衞生防護中心
Centre for Health Protection

# Scientific Committee on Enteric Infections and Foodborne Diseases

## Prevention and Control of Norovirus Infection in Hong Kong

### Purpose

This paper reviews the latest global and local epidemiology of norovirus infection and examines the public health measures for prevention and control of the disease.

### Virology

2. Noroviruses (NoVs) are a group of non-enveloped, single-stranded RNA viruses classified into the genus Norovirus (previously referred to as Norwalk-like viruses or small round-structured viruses) of the family *Caliciviridae*. Noroviruses can be divided into at least five genogroups, designated GI-GV, and based on amino acid identity in major structural protein (VP1)[1, 2]. The strains that infect humans are found in GI, GII and GIV (referred to collectively as "human noroviruses")[1]. Different genogroups can be further classified into various genotypes. Great diversity of NoV strains is attributed to the accumulation of point mutations and recombination between two related viruses[3]. The role of GI and other GII genotypes appears to be greater in settings that involve foodborne or waterborne transmission[1]. In recent years genogroup II genotype 4 (GII.4) viruses have been associated with the majority of gastroenteritis cases and outbreaks worldwide[1, 3, 4].

### Transmission and clinical features

3. Norovirus is the most common viral agent causing acute gastroenteritis worldwide in form of outbreaks and sporadic cases. Humans are believed to be the only host for human noroviruses[3]. The

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virus is shed primarily in the stool but also can be found in the vomitus of infected persons. It can be detected in stool for a median of 4 weeks and up to 8 weeks following infection. Peak viral shedding occurs 2-5 days after infection. Asymptomatic persons can also shed the virus[1, 5].

4. The transmission occurs by person-to-person, foodborne and waterborne routes. Person-to-person transmission could occur directly by faecal-oral route or by indirect exposure via fomites or contaminated environmental surfaces. Transmission via aeroionisation of vomitus in school, hotel and emergency room outbreaks has been postulated based on epidemiologic surveillance studies[6-9]. Nursing homes and hospitals are commonly involved in NoV outbreaks. Spread of outbreak through person-to-person transmission among residents is facilitated by the enclosed living quarters and reduced levels of personal hygiene[10]. Outbreaks in these settings can be prolonged and illness can be more severe in hospitalized patients and elderly[1, 11, 12].

5. Foodborne transmission occurs either by contamination at the source by human faecal matter or contamination during food preparation by infectious food-handlers. Shellfish such as oysters can accumulate NoVs when they feed by filtration in contaminated water[13, 14]. As oysters are often eaten raw and inadequately cooked, this increases their potential in NoV transmission. Ready-to-eat foods such as sandwiches and salads are also common food vehicle for NoV transmission because they require handling without subsequent cooking[1, 10]. It was reported in the literature that asymptomatic food-handlers have found to be responsible for foodborne transmission[15]. NoV gastroenteritis outbreaks have also been associated with sources of contaminated water, including municipal water and recreational water[16-20].

6. NoVs have several characteristics that facilitate their spread during epidemics.

(a) The low infectious dose (approximately 18 to 1000 viral particles) allows the virus to spread through droplets, fomites, person-to-person contact, and environmental contamination[3, 21].
(b) Prolonged asymptomatic shedding increases the chance for secondary spread. Viral shedding precedes the onset of illness in up to 30% of exposed persons and can continue long after the symptoms have resolved[3, 5, 19].
(c) The ability of the virus to survive relatively high levels of chlorine (up to 10 ppm) and varying temperatures (i.e., from freezing to 60°C) facilitates spread through recreational and drinking water and food items[19, 22].
(d) Due to the diversity of NoV strains, lack of complete cross-protection, and lack of long-term immunity, repeated infections can occur throughout life[3, 19].

7. NoV infection affects people of all age groups. The illness usually presents after an incubation period of 24-48 hours although some cases can occur within 12 hours of exposure[1]. It is characterized by acute onset, non-bloody diarrhoea, vomiting, nausea, abdominal cramps and low-grade fever. It is commonly known as the "winter vomiting disease" as it is characterized by high incidence of vomiting, and occurs predominantly during the winter season. Infection, however, can be asymptomatic[1, 3, 5]. A study showed that among 50 volunteers exposed to NoV, 82% became infected and of these infections, 68% developed illness, whereas the remaining 32% were asymptomatic[23]. Genetic susceptibility has been suggested to play a role in the development of NoV infection[10]. Symptoms of NoV infection are self-limiting and typically resolve without treatment after 1-3 days. Prolonged courses of illness lasting 4-6 days can occur particularly among young children and hospitalized patients[3, 12, 24]. Fluid rehydration and electrolyte replacement are required for patients with dehydration[10]. Deaths have been reported during outbreaks in nursing homes for elderly[25].

## Laboratory diagnosis

8. Electron microscopy (EM), immune electron microscopy (IEM), enzyme immunoassays (EIA) and reverse transcription-polymerase chain reaction (RT-PCR) assays can be used to detect NoVs. A high concentration (approximately $10^6$ to $10^7$/ml) of virus in stool is necessary for the virus to be detected by EM[19]. This level of viral excretion may not be reached in all cases of norovirus infection. EM is thus useful only for a proportion of specimens collected during the early stages of illness when higher quantities of virus are shed. IEM can improve the sensitivity of EM by 10- to 100-fold. However the detection of viruses by IEM is highly operator-dependent and there is risk of false-negative test due to masking of virus by a large excess of antibody[19]. Its sensitivity is hence lower when compared with EIA and RT-PCR.

9. EIA offers a rapid detection of NoV antigen in clinical samples. It is highly specific for some NoVs but generally not sensitive enough[10, 26]. When compared with RT-PCR, the EIA has been reported to have a sensitivity and specificity of 55.5% and 98.3% respectively[27].

10. RT-PCR assays are widely used in laboratories for detecting NoVs in clinical (e.g. faecal specimens) and environmental specimens. They are more sensitive than EM and EIA. Development of real-time RT-PCR assays, which can be more sensitive and rapid than conventional RT-PCR, provides both confirmation and quantitation in a single assay[3]. RT-PCR followed by nucleotide sequencing is particularly useful in molecular epidemiology studies to identify the source of and to investigate outbreaks[10]. In Hong Kong, Public Health Laboratory Services Branch (PHLSB) of Centre for Health Protection (CHP) mainly performs real-time RT-PCR for diagnosis of NoVs in clinical specimens.

## Global disease burden

11. NoV plays an important role in causing both mild and severe gastroenteritis worldwide. In a systematic review, NoV accounted for 12% of children <5 years of age with severe diarrhoea and 12% of mild and moderate diarrhoea cases among persons of all ages[28]. It is estimated to cause around 900,000 episodes of gastroenteritis that require a clinic visit and around 64,000 hospitalizations among children <5 years of age residing in high-income countries each year[28].

12. A comparison of NoV sequences collected from around the world over the course of a decade has led to the finding that a new strain causing extensive infections emerges every 2 to 4 years[3, 29-31]. In 2002, the number of reported NoV outbreaks increased sharply in many countries, followed by 4 epidemic winters in 2002-2003, 2004-2005, 2006-2007, and 2007-2008 in the Northern Hemisphere. Genetic analyses showed that NoV epidemics coincided with the emergence of novel GII.4 variants except for the 2007-2008 epidemic, which was a continuation of the 2006-2007 epidemic[4]. In a study reviewing NoV outbreaks data (dates of onset from January 2001 to March 2007) collected from 15 institutions on 5 continents, GII.4 outbreaks accounted for 62% of all reported NoV outbreaks. Eight GII.4 variants were identified and four had a global distribution. Two other variants caused epidemics which were geographically limited and the remaining two were found across the world but at low frequencies[4].

13. In the United States (US), approximately 21 million illnesses attributable to NoV are estimated to occur annually[1]. It is suggested that NoV is the leading cause of acute gastroenteritis in the US community and among persons seeking care in outpatient clinics or emergency departments across all age groups[1]. From January 2007 through April 2010, a total of 7734 acute gastroenteritis outbreaks were reported in US. 74% of them were suspected or confirmed to be due to NoV. 65% occurred in long-term care facilities including nursing homes and hospitals. 79% of suspected or confirmed NoV outbreaks from 29 states resulted primarily from person-to-person transmission[32]. NoV was also the most common cause of foodborne outbreaks in US in 2006 to 2008[33-35]. Among the 479 foodborne outbreaks with a laboratory-confirmed single etiologic agent reported to Centers for Disease Control and Prevention (CDC) in 2008, NoV accounted for 49% of outbreaks and 46% of illnesses[35]. Investigations of foodborne NoV outbreaks have implicated multiple food items including oysters, salads, sandwiches, cakes, frosting, raspberries, drinking water and ice[19]. Many outbreaks were resulted from contamination of food during preparation and service via unwashed or improperly washed hands of food workers who were shedding virus in their stools[35]. NoV outbreaks in cruise ships were also frequently reported by CDC with 10 outbreaks recorded in 2011[36].

14. In the United Kingdom (UK), NoV is estimated to cost the National Health Service in excess of £100 million per annum (2002-2003 figures) in years of high incidence[37]. It is estimated that approximately 3000 NoV admissions to hospitals in England occur per year[38]. According to a prospective community cohort study conducted between April 2008 and August 2009, NoV was the most common organism, with incidence rates of 47 community cases per 1000 person-years and 2.1 GP consultations per 1000 person-years. It is estimated that NoV accounts for about 16.5% of the 17 million cases of Infectious Intestinal Disease in England per year[39]. In 2010, NoV was the second most frequently implicated causative agent (after campylobacter) in foodborne outbreaks in England and Wales with the main contributory factor being infected food handlers[40].

15. In the Mainland China, a prospective investigation carried out among paediatric outpatients and inpatients with acute non-dysenteric diarrhoea between August 2008 and July 2009 in Shanghai, Hangzhou, Chongqing and Tianjin revealed that about 26% of faecal samples were tested positive for NoV by RT-PCR[41]. From July 2007 to June 2008, hospital-based sentinel surveillance was conducted for acute nonbacterial gastroenteritis in a general hospital in Beijing. Sporadic and outbreak adult cases with acute gastroenteritis were sampled. 147 samples (26.4%) were positive for NoV, consisting of genogroup I (25) and genogroup II (112)[42].

16. For particular food items, NoV outbreaks linked to the consumption of oysters have been constantly reported worldwide. Between 1993 and 1996, three oyster-related NoV gastroenteritis multi-state outbreaks occurred in US. It was postulated that contamination of oyster-bed in Louisiana was by sewage disposal from oyster harvesters[43]. From January to March 2010, the European Centre for Disease Prevention and Control (ECDC) was informed about NoV outbreaks linked to consumption of oysters in five countries: UK, Norway, France, Sweden and Denmark. A total of 65 small clusters involving 334 cases were reported. After further verification using descriptive epidemiology and microbiological evidence, 27 of the clusters were verified. NoV of both genogroup I and II were detected in oysters and in stool samples collected from these outbreaks[10]. The detection of multiple NoV strains reflects an environmental source of sewage contamination[14, 44].

17. Although waterborne outbreaks are far less common than foodborne outbreaks, NoV outbreaks have been associated with sources of contaminated water, including municipal water, well water, stream water, commercial ice, lake water and swimming pool water[19]. In 2004, an outbreak of NoV involving 53 persons in US was reported. It was associated with swimming pool contamination and a mechanical failure of automated pool water disinfection equipment[17].

## Local epidemiology

## I. Institutional gastroenteritis outbreaks

18. In Hong Kong, CHP receives reports of acute gastroenteritis (AGE) outbreaks for investigation. An outbreak is classified as acute gastroenteritis outbreak when the main presenting symptoms are acute onset of diarrhoea with or without vomiting in the absence of a common food source. Other common symptoms include abdominal pain and fever. NoV is a common viral agent causing seasonal increase in AGE outbreaks.

19. Cyclical increase in NoV activity at 2-3 years interval has been observed locally (Figure 1). Emergence of NoV new strains (mainly GII.4 variants) was observed during these cyclical epidemics. A new GII.4 variant was found in the unusual NoV epidemic beginning in May 2006 (Figure 2). Besides Hong Kong, NoV epidemics were also reported in various countries including Australia, Canada, UK and several European countries since early 2006. Sequences of the two strains causing epidemics in Europe, 2006a/EU and 2006b/EU were compared with the new strain in Hong Kong. Analysis by PHLSB showed close similarity to 2006b/EU while 2006a/EU was not detected in Hong Kong specimens[45, 46]. For local epidemic in 2009-2010, a new NoV strain was found by laboratory surveillance in outbreaks and it had also been detected in other countries in 2009[47]. In 2011, the predominant circulating strain was GII.4 2010 in the first half of the year, subsequently becoming GII.4 2006b in the latter half.

Figure 1. Cyclical pattern of NoV activity in Hong Kong from 2005 to 2011

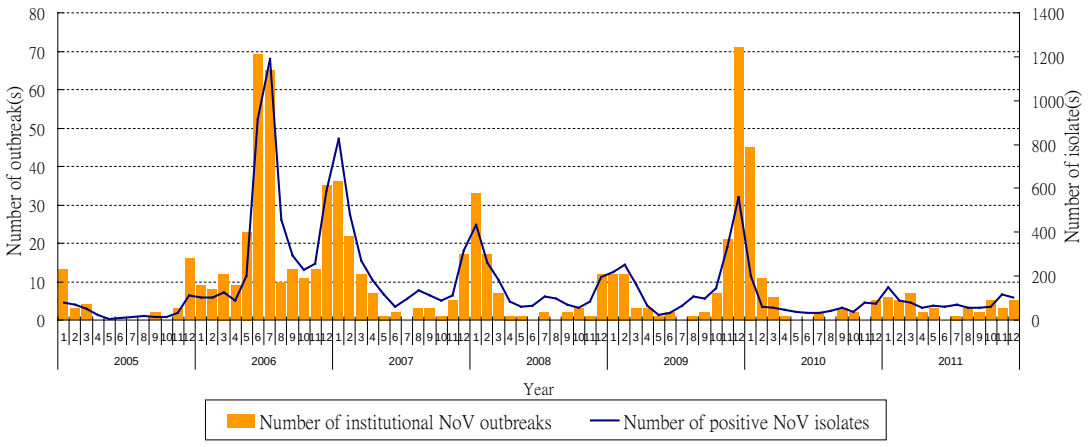
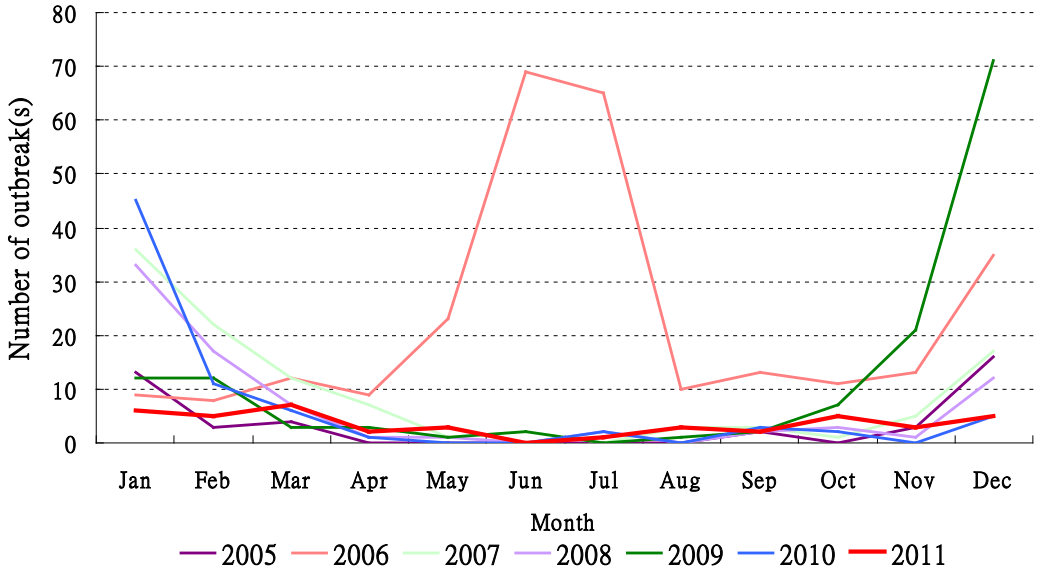
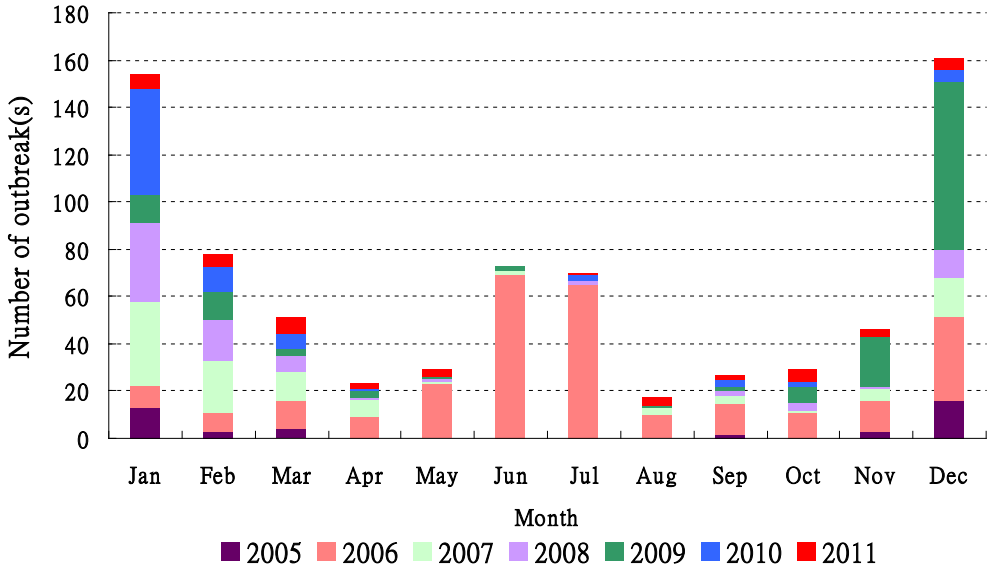


Figure 2. Monthly record of institutional NoV outbreaks from 2005 to 2011



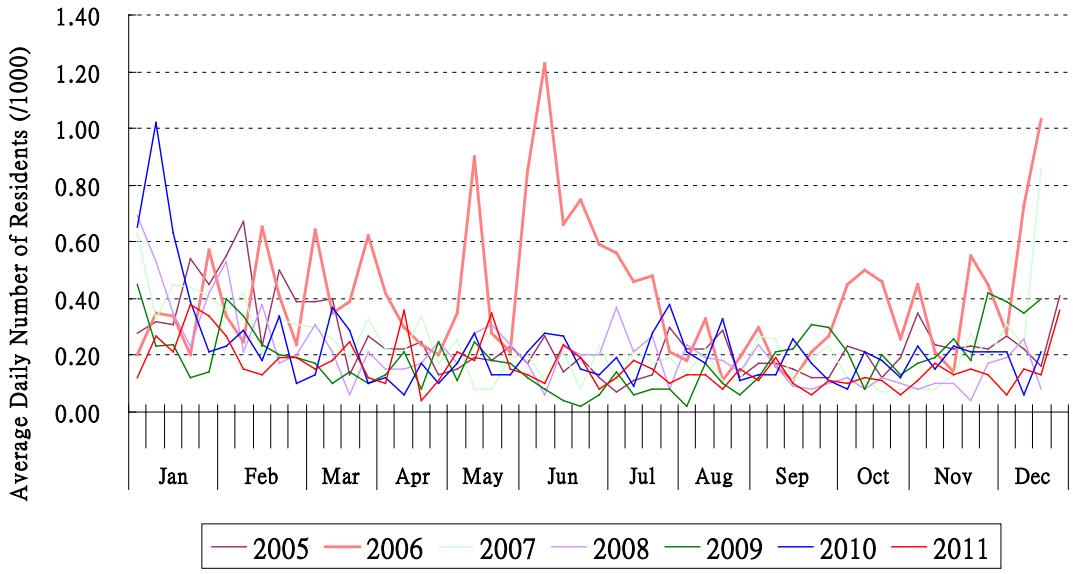

20. Seasonal pattern is observed for NoV infection with more outbreaks recorded in cooler months of the year i.e. from November to March (Figure 3). The seasonal distribution of NoV infection in Hong Kong was similar to that reported in UK and US[48]. Nevertheless, there was an unusually high NoV activity from May to August recorded by CHP in 2006 as described in paragraph 19.

Figure 3. Seasonal pattern of institutional NoV outbreaks from 2005 to 2011



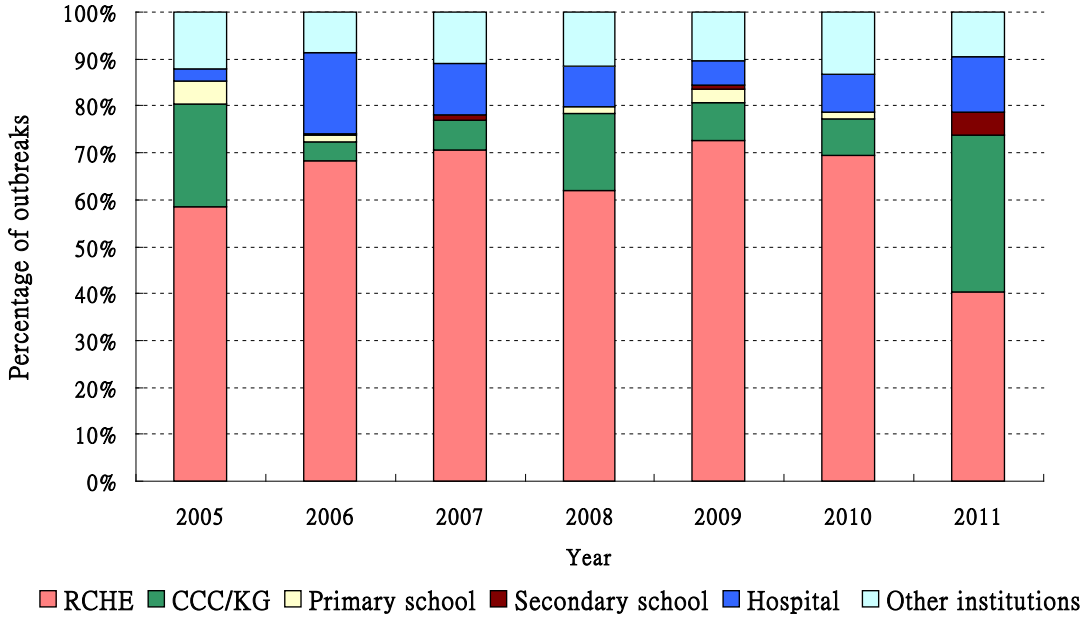

21. Seasonal increase of NoV activity correlated with the increase in diarrhoea activities detected by sentinel surveillance systems especially at residential care homes for elderly (RCHE) in Hong Kong. The unusual 2006 summer peak of NoV activity also correlated with the increase in diarrhoea activities at sentinel RCHE (Figure 4).

Figure 4. Acute diarrhoea activities reported by sentinel surveillance based at RCHE, 2005 to 2011




22. Among 1222 institutional AGE outbreaks recorded by CHP from 2005 to 2011, 62.0% (758) were confirmed to be caused by NoV. Over half of NoV outbreaks (66.8%) occurred in RCHE (Figure 5). 11.3% of outbreaks occurred in hospitals, 9.4% occurred in child care centres/kindergartens (CCC/KG), 1.6% in primary schools, 0.7% in secondary schools and the remaining 10.2% in other institutions e.g. residential homes for disabled or children, special schools, correctional institutions etc.

Figure 5. Place of occurrence of institutional NoV outbreaks from 2005 to 2011

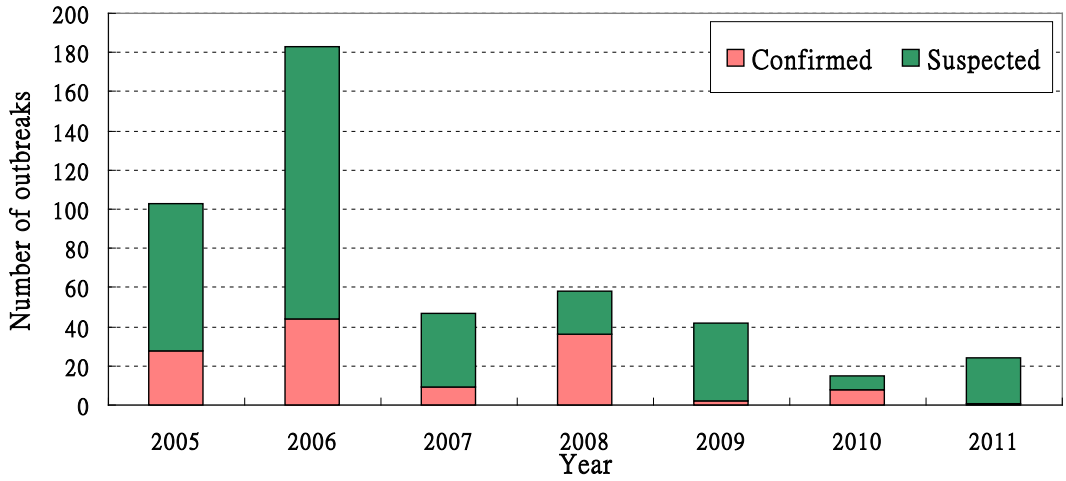


23. Among all confirmed NoV outbreaks recorded by CHP in 2005 to 2011, the majority (88.8%) involved 20 persons or less. The number of persons affected ranged from 2 to 107 (median: 9). A total of 8974 persons were affected. 24.9% of the affected persons required hospitalisation while 73.0% of hospitalised patients were from RCHE. The NoV outbreak affecting 107 persons (103 passengers and 4 crew members) occurred in a cruise ship departed for Hong Kong from Singapore in 2007. The Department of Health (DH) conducted investigation and advised on infection control measures immediately after the ship had docked at Hong Kong.

## II. Foodborne disease outbreaks

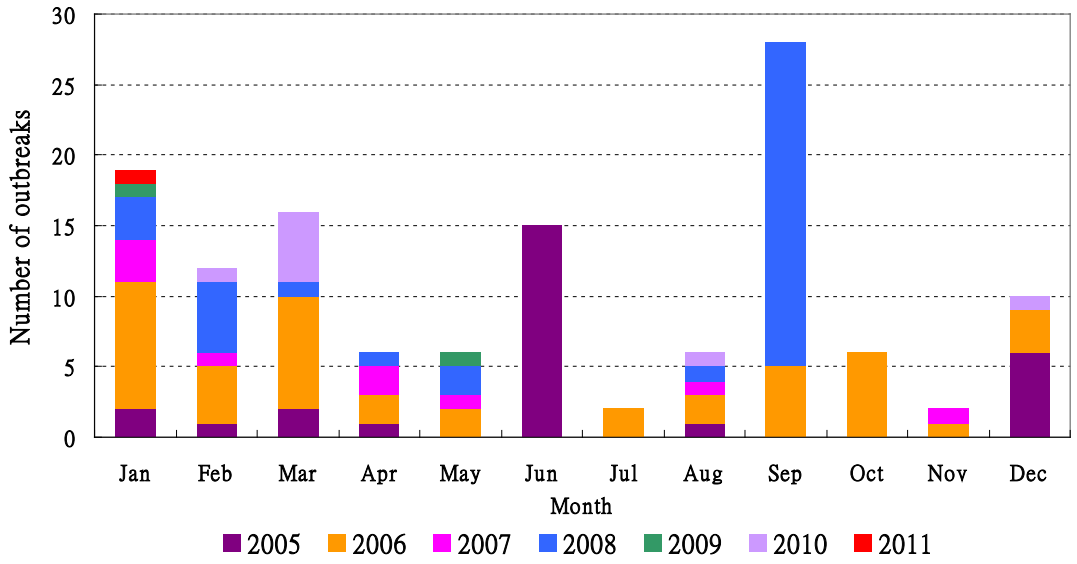
24. An outbreak of food poisoning is defined as an incident in which two or more persons experience a similar illness after ingestion of a common food, and epidemiological analysis implicates the food as the source of the illness. From 2005 to 2011, more than 4,300 food poisoning outbreaks were notified to the Department of Health (DH) and 10.8% of them were suspected to be associated with NoV. Among these 472 food poisoning outbreaks, 1,977 persons were affected. Less than one-third (27.1%) of the outbreaks were confirmed by laboratory specimens (including outbreaks with laboratory confirmation and their epidemiologically-linked outbreaks) after investigation (Figure 6). The following analysis was based on these confirmed food poisoning outbreaks.

Figure 6. Food poisoning outbreaks associated with NoV from 2005 to 2011



25. The occurrence of food poisoning outbreaks caused by NoV did not show any obvious seasonal pattern (Figure 7). Most (79.7%) of the outbreaks affected 5 persons or below and only 1.6% of the outbreaks affected more than 20 persons. Overall, the median size of outbreak was 3 persons.

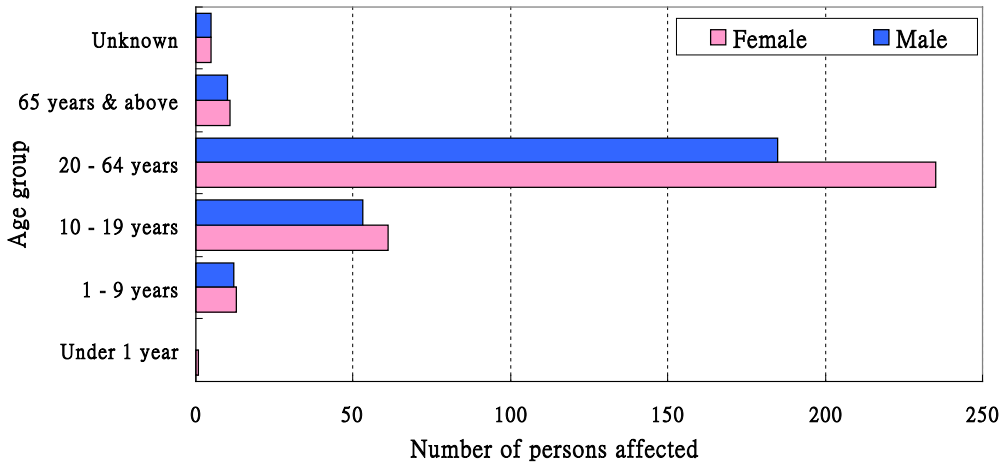
Figure 7. Monthly number of confirmed food poisoning outbreaks caused by NoV from 2005 to 2011




26. A large-scale food poisoning outbreak caused by NoV was reported in June 2005. It affected 35 persons (8 teachers and 27 students) of a secondary school who attended a graduation dinner held in a hotel. None of them required hospitalisation. Another 12 food poisoning outbreaks, affecting 38 persons, relating to the buffet dinner in that hotel were subsequently reported to CHP. After investigation, it was found that consumption of contaminated raw oyster might have contributed to these food poisoning outbreaks. A number of linked outbreaks, which might be related to consumption of raw oysters, were also reported in September 2008. Relevant control measures were taken accordingly.

27. Among all affected persons, less than 8% were below 10 years or above 64 years of age (Figure 8). There was no obvious sex preference (male to female ratio was 1:1.2). Only 15 affected persons (2.5%) required hospitalisation.

Figure 8. Age and sex distribution of persons affected in confirmed food poisoning outbreaks caused by NoV from 2005 to 2011




28. Most (74.2%) of the confirmed food poisoning outbreaks caused by NoV occurred at restaurants or food premises, while 17.2% occurred at home (Figure 9). The commonly implicated food item was seafood (75.8%). Oyster was the most common food item among various seafood identified, while other seafood included clam, crab, fish, scallop, shellfish, shrimp and squid (Figure 10). Other implicated food items included sushi or sashimi, chicken, pork and salad. Overall, contaminated raw food (45.3%) and inadequate cooking (41.4%) were identified as the main contributing factors (Figure 11).

Figure 9. Place of consumption of confirmed food poisoning outbreaks caused by NoV from 2005 to 2011

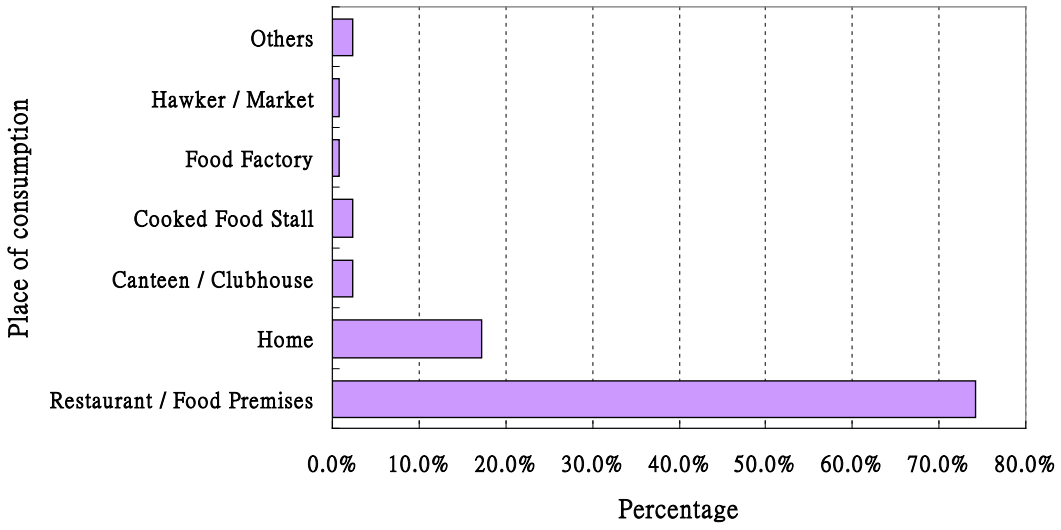


Figure 10. Food items associated with confirmed food poisoning outbreaks caused by NoV from 2005 to 2011

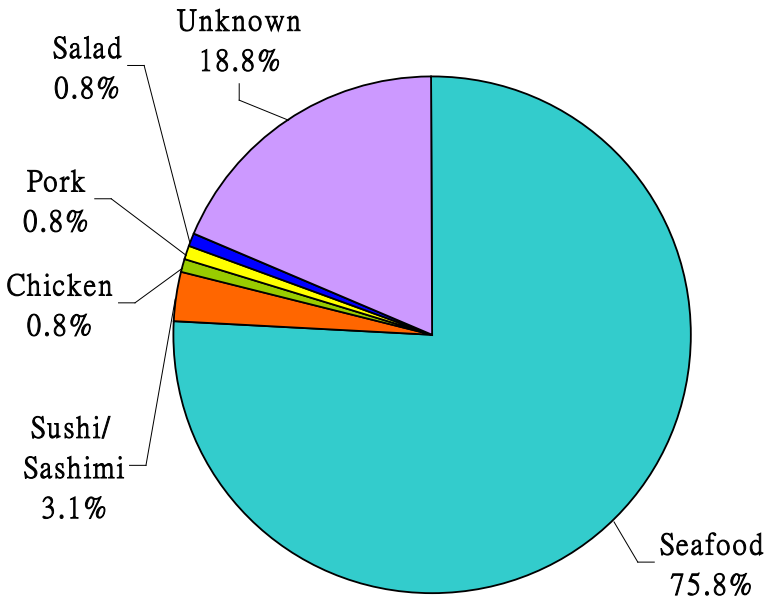
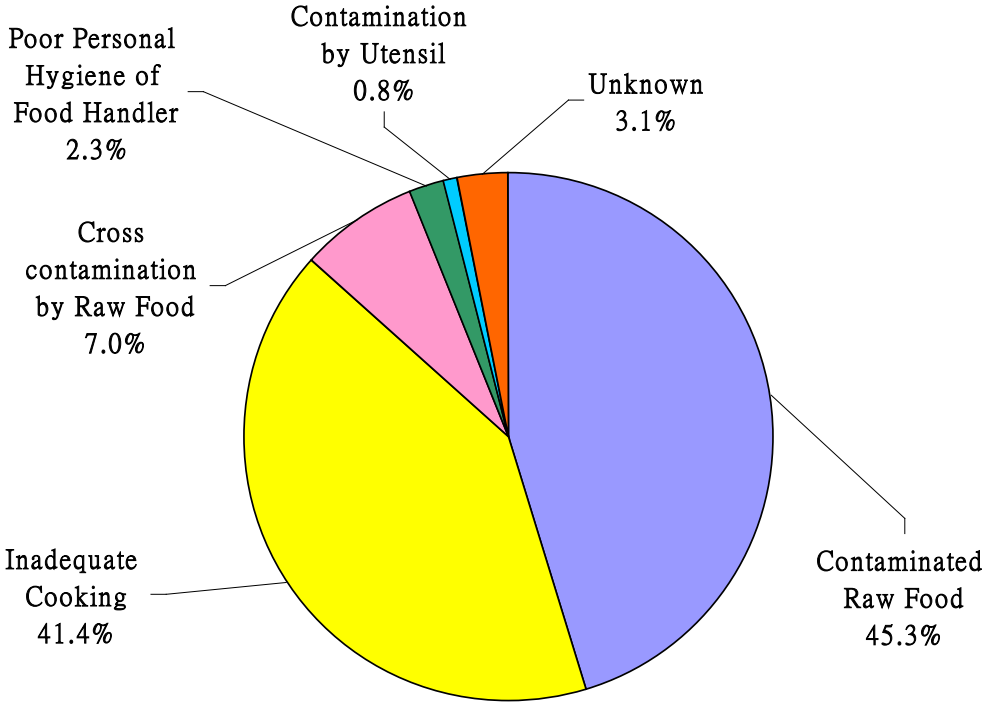



Figure 11. Contributing factors associated with confirmed food poisoning outbreaks caused by NoV from 2005 to 2011



29. In summary, NoV is the most common viral agent causing AGE outbreaks in institutional settings in Hong Kong. Both cyclical and seasonal patterns are observed for NoV infection. Majority of NoV institutional outbreaks occurred in residential care homes for elderly. It is also the most common viral food poisoning outbreak agent. Most of the foodborne outbreaks affected less than 5 persons but occasionally large outbreaks occurred. Most of the confirmed food poisoning outbreaks occurred at restaurants or food premises. The most commonly associated food item was seafood, especially oysters. Contaminated raw food and inadequate cooking were often identified as the contributing factors in causing foodborne outbreaks.

## Prevention and control for NoV infection in Hong Kong

30. The Working Group on NoV Prevention of the SCEIFD has developed the paper in year 2006 on "Strategies for Norovirus Prevention and Control". Over the years, key strategic areas have been addressed and relevant control measures are summarised as follows:

## I. Disease surveillance and diagnostic capacities

31. Sentinel surveillance at the community level provides early warning of AGE activities and some perspectives of disease burden. Besides the sentinel surveillance systems based at private medical practitioners (PMPs), general outpatient clinics (GOPCs), CCC/KGs and RCHEs, CHP has expanded the surveillance systems to Chinese medicine practitioners (CMPs) in recent years to monitor the activities of AGE. CHP has also undergone continuous enhancement of these surveillance systems. The scope of surveillance has widened to detect vomiting activities in RCHEs. More sentinel partners have been recruited to improve the geographical coverage and representativeness of the systems. CHP also developed the integrated electronic platform "Sentinel Online" to collect data from various sentinel sites for automated statistical analysis. In 2012, CHP will launch the new accident & emergency departments (AEDs) communicable diseases syndromic surveillance system to extend the coverage of AGE surveillance at the AEDs of public hospitals. The development of Communicable Disease Information System (CDIS) by CHP would enhance disease surveillance and facilitate timely information exchange with various surveillance partners in future. The development of the surveillance systems since the last strategic paper in 2006 is summarised as follows:

| Year | Milestones of community-based surveillance systems development |
|---|---|
| 2006 | ▪ The scope of surveillance was expanded to detect vomiting activities at sentinel RCHEs. |
| 2007 | ▪ CMP sentinel surveillance system, consisting of 59 CMPs from 16 clinics, was launched to detect health events including acute diarrhoea activities at community level.<br>▪ PMP sentinel surveillance system was expanded to include more medical practitioners. |
| 2008 | ▪ A pilot online data reporting system for PMP sentinel surveillance was launched. |
| 2009 | ▪ Sentinel Online System was officially rolled out.<br>▪ Seven RCHEs and 82 CCC/KGs were recruited into the sentinel systems, making up a total of around 60 RCHEs in 17 districts and around 120 CCC/KGs that covered 18 districts. |
| 2010 | ▪ PMP sentinel surveillance system was expanded to include more medical practitioners, making up a total of around 50 PMPs in 17 districts now. |
| 2011 | ▪ CMP sentinel surveillance system was expanded to include 13 more Chinese medicine clinics, making up a total of 29 clinics with about 100 CMPs in 17 districts. |
| 2012 | ▪ AEDs syndromic surveillance system was launched to monitor communicable diseases including AGE at AEDs of 16 public hospitals. |

32. PHLSB has been undertaking surveillance of NoV. It takes part in disease surveillance and outbreak investigation via regular collection of baseline laboratory epidemiological data and timely laboratory diagnostic service for NoV. PHLSB undertakes laboratory detection of NoV and rotavirus using nucleic acid amplification tests. For strain analysis of NoV, nucleotide sequencing is performed to provide epidemiological information. Genetic analysis also helps to monitor the predominant circulating NoV strains and detect any emerging new strains in Hong Kong.

## II. Outbreak control at institutional and health care settings

33. CHP receives voluntary reporting of AGE outbreaks from different institutional settings, such as elderly homes, schools, residential homes and hospitals. For these outbreaks, where the risk of person-to-person transmission is high, specific control measures will focus on containment of infectious individuals, hygiene improvement and environmental decontamination.

34. After receiving AGE outbreak notification, CHP will conduct epidemiological investigation and field visit where appropriate. Health advice will be given to the institution on disinfection procedures and preventive measures. Symptomatic residents/ students or staff will be encouraged to provide stool specimens for laboratory confirmation if tests were not yet done. The institution will be advised to carry out appropriate infection control measures and it will be put under medical surveillance. CHP will also inform and liaise with the relevant government departments for outbreak control when necessary.

## III. Food poisoning outbreak investigation and control

35. In Hong Kong, food poisoning is a statutory notifiable disease under Prevention and Control of Disease Ordinance (Cap 599). Upon notification of food poisoning outbreaks, CHP will initiate prompt epidemiological investigation. Outbreaks associated with food premises would be referred to the Food and Environmental Hygiene Department (FEHD) for further investigation. FEHD collects specimens for investigations where appropriate, provides specific advice on food hygiene, conducts source tracing and takes actions against any irregularities identified during the course of investigation at food premises. Health education on food hygiene and food safety will be stressed.

## IV. Food Safety

36. The Centre for Food Safety (CFS) of the FEHD is responsible for enforcement of food safety legislation, import control and food surveillance. Since 2009, the Public Health and Municipal Services (Amendment) Bill has empowered the Director of FEHD to prohibit the import and supply of problem food and order a recall of the problem food for a better protection of public health. To further strengthen food safety, the Food Safety Ordinance (Chapter 612) has commenced its full operation on 1 February 2012. This new ordinance introduces a food tracing mechanism to help the Government trace the source of the food more effectively and take prompt action when dealing with food incidents. The food tracing mechanism includes a registration scheme for food importers and food distributors and a record-keeping requirement relating to movement of food. With the commencement of new ordinance, source tracing of high-risk food such as oysters will be more efficient to address public food safety concern. The Ordinance also empowers the Secretary for Food and Health to make regulations on import control for specific food types in future. At the import level, the importers are encouraged to obtain health certificates from respective health authorities of the exporting countries, certifying that the food is originated from an approved source and that it is fit for consumption.

## V. Risk communication and public health education

37. Vaccine is not yet available for NoV infection. Prevention of infection is one of the key components in the overall public health strategies. A multi-pronged approach is adopted in risk communication. CHP and CFS continue to provide the public with knowledge of the illness and related health advice on personal, environmental and food hygiene through various channels e.g. printed materials, internet, television, radio and health talks. Emphasis has been put on high risk foods. CFS has developed food safety guidelines for the public and food industries on preparation of oysters, sushi and other ready-to-eat food. Prior to the usual peak season of viral AGE, CHP will issue letters to alert hospitals, doctors, persons-in-charge of institutions and schools. CHP has also developed infection control guidelines for institutions such as schools, residential homes for elderly and hospitals to prevent communicable diseases, especially on the proper management of vomitus in institutions. Specific and practical message on disinfection of contaminated environment has been provided to public. Regular training for staff at healthcare and institutional settings has also been conducted e.g. Infection Control Stewardship Programme in residential care homes for elderly organised by CHP in 2011. In the past years, CHP also issued press releases before each peak season of NoV outbreak to raise public awareness on prevention of the disease.

## VI. Local researches on NoV

38. The Health Care and Promotion Fund (HCPF) was established by the Hong Kong Government for the purpose of increasing health promotion and disease prevention. Related local researches on NoV have been supported by HCPF. Since the 2006 strategic paper, there have been researches on establishment of public health NoV genome database, development of in vitro cell culture model for human NoV and institutional risk factors for NoV outbreaks in elderly homes.

## Recommendations

39. NoV infection is a disease of significant public health concern due to its potential in causing large scale outbreaks and putting pressure on healthcare system particularly during peak seasons. The emergence of new NoV strains is of global concern for its potential in causing extensive infections. NoV outbreak is however preventable through stringent public health measures.

40. To ameliorate the impact of NoV infection in Hong Kong, the following measures are recommended:

- Continue to enhance the current surveillance systems and strategies to facilitate timely monitoring of acute gastroenteritis activity in community level by:
    - Expanding the geographical coverage of existing sentinel surveillance systems to cover all 18 districts of Hong Kong by 2013.
    - Integration of existing sentinel systems into the electronic CDIS platform to facilitate timely analysis and rapid response by late 2014.

- Explore the opportunity to involve different stakeholders in healthcare system especially the private sectors on diarrhoeal disease surveillance.

- Explore the feasibility to designate active sentinel surveillance hospitals in performing laboratory tests on all suspected cases with infectious gastroenteritis for disease burden estimation.

- Continue to raise the public awareness on NoV infection through various channels and education materials, especially during high season. Advise the importance of good personal, environmental and food hygiene.

- Strengthen the education of food handlers in proper food handling and cooking procedures to prevent foodborne NoV infection. It is important to maintain good personal and food hygiene when preparing ready-to-eat food.

- Provide the updated guidelines on prevention of communicable diseases to institutions. Regular infection control trainings for staff at healthcare and institutional settings will be useful. Proper disinfection of any contaminated environment should be emphasized. Encourage institutions to notify CHP as early as possible for any suspected gastroenteritis outbreaks.

- Continue the laboratory surveillance of local circulating NoV strains for early detection of new variants. Keep close monitoring of globally circulating and any emerging NoV strains.

- Maintain a high standard of food safety and strengthen food tracing mechanism.

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