks linked to a common event or source where the following criteria apply:

- Incubation period between 10 and 50 hours and a mean duration of 12-60 hours.
- Predominant symptoms vomiting or diarrhoea.
- Clinical samples negative for bacterial pathogens.

Note that samples should be collected as soon as possible but in some cases may yield positive results up to 10 days after symptom onset.

All specimens must be carefully labelled with the case's personal details and accompanied by a request form with an EpiSurv outbreak number. An EpiSurv number can be obtained by contacting the local public health service. Samples accompanied by an EpiSurv number can be submitted to non-public health laboratories. Non-public health laboratories usually have existing courier systems that may be utilised to transport samples for viral analysis. This request should be directed to the community laboratory microbiologist.

3.1.1 Stool sampling

In addition to norovirus, stools should be tested for other common viruses (e.g. rotavirus, adenovirus), bacteria and parasites (*Giardia* and *Cryptosporidium*) causing gastrointestinal illness, to exclude these pathogens. If possible, in consultation with the local public health service, it is also worthwhile excluding toxin-forming bacteria, particularly *S. aureus* and *B. cereus*.

3.1.1.1 Timing of stool samples

Ideally stool samples should be taken during the symptomatic phase of the illness (2-3 days from onset). However, excretion persists for some days. Positive RT-PCR results

have been frequently obtained on samples taken at 3-4 days from the onset of illness [31]. A positive result has been recorded from a case some 12 days after the onset of illness (the literature documents a positive RT-PCR result for norovirus 14 days after symptom onset [32]). Parashar and co-workers reported a study where food handlers were found to excrete norovirus for up to 10 days following infection [33]. Therefore, stool sampling should generally be considered up to 10 days from the onset of illness.

3.1.1.2 Number of stool samples required for clinical analysis

For those cases in the symptomatic phase of illness two stool samples from different bowel motions should be sufficient to confirm norovirus infection. Standard specimen containers should be at least one-third filled with sample.

3.1.1.3 Total number of samples required

In small outbreaks, the number of clinical samples obtained may be limited by the low number of cases. For propagated outbreaks the strategy is to test in batches of 3 until a positive result is obtained. Once the presence of norovirus is confirmed, subsequent specimens from new cases are not necessary.

3.1.1.4 Sample storage and transport

Specimens should be stored awaiting collection in a cool place. This can be a dedicated specimen fridge or freezer but because of the risks of cross-contamination specimens should not be placed in a food refrigerator. Transport to the laboratory should be conducted under biohazard precautions, with all specimens double bagged and preferably refrigerated in a chilly bin during transportation.

3.1.2 Vomitus samples

Norovirus can be detected in vomitus. The same recommendations for storage and transport pertain to vomitus as for stool samples. However, virus yield is better from stool/faecal specimens than from vomitus so stool specimens are preferable.

3.2 Collection of other samples

3.2.1 Food samples

Norovirus tests on food samples are technically difficult and expensive. Requests for analysis of food will be considered by ESR on a case-by-case basis but in general, strong epidemiological evidence linking a suspected food to an outbreak is required. The foods for which testing is available include bivalve shellfish such as oysters and

muscles (usually due to primary contamination at the growing site), salad greens, fresh whole fruits (berries, tomatoes) and ready-to-eat meats. Analysis is performed at the ESR Environmental Virology Laboratory, Porirua.

3.2.2 Environmental samples

3.2.2.1 Surface swabs

Solid surfaces such as door handles, taps and benchtops can be swabbed with sterile cotton swabs moistened in viral transport medium (VTM), placed back into the VTM container, and then sent to the ESR Environmental Virology Laboratory. VTM is available on request from either the Auckland ESR Public Health Laboratory or the ESR Environmental Virology Laboratory, Porirua. Alternatively the commercially available 'green topped' viral culture swab can be used.

3.2.2.2 Water samples

Water testing for norovirus is now available in NZ. A 20 litre sample taken in a clean plastic drum is recommended. The sample should be taken from the cold tap only and the tap should not be flamed.

Discuss testing with the manager of the ESR Environmental Virology Laboratory, Porirua prior to sampling.

4. Management of patients with norovirus infection

The aim of management is to minimise the cases' exposure to other residents, patients, staff and visitors particularly during their symptomatic phase when excretion of virus is likely to be the highest. A sickness log should also be kept on all cases including staff members, detailing which room they resided in (or for staff, rooms they attended during the incubation period for illness) and the nature, date of onset of symptoms, and when their symptoms resolved (see Appendix 1).

4.1 Clinical assessment

Any vomiting staff member, patient or elderly care resident should be considered to have norovirus infection until proven otherwise. They should immediately be shifted into an isolation room (or if staff, sent home) and given priority medical assessment. While norovirus gastroenteritis is a self-limiting infection, the elderly, particularly those with pre-existing medical conditions, often suffer greater morbidity. A careful assessment of hydration state should be made. Patients or residents exposed to a case or present during a defined outbreak period should, where possible, be cohorted for a maximum incubation period (3 days) and any new admissions should be segregated from those who may be about to develop symptoms.

4.2 Hand hygiene

Hand hygiene is critical to outbreak management. The actions taken to decontaminate the hands of micro-organisms with the potential to cause human illness are collectively referred to as 'hand hygiene'. These actions include hand washing with soap and water followed by effective drying, antiseptic hand-wash, use of antiseptic (waterless) hand-rub or surgical hand antisepsis[34]. Hand hygiene is well documented as being the most important hygienic measure for preventing the spread of infection [34, 35].

All those in the institution where an outbreak occurs should be counselled about hand hygiene – staff, patients and residents. In an outbreak of norovirus infection it is recommended that hands be thoroughly washed and dried.

4.2.1 Hand washing

The Ingredients = running water + soap + friction + time

The time spent washing is important in reducing the transmission of micro-organisms. Hand washing with running water, and vigorously rubbing with soap for at least 20 seconds is recommended [36]. The use of a nail brush is not recommended. Local observations of the hand hygiene practised by the public in the toilets of a shopping mall are cause for concern. On average, people washed their hands for 8.6 seconds in the shopping malls [37].

4.2.2 Hand drying

Time spent drying is important – ‘dry hands are safe hands’

Wet hands can transfer microbes more efficiently than dry hands not washed at all [38]. The drying time required to reduce the transfer of germs varies with each drying method. Repeated drying of hands on a single reused cloth towel is not recommended. This is because the towel is likely in time to become wet and may act as a source of hand contamination rather than a solution to it.

The methods and recommended duration of drying are outlined in Table 2 [36, 38].

Table 2. Recommended hand drying methods and times

Drying method	Recommended protocol	Total drying time	Comments
Single use paper towel	Rub hands on two towels drying for 10 seconds on each	20 seconds	The first towel removes the bulk of the water, the second achieves a thorough dryness
Single use cloth towel (roller with plastic contamination guard)	Rub hands on two section of the towel drying for 10 seconds on each section.	20 seconds	The first section removes the bulk of the water, the second achieves a thorough dryness
Hot air dryers	Rub hands together while rotating under warm air	45 seconds	Prolonged period required for complete dryness
Combination of cloth/disposable towel and hot air dryer	Rub hands on one section of cloth or disposable towel for 10 seconds to remove bulk of water. Then rotate hands while rubbing together under the hot air dryer for 20 seconds	30 seconds	This is called the 10/20 drying method.

4.2.3 When should hand hygiene be performed?

Decontamination of hands is part of standard precautions and should be performed after any contact with patients' intact skin or with environmental surfaces in the vicinity of the patient [34]. In general, hand hygiene should be performed at any time when a significant hand contamination event has occurred and the potential for cross-contamination then arises such as hands-on contact with potentially infected persons. Cross-contamination occurs when unhygienic hands move on to touch foods, utensils and other objects in the environment.

'Risk' activities resulting in hand contamination are:

- going to the toilet
- cleaning toilets and bathrooms
- handling potentially soiled clothes and bed linen
- cleaning up after emetic or faecal accidents
- handling cleaning accessories such as cloths, buckets and mops
- removing gloves
- touching any environmental surface in an isolation room of a norovirus case.

Note: Hands should also be washed and dried after every break and on entry to the food preparation area.

4.2.4 Alcohol-based hand sanitisers

The use of alcohol hand disinfectant has been shown to have advantages over standard hand washing in respect to bacterial contamination of hands [39-41]. However it is recognised that alcohol is not usually effective for disinfection of non-enveloped viruses [42] and there is conflicting evidence about how effective hand sanitisers are against viruses such as norovirus. [5] [5, 43-47]

In an outbreak situation people should be encouraged to use alcohol gel only after they have washed and dried their hands thoroughly. However in situations where access to adequate water for handwashing is limited, it is reasonable to provide and encourage the use of alcohol hand sanitisers as a means of achieving a degree of hand hygiene. Commercially produced alcohol hand-rub solutions are readily available but if these are unable to be accessed an alcohol hand-rub solution can be prepared by adding 2ml of glycerine, propylene glycol, or sorbitol to 100 ml of 60-90% alcohol solution [48]. Three to five mls of alcohol hand-rub should be poured into the palm of the hands and then the hands rubbed together until they are dry. Chlorhexidine 4% can be used as a sanitizer during hand washing.

4.2.5 Use of gloves

The wearing of gloves is not a substitute for hand hygiene. Gloves in themselves confer no protection against cross-contamination i.e. they, like bare hands may transfer

microbes to other environmental surfaces. Hands must be washed, dried and gloves replaced before and discarded after significant contact with the patient. Hands must be washed after activities involving handling of contaminated items and after removal of gloves.

4.3 Patient isolation

Place symptomatic patients in contact isolation – preferably a single room with dedicated ensuite or toilet. Signage, stating the patient is in isolation should be posted on the door of their room or wherever the isolation zone begins.

If the patient is vomiting, airborne precautions should be instigated (7.1.3). If there are a number of cases, consider cohorting them in the same room(s). Precautions can be discontinued 48 hours after symptoms cease in faecally continent cases.

4.4 Patient movement and transfer

Movement of patients out of isolation rooms should be restricted to essential purposes. Symptomatic cases should not be transferred within the institution to other wards, hospitals or elderly care facilities for at least 48 hours after symptoms cease. Even at this point the receiving institution should be made aware of the case's illness so that extra infection control measures can be undertaken at the management's discretion. Local experience suggests that the transfer of previously symptomatic cases between institutions appears to be an important way in which norovirus is introduced. Where wholesale exposure of patients or residents to norovirus is likely to have occurred a temporary ban on transfers to other hospitals and elderly care facilities may need to be imposed.

4.5 Closure of facility to residents and admissions

In certain circumstances, such as where outbreak control is difficult and significant ongoing risk of norovirus infection exists, closure of hospital wards or elderly care facilities to new admissions or residents may need to be considered. In general criteria for considering closure will include:

- Ongoing cases despite full implementation of outbreak control measures.
- Where there is a high level of debility among new arrivals e.g. an elderly care hospital or hospice constitutes a considerable risk of severe disease.

5. Management of staff

5.1 Staffing of Isolation room(s)

Non-essential staff should be prevented from entering isolation rooms. Cohort staff who look after cases during an outbreak so that the minimum number of staff is exposed to cases. Staff having direct contact with symptomatic cases in the isolation room environment should wear gown, gloves and if the case is vomiting a NIOSH-approved (N95) particulate respirator mask. Suitable respirators available in New Zealand include 3M 1860, Moldex 2200, Gerson G1920 and Tecnol PFR 95[49]. If the case is not actively vomiting, masks have not been shown to confer any greater protection against infection for close contacts [50]. If possible, airflow should be vented to the exterior of the building from the room(s) such as by opening exterior windows.

No staff or visitors should enter the isolation room unless familiar with isolation procedures. The importance of hand hygiene after glove removal should be highlighted to staff and visitors.

An example information sheet for staff is shown in Appendix 5.

5.2 Management of infected staff

The loss of a large number of staff through illness may place a significant burden on those remaining at work but exclusion of the ill is still an important strategy:

- A staff illness policy outlining the requirements for exclusion and the circumstances for return should normally operate in any institution.
- A sickness log should be operated to record details of ill staff and their symptoms when they became ill, and when they returned to work.
- During an outbreak staff should be excluded at the first suggestion of illness e.g. nausea, abdominal pain.
- Hand hygiene and information of how to deal with emetic or faecal accidents should be stressed to sick staff who are going home so that the risk of household transmission of norovirus infection is minimised.
- Viral excretion persists for days so it is not practical to require clearance of norovirus from stool before staff return to work. Staff should be allowed to return to work after being symptom free for at least 48 hours.
- In view of the above, returning staff should be further counselled on the importance of hand hygiene as they may still be infectious.

6. Management of visitors

Visits to symptomatic cases should be minimised. Visitors of a suspected case should be prevented from visiting other patients/residents. Visitors must comply with all isolation procedures and should be supervised when putting on and removing gown and gloves to ensure hand hygiene is thorough. Visitors should be told not to visit patients or residents in other institutions for at least three days if they visit suspected cases of norovirus infection.

7. Cleaning and disinfection

Enhanced cleaning of cases' rooms, toilet and bathroom areas, and environmental surfaces exposed to hand contact e.g. telephones, hand rails and door handles, should be undertaken.

Noroviruses are non-enveloped, single-stranded RNA viruses. Quaternary ammonium compounds are commonly used for disinfection in a variety of settings and work by disrupting viral envelopes. As norovirus does not have an envelope, quaternary ammonium compounds do not have significant activity against them (47, 48, 49). Ethanol and anionic compounds have also been shown to be ineffective as disinfectants for norovirus (50).

Quaternary ammonium and phenolic disinfectants are *not* recommended for use in norovirus outbreaks as they are not as effective as bleach. Household bleach is a high level disinfectant capable of killing norovirus. In order to work properly bleach disinfectant needs:

- Enough time to kill – at least 30 minutes contact time is ideal.
- Sufficient strength or concentration.
- A surface free of organic material such as vomit or faeces.

IMPORTANT: ensure that bleach solution is made up fresh each day and discarded if not used within 24 hours.

Supermarket bleaches are sold in different strengths, usually 2-5% sodium hypochlorite solution. The strength is written on the label. The recommended concentration of bleach disinfectant is 1000ppm (0.1%) hypochlorite [6]. To achieve this, the following table (table 3) provides a guide to diluting supermarket bleach.

Table 3 – Recipes to achieve a 0.1% Bleach Solution

Original strength of Bleach (% sodium hypochlorite)	Bleach (millilitres)	Water (millilitres)	Total (millilitres)	Parts per million (ppm)
1%	1000	9000	10,000	1000
2%	500	9500	10,000	1000
3%	333	9677	10,000	1000
4%	250	9750	10,000	1000
5%	200	9800	10,000	1000

An alternative to hypochlorite is accelerated potassium peroxydisulphate (the active ingredient in Virkon®). Virkon is a broad spectrum virucidal which, at a strength of 1%, has been shown to be effective against feline calicivirus [51]. While more expensive than hypochlorite, Virkon has advantages in that it is less corrosive than hypochlorite, is safe to use both as a spray and surface decontaminant and is virtually odourless. A list

of retailers of Virkon can be found in Appendix 6. Other alternatives are disinfectants containing 0.05% iodine, 0.5% glutaraldehyde [5]. Chlorine dioxide can also be used.

7.1 Cleaning equipment

7.1.1 Cloths

For general cleaning of the environment disposable cloths should be used and disposed of in a biohazard bag. As an additional precaution separate coloured cloths should be used for cleaning higher risk areas such as toilet and bathroom areas and their use should be restricted to these areas only. Discard after use.

7.1.2 Mops

Reusable mops should be soaked in 0.1% hypochlorite solution and hot laundered.

7.1.3 Personal protective equipment

No staff member should be expected to clean up faecal or emetic accidents or be exposed to cases toilet facilities without adequate personal protection. Recommended protective equipment includes:

- Disposable gloves
- Disposable gown
- Particulate respirator mask (N95) if in the presence of vomiting cases or where aerosols may be generated (e.g. cleaning the toilet bowl)

7.2 Cleaning of toilets, bathrooms and vacated rooms

Solutions exceeding 1000 ppm chlorine may be used in bathrooms, particularly if faecal or emetic accidents have previously occurred. Special attention should be given to toilet seats, bowls, toilet paper dispensers, door handles and latches, tap faucets and handles. Rooms that previously housed outbreak cases should be thoroughly cleaned when the resident or patient vacates. Special attention should also be paid to cleaning soiled mattresses, soft furnishings including drapes and carpets. Furnishings can be exposed to sunlight to assist disinfection by placing them outside. Do not machine buff contaminated areas as this may result in norovirus particles becoming airborne. Dry vacuuming of carpets and soft furnishings is discouraged as the virus is suspected to persist for some weeks [25] and by vacuuming can also be re-suspended in the air.

Both staff and public toilets should be subjected to increased frequency of cleaning e.g. every 2 hours during an institutional outbreak.

When guests, residents or patients vacate their rooms, flat surfaces should be cleaned using hypochlorite solution or Virkon using disposable cloths (or soft furnishings steam cleaned). Curtains should be laundered.

7.3 Swimming and therapeutic pools

A written protocol should exist for faecal or vomiting accidents involving swimming pools and accompany the records verifying good pool management procedures. This protocol should follow the standards outlined in NZ Standard 5826:2000 Pool Water Quality. The procedure should differentiate between solid faecal matter and diarrhoea, as well as between standard measures and disease outbreak measures in the case of diarrhoea.

These procedures aim to provide pool managers with adequate and practical measures to reduce the risk of pathogen contamination of pool water. The pool management must record all faecal accidents.

Faecal solids

The following procedure shall be followed:

1. Evacuate and isolate the pool
2. Remove solids
3. **Spot** super chlorinate (in excess of 100mg/L) using a water can or similar.
4. Keep area clear for 30 minutes
5. Ensure the chlorine is adequately dispersed before allowing people to re-enter the pool (spot test area to check chlorine dilution)

Diarrhoea/Vomit

The following procedure shall be followed:

1. Evacuate and isolate the pool
2. Remove any solid matter, vacuum to waste
3. Increase the pool FAC to **no less** than 5 mg/L
4. Keep area clear long enough for faecal matter to be removed by vacuum and at least 3 pool turnover periods
5. Ensure the chlorine is adequately dispersed before allowing people to re-enter pool

In an outbreak situation, consideration should be given to restricting convalescent cases who are now asymptomatic from pool use.

7.4 Cleaning up vomit and faeces

Vomiting in particular confers significant risk of infection to those exposed to aerosols [22]. The following precautions should be followed:

- Apart from those necessary to attend to the cases, staff and others should be quickly ushered from the room or if in a corridor, the area should be cordoned off.
- Involve as few staff as possible in the clean up operation. If possible, cohort staff involved in cleaning up contaminated material to limit the exposure of other staff.
- Spray the area immediately with an air freshening aerosol spray. This neutralises the odour and may assist by causing aerosols containing virus to drop to the floor where they can be disinfected (personal communication, Rosemary Whyte, ESR, Christchurch).
- If possible, open windows and doors to direct the airflow to the outside of the building.
- Staff should wear disposable gloves, plastic disposable apron and a particulate respirator mask (N95) if aerosols are likely to be present (if it is within an hour of the incident occurring).
- Clean up by removing soiled clothing in an impermeable and appropriately coloured bag for linen.
- If possible, remove soiled furniture to a safe and isolated place for thorough cleaning.
- Where there is soiling by faeces it is important to clean the soiled area with detergent and hot water with a disposable cloth to remove all organic debris first then disinfect with hypochlorite. Where there is faecal soiling, using hypochlorite alone will not adequately decontaminate surfaces[52].
- If possible, disinfect the contaminated and surrounding areas with 1000ppm (0.1%) hypochlorite solution or 1% Virkon.
- Dispose of mask (where worn), gloves and aprons in designated biohazard bags.
- Wash and dry hands thoroughly per hand hygiene protocol
- Restrict access to the contaminated area for at least 30 minutes, if necessary cordon it off.

7.5 Cleaning soft furnishings and fabrics

Hypochlorite is corrosive and may rot or bleach soft furnishings and fabrics. Virkon may be used on these but may have limited penetration into fabrics and organic material such as vomit may reduce its effectiveness.

- Contaminated soft chairs, mattresses and carpets (that are not bleach resistant) should be cleaned with hot water and detergent and subsequently steam cleaned
- Contaminated curtains, soiled linen and bedclothes should be handled with the protective clothing (apron, gloves). Ideally the linen should be placed in a colour coded linen bag to warn of contamination (e.g. yellow skip). Any waste should be put into waste bags inside the case's room. Linen and waste bags are to be replaced at least daily or when two thirds full
- Vacuuming carpets (when dry) is to be discouraged as norovirus particles can become airborne and may remain infectious for weeks [25].

7.6 Laundry

Laundry may be contracted out or some larger institutions may launder on site. Laundry workers need to be protected from the risk of norovirus infection. Soiled clothes or linen should be hot-washed and those workers handling these items should wear disposable gown, mask and gloves.

7.7 Food service

- Usual meal trays, plates and cutlery may be used. Menus and trays do not need special treatment
- A written infected food handler policy should exist and food handlers sent home at the first sign of any illness
- Access to the kitchen and food preparation areas should be limited to dedicated staff only.

8. Outbreak notification

All suspected outbreaks should be promptly notified to the local public health service. A database recording all known New Zealand communicable disease outbreaks is maintained by the public health service and ESR via EpiSurv, the computerised communicable disease notification system. This provides an important surveillance tool for outbreaks in the community, hospitals and elderly care facilities. The manager of the institution should immediately notify a suspected outbreak to the local public health service who are responsible for disease control activities in partnership with infection control specialists (where available). An urgent meeting should be held between relevant stakeholders when an outbreak is *suspected*. Outbreak management will involve both investigation and control activities. Investigation is important if there is an ongoing suspected source of infection or the investigators have an hypothesis about the source of infection that they want to test. Beyond this, given the importance of direct person-to-person transmission and high norovirus infectivity, most of the emphasis will be placed on outbreak control.

9. Public Health investigation and management

A useful guide to outbreak investigation is (WHO):

- Confirm outbreak and diagnosis
- Define case
- Identify cases and obtain information
- Descriptive data collection and analysis
- Develop hypotheses
- Analytical studies to test hypotheses
- Special studies if deemed necessary
- Communication including outbreak report
- Implement control measures which may include:
 - Controlling the source of the pathogen
 - Interrupting transmission
 - Modification of host response (e.g. antibiotics – not relevant in norovirus outbreaks)
- Evaluate process.

Outbreak management can be defined as: 'the process of anticipating, preventing, preparing for, detecting, responding and controlling outbreaks in order that health and economic impact is minimised'[4]. Outbreak management is an important and skilled role. The manager(s) of the institution should, on suspecting an outbreak, hold an initial outbreak meeting. This should include key staff and members of external agencies including the local public health service and if available, infection control specialists. A suggested agenda is shown in Appendix 2.

9.1 Outbreak recognition

In practice the recognition of an outbreak of gastrointestinal illness due to norovirus is usually straightforward due to the prominence of vomiting and diarrhoea and their acute onset in a number of people.

9.1.1 Clinical and epidemiological criteria for outbreak recognition

A number of clinical and epidemiological criteria have been used to assess the likelihood of an outbreak of gastrointestinal illness being due to norovirus [8]. These criteria suggested by Kaplan et al in 1982 are:

- Stool culture negative for bacteria
- Mean duration of illness 12-60 hours
- Vomiting in over 50% of cases
- Incubation period 24-48 hours (if known)

Subsequently Hedberg and Osterholm [53] suggested on the grounds of improved discrimination that the third criterion be replaced by:

- The ratio of frequency of vomiting/fever >1

9.2 Outbreak definition

An outbreak of viral gastrointestinal illness can be defined as two or more linked cases exhibiting symptoms of vomiting or diarrhoea. However, for the purpose of control, any vomiting person should be suspected of having norovirus infection until proven otherwise and an outbreak “suspected” with only one case.

9.2.1 Case definition

For the purposes of describing and summarising the outbreak, individual cases of norovirus infection are further defined as:

‘Probable’ (clinically compatible illness, usually consisting of diarrhoea or vomiting)

or

‘Confirmed’ (satisfies the ‘probable’ definition but has a positive stool/vomit RT-PCR test for norovirus).

9.3 Data collection and descriptive analysis

The steps are:

- Obtain the descriptive data:
 - Who was ill (demographic data – age, gender) and when (date and time of onset)?
 - Was there direct contact between ill cases?
 - Where did ill residents reside (room number, occupancy and vacation dates)?
 - Was there preceding contact with ill staff?
 - Document the timing of faecal and emetic accidents and those potentially exposed
 - Construct an epidemic curve (graph of the number of cases by time and date of onset)
 - Is the outbreak ongoing - are new cases occurring?

9.4 Developing hypotheses

Based on the descriptive data are there any thoughts about the source of infection and routes of transmission?

- Are any of the cases food handlers?
- Could drinking or bathing water be a source of infection?
- Is direct person-to-person transmission likely to be an important route of infection and if so, how?

9.5 Further study

Perform a thorough site investigation.

- What hazards are there for norovirus transmission?
 - Contaminated water? Poor hand hygiene?
 - Review hand hygiene and ill worker protocols. Are changes necessary?
 - What is the system for disposal of soiled linen and clothing?
 - Are the staff, residents and visitors adequately protected from exposure to norovirus?

Would there be any benefit in further investigation by way of analytical epidemiological study e.g. cross-sectional or case-control study in documenting risk factors for illness?

9.6 Communication

The key issue is: have all those who need to know about the outbreak been informed?

9.6.1 Media

Outbreaks of viral illness in institutions attract undue media attention. The friends or families of staff, residents and patients often alert the media. Sometimes the media are alerted to an outbreak before the public health authorities. One agenda item in the initial outbreak meeting should deal with media inquiries, how they will be responded to and by whom. A proactive response to the media characterised by an agreed strategy is recommended.

9.6.2 Staff, residents or patients

These groups have a right to know about any outbreak of infectious disease to which they may be exposed, what to do to avoid infection and given advice on what to do if they display symptoms. In relation to norovirus, an information pamphlet should be circulated (see appendix 3). Staff should be updated on developments and changes in control strategies at the start of their work shifts.

9.6.3 Visitors

Visitors should also be informed of the existence of a norovirus outbreak, preferably by communication in advance of their arrival or by signage or information at the door of the institution so that those who wish to avoid potential exposure, may do so (see Appendix 4).

9.6.4 Spokesperson

Decide if it is necessary to appoint a spokesperson and if so, who this should be.

9.6.5 Outbreak report

Ensure that all elements of the investigation and control activities are documented and included in a formal outbreak report. Distribute the report to key staff, management and others who need to know. If the local public health service is not involved in the report's preparation, they should be given a copy.

9.7 Implementing outbreak control measures

The ability to respond to a norovirus outbreak will depend on the nature of the facility. Hospitals are likely to have dedicated infection control specialists. Elderly care facilities that are not hospitals are less likely to have ready access to technical assistance in terms of infection control. Where the capability to respond is limited, a closer liaison with the local public health service will be necessary.

In institutional settings outbreaks are propagated by person-to-person transmission by the faecal-oral route either by manual contact or by exposure during faecal and emetic accidents and by aerosols.

The broad principles of hazard control involve elimination, isolation or minimisation. In this way a range of strategies can be envisaged in terms of controlling the hazard of exposure to norovirus. Table 4 documents a range of outbreak control strategies.

Table 4. Summary of outbreak control strategies

Elimination	Isolation	Minimisation
<ul style="list-style-type: none">• Send symptomatic staff home immediately• Disinfection of high risk areas for environmental contamination• Cleaning and disinfection of surfaces or areas contaminated with vomit or faeces• Steam cleaning carpets and soft furnishings contaminated by faeces or vomit	<ul style="list-style-type: none">• Cordon off emetic or faecal accident sites• Place cases in contact isolation• Limit cases to dedicated toilet/bathroom• Cohort cases contacts separately i.e. those that shared a room with a symptomatic case should be observed for 72 hours after last contact with case	<ul style="list-style-type: none">• Thorough hand hygiene• Wear a gown and gloves to clean up vomit or faeces, (mask for actively vomiting cases) and open windows and doors to direct airflow out of the building• Aerosol spray after emetic or faecal accidents• Limit staff contact with soiled clothing and bedding

9.8 Evaluation

Hold a debrief meeting to discuss what went well and what went badly in terms of outbreak management. The debrief meeting should identify and document any changes required to policies in that facility for managing norovirus outbreaks in the future.

Appendix 2. Template agenda - norovirus outbreak meeting

Meeting Date:

Meeting Time:

List of those Present:

Outbreak Summary

Location of Outbreak:

Main symptoms:

Case Definition:

Number of suspected cases:

Number of confirmed cases:

Total cases:

Number of cases in staff:

Date of onset of illness in first case

Date of illness in most recent case

Where are cases in the institution? Are they clustered geographically e.g. by proximity of rooms?

Any suspected source?

If food is implicated, are there any leftovers?

Have any cases been seen by a doctor and stool sampled?

Outbreak Investigation

Who will lead the investigation?

What staff will be necessary to do the investigation and what will be their roles?

Is an analytical (statistical) analysis contemplated? If so, is there capacity to undertake this 'in-house' or is assistance required?

Outbreak Management

What needs to be done in relation to:

Hand hygiene protocols?

Improved cleaning schedules?

Staff illness policies?

Cohorting of staff and cases?

Is a HACCP-based food safety audit indicated?

Is a risk assessment of the water supply indicated?

Contemplating temporary closure?

Ordering extra personal protective equipment?

Develop a Media Strategy

Who will be spokesperson?

Is a proactive media release warranted – e.g. to prevent public harm ?

Provision of Information

Provide information to those who need to know: guests, patients, residents, visitors.

How will this be done – signage, pamphlets?

Date and Time of Next Outbreak Meeting

Appendix 3. Norovirus information pamphlet

- Prevent ill food handlers from preparing food at home and at work until 24 hours after all symptoms cease.

Remember

- Source your shellfish from a reputable supplier.
- Cook food thoroughly - the virus dies when food is steaming hot.
- Avoid contact with infants, the elderly or those with long term illness until you are free of all symptoms.
- Don't handle food until you are free of all symptoms for at least 24 hours.
- Strict hand hygiene is important. Clean hands properly ("20 seconds to wash, 20 seconds to dry") after going to the toilet, before handling food and after going touching anything that may be contaminated with norovirus.

For more information contact
Auckland Regional Public Health Service,
Ph (09)623 4600.



Norovirus

A common cause of
Gastroenteritis



Norovirus

What is it?

Norovirus is a common cause of gastroenteritis or 'the 24 hour summer tummy upset'. Norovirus is easily spread when people eat food or drink fluids contaminated with the virus.

What are the symptoms?

Nausea, vomiting, abdominal pain and diarrhoea usually occurs 10 - 50 hours after contact with the virus. Headache, fever and chills may also occur.

Symptoms usually last from 12 to 72 hours, but some people may be unwell for longer.

Symptoms can be mild and sometimes infected people have none.

How is it treated?

There is no specific treatment to rid the virus from your body. Your immune system will overcome the virus, given time. To assist with recovery, extra fluid and rest are recommended. However, a doctor should always be consulted if symptoms are severe and they may give further advice or treat specific symptoms.

How is it spread?

People become infected when they swallow the virus. The virus can be found in:

➤ The Environment

- ▶ Human sewage and sewage polluted water, can contaminate shellfish beds, irrigation water and drinking water if it is not treated adequately.

- ▶ Person to person spread can occur through inhaling airborne particles of virus released during vomiting.

- ▶ Norovirus is very hardy and can survive for long periods on any surface touched by contaminated hands. This is particularly so for toilet surfaces, door knobs and tap fittings.

➤ Humans

- ▶ When people are ill, they excrete a large amount of norovirus in their vomit and faeces. Food can become contaminated if ill foodhandlers don't wash their hands well after toileting.

- ▶ Proper hand hygiene (through washing+drying) is critical as infection can be transmitted from improperly cleaned hands to food, drink or surfaces.

How to Prevent it?

- Be careful when cleaning up after ill people. Vomit or faeces should be cleaned up using first a detergent solution then a solution of household chlorine bleach. If vomiting occurs outside of the toilet, open windows and doors to direct airflow to the exterior of the building.
- Clean hands thoroughly. Clean hands are hands that are washed with soap and water for 20 seconds and thoroughly dried on a clean dry cloth towel or disposable paper towel for a further 20 seconds. Clean hands after contact with soiled articles, after going to the toilet and before handling food.
- Prevent ill food handlers from preparing food at home and at work until 24 hours after all symptoms cease.

Appendix 4. Notice for visitors about norovirus outbreak

A T T E N T I O N

T O A L L V I S I T O R S

**P L E A S E B E A W A R E T H A T T H I S F A C I L I T Y
C U R R E N T L Y H A S R E S I D E N T S W H O A R E
E X P E R I E N C I N G S Y M P T O M S O F V I R A L**

**G A S T R O E N T E R I T I S .
(V O M I T I N G A N D D I A R R H O E A)**

**V i r a l G a s t r o e n t e r i t i s c a n b e e a s i l y t r a n s m i t t e d f r o m
i n f e c t e d p e r s o n s . I f y o u n e e d t o v i s i t a r e s i d e n t w i t h i n t h e
f a c i l i t y p l e a s e i d e n t i f y y o u r s e l f t o a s t a f f m e m b e r .**

**P l e a s e r e m e m b e r t o t h o r o u g h l y w a s h a n d d r y y o u r h a n d s
b e f o r e l e a v i n g t h e p r e m i s e s .**

Appendix 5. Example Information Sheet for Staff

Viral Gastroenteritis Outbreak

Suspected Norovirus Outbreak

- Symptoms of diarrhoea, vomiting, nausea, stomach cramps and fever – predominantly vomiting and nausea
- Short duration (less than 60 hours)
- Self limiting
- Transmission through faecal oral route & the inhalation of vomit particles
- Environmentally hardy
- Low infectious dose

Hospitals & residential care facilities at significant risk due to high risk populations (immunosuppressed, enclosed living conditions). Previous Auckland outbreaks have resulted in deaths.

INFECTION CONTROL

Hand hygiene

Meticulous and frequent hand hygiene practices are imperative. This includes 20 seconds washing and 20 seconds drying, however alcohol hand disinfectants are also satisfactory if hands are not visibly soiled. This should be done after leaving each patients room, after going to the toilet, after cleaning toilets, bathrooms and handling potentially soiled linen, after cleaning up emetic or faecal accidents and prior to handling or preparing food.

Patient isolation

Symptomatic patients should be placed in isolation and signage should be posted on the door of their room. Movement of patients out of isolation rooms should be restricted to essential purposes only and non-essential staff should be prevented from entering the room. Symptomatic patients should not be transferred to other wards/facilities until at least 48 hours after cessation of symptoms. When transferred the receiving facility should be informed of the cases illness.

Visitors should be kept to a minimum, however if a visitor does have contact with a symptomatic person, they should not enter the room of any other patient and also be advised to not visit any other patient of a rest home, hospital or other institution for at least 3 days after contact.

Staff protection

Any staff entering the room of a symptomatic patient should wear gown, gloves and *if the patient is vomiting* an N95 particulate respirator mask. Hand hygiene practices should always be carried out after removing gloves.

A strict staff exclusion policy should be put in place requiring symptomatic staff to not return to work until 48 hours symptom free. In addition a sickness log should be operated to record details of staff and their symptoms, onset and date of return to work.

Cleaning and disinfection

Increased frequency of cleaning is required in an outbreak situation. This includes door handles, toilets, and other environmental surfaces exposed to hand contact (such as telephones, magazines). Disinfectant solutions must contain sodium hypochlorite in order to inactivate norovirus. Contact time is also imperative – usually about 30 minutes (see the instructions on your product specifications).

Faecal or vomit accidents should be cleaned up straight away.

1. Isolation of area
2. Few staff members as possible should do the cleaning
3. Spray area immediately with air freshener (to neutralise odour and assist in causing the virus particles to drop to the floor where they can be disinfected)
4. Open windows & doors to create airflow
5. Staff should wear PPE (gloves, apron and mask)
6. Remove soiled linen into disposable bag
7. If linen is soiled with faeces clean the soiled area with detergent and hot water using a disposable cloth to remove all organic debris before disinfecting with sodium hypochlorite
8. Carry out hand hygiene procedures
9. Restrict access to contaminated area for at least 30 minutes.

(as sodium hypochlorite may rot some surfaces, Vircon can be used on soft furnishings and fabrics)

Recommendations for Cleaning and Disinfecting

Hypochlorite has long been recognized as having outstanding disinfection properties and is widely available, cheap and commonly used in homes, schools, hospitals, swimming pools and in drinking water supplies.

Hypochlorite is available under many brand names including:

- No Frills Bleach
- Janola
- Brite Bleach
- White Magic
- Hypersol
- Exit Mould

Cleaning

Clean first before disinfecting to allow disinfectants to work. Soaps, detergents, scourers and hot water help with cleaning but do not disinfect. Scrubbing is also effective.

Disinfecting

- Household bleaches are sold in different strengths (usually 2% - 5% hypochlorite). These strengths are written on the label.
- Dilute the bleach with water to make a 0.5% hypochlorite solution (See table below)
- Saturate the area to be disinfected.
- Leave the solution on the area for as long as possible, preferably 30 minutes.
- Wash off the solution thoroughly with copious amounts of water.
- If a toilet cleaner is used, make sure it is a product which contains at least 0.5% hypochlorite.
- Never mix different chemicals!

Making a hypochlorite solution

- Fill the container with the appropriate quantity of bleach.
- Add the appropriate quantity of water.
- Put the cap on and mix gently.

Original strength of Bleach (% sodium hypochlorite)	Bleach (millilitres)	Water (millilitres)	Total (millilitres)	Parts per million (ppm)
1%	1000	9000	10,000	1000
2%	500	9500	10,000	1000
3%	333	9677	10,000	1000
4%	250	9750	10,000	1000
5%	200	9800	10,000	1000

Safety Tips

- Never mix chemicals as toxic gases can be produced.
- Be aware – bleach irritates the nose, lungs, skin and some people are particularly sensitive.
- Wear gloves, especially if handling undiluted bleach
- Store disinfectants and diluted disinfectants safely away from children and label them properly.

Appendix 6. Distributors of Virkon

Global Science and Technology Limited

Supply Virkon throughout NZ
PO Box 101253, NSMC
127 Sunnybrae Rd
Glenfield
Auckland
Phone: 0800 734 100

Health Support Ltd (HSL)

Supply Virkon throughout NZ
2 Segar Ave
Point Chevalier
Auckland
Phone: 09 815 2600 or 0800708060

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