Norovirus in Healthcare Settings – Prevention and Management of Outbreaks

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Norwalk virus

- 1968 Outbreak in Norwalk, Ohio
  - 50% primary attack rate
  - 38% secondary attack rate
  - nausea and vomiting: >90%
  - diarrhea: 38%
  - duration 12 – 24 hours

Noro-*what?*
New Nomenclature

Old

- **Norwalk virus**
- **Norwalk-like virus**
- **Calicivirus**
- **Norwalk-like calicivirus**
- **Small round-structured virus (SRSV)**

New

Norovirus

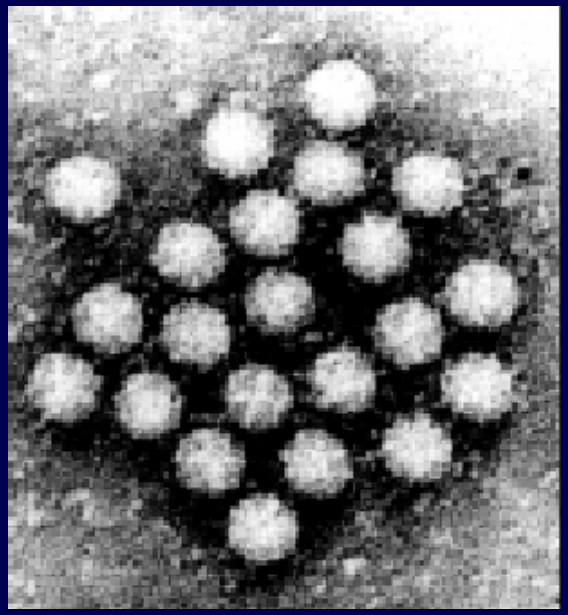
Taxonomy and Nomenclature

Caliciviridae

Norovirus	*Sapovirus*	*Lagovirus*	*Vesivirus*
Norwalk-like viruses	Sapporo-like viruses	Rabbit hemorrhagic disease virus	Feline calicivirus (and other)
Small round structured viruses	Classical calicivirus	(and other)	
Calicivirus	Sapporo virus		
Norwalk virus			

Norovirus

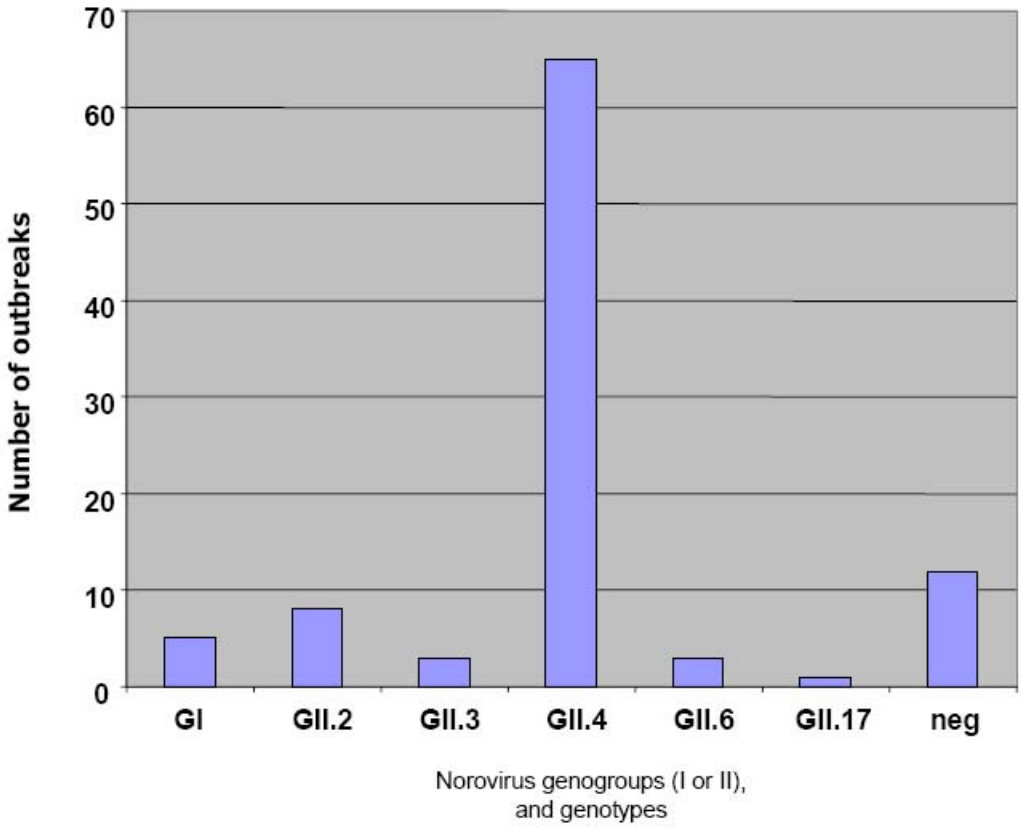
- Structured RNA virus, family Caliciviridae
- Most common cause of enteric illness, by far
- Human reservoir
- Fecal-oral transmission
  - Person-person
  - Foodborne
  - Waterborne



Norovirus

- 5 Genogroups
  - GI, GII, and GIV associated with human illness
  - GI: 8 genotypes
  - GII: 17 genotypes
  - GIV: 1 genotype
- Since the 1990's, global epidemics have been associated with Genogroup II, genotype 4 (GII.4)

NoV genotypes associated with outbreaks analyzed at CDC in 2006 (n = 106)



CDC

Norovirus Outbreaks by Month, Minnesota, 2001 – 2007

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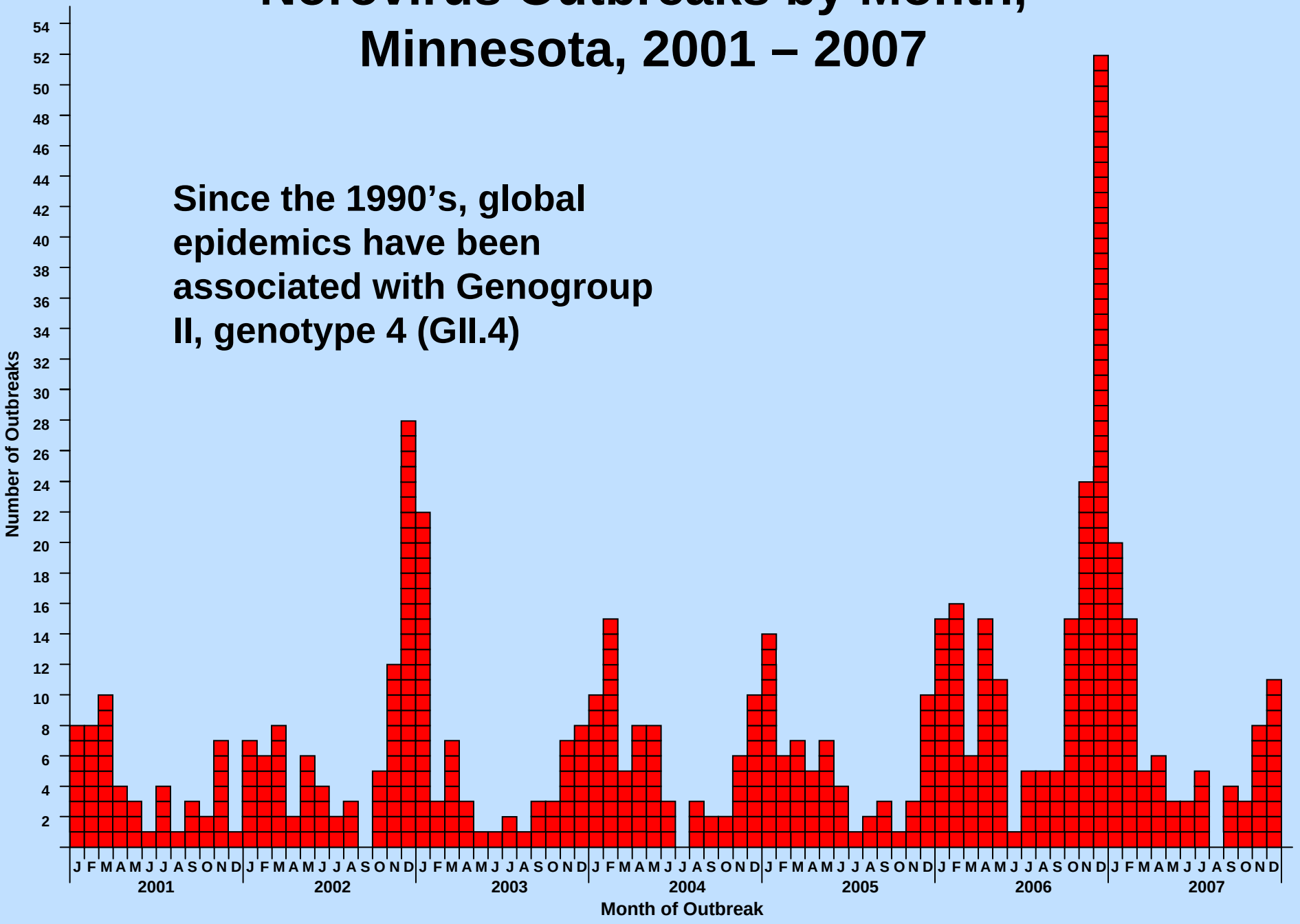
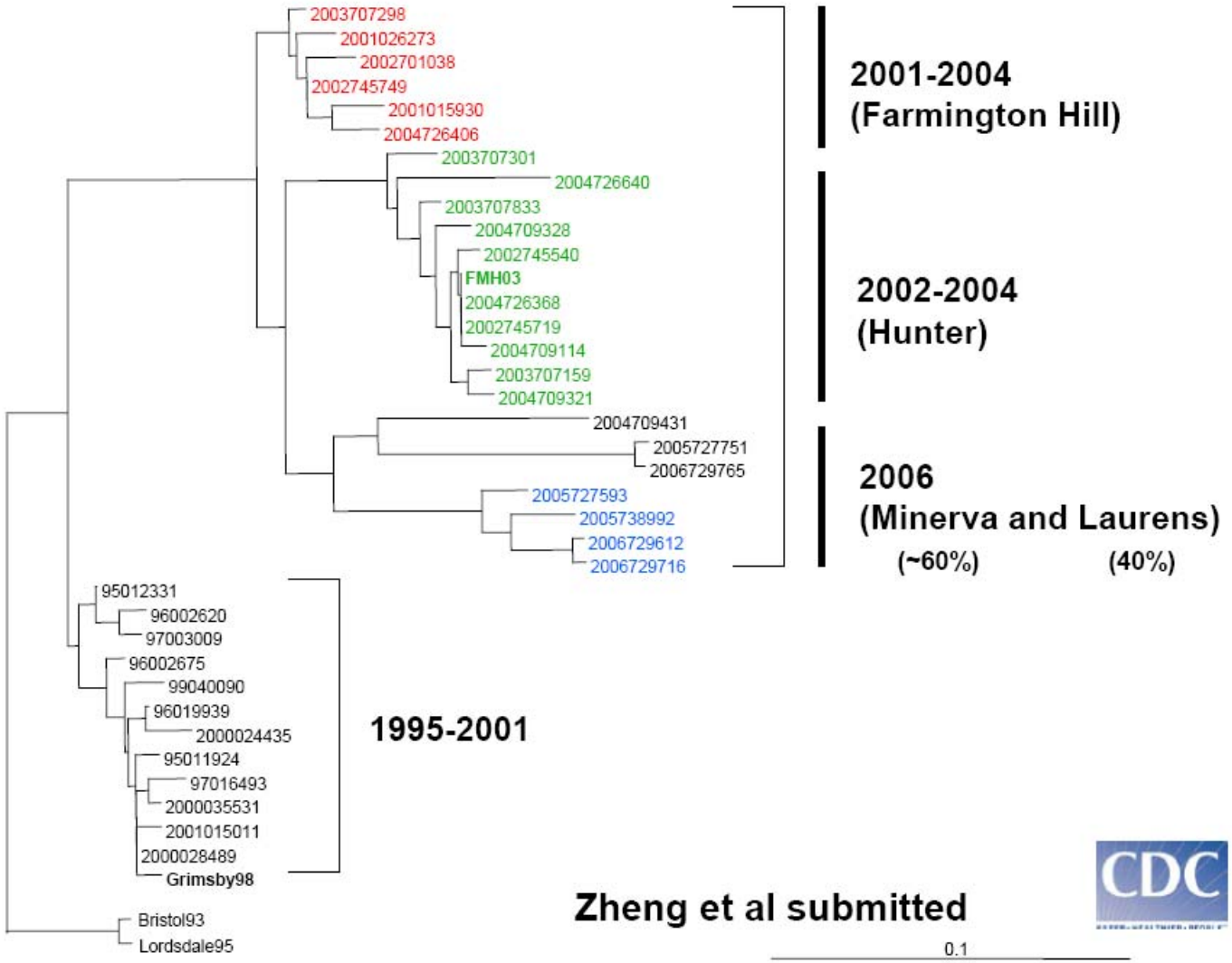


Molecular Evolution of Norovirus GII.4 Strains



Story last updated at 7:59 a.m. Sunday, December 1, 2002

Disney cruise ship undergoes second disinfection

ORLANDO, Fla. (AP) – A Disney cruise liner marred by a second outbreak of a flu-like virus returned to port Saturday, and workers once again began disinfecting the ship after 218 people became ill during its latest voyage.

In the past few months, about 1,000 passengers and crew on two voyages of the Magic and four voyages of Holland America's Amsterdam have contracted a Norwalk-like virus, one of a number of

Tuesday, 3 December, 2002, 16:48 GMT

Cruise ship hit by tummy bug

Other cruise ships experienced similar outbreaks recently

US health inspectors are investigating an outbreak of gastrointestinal illness that made more than 200 people sick on a cruise ship.

BBC NEWS WORLD EDITION

Friday, 22 November, 2002, 14:02 GMT

Virus ravages US cruise ships

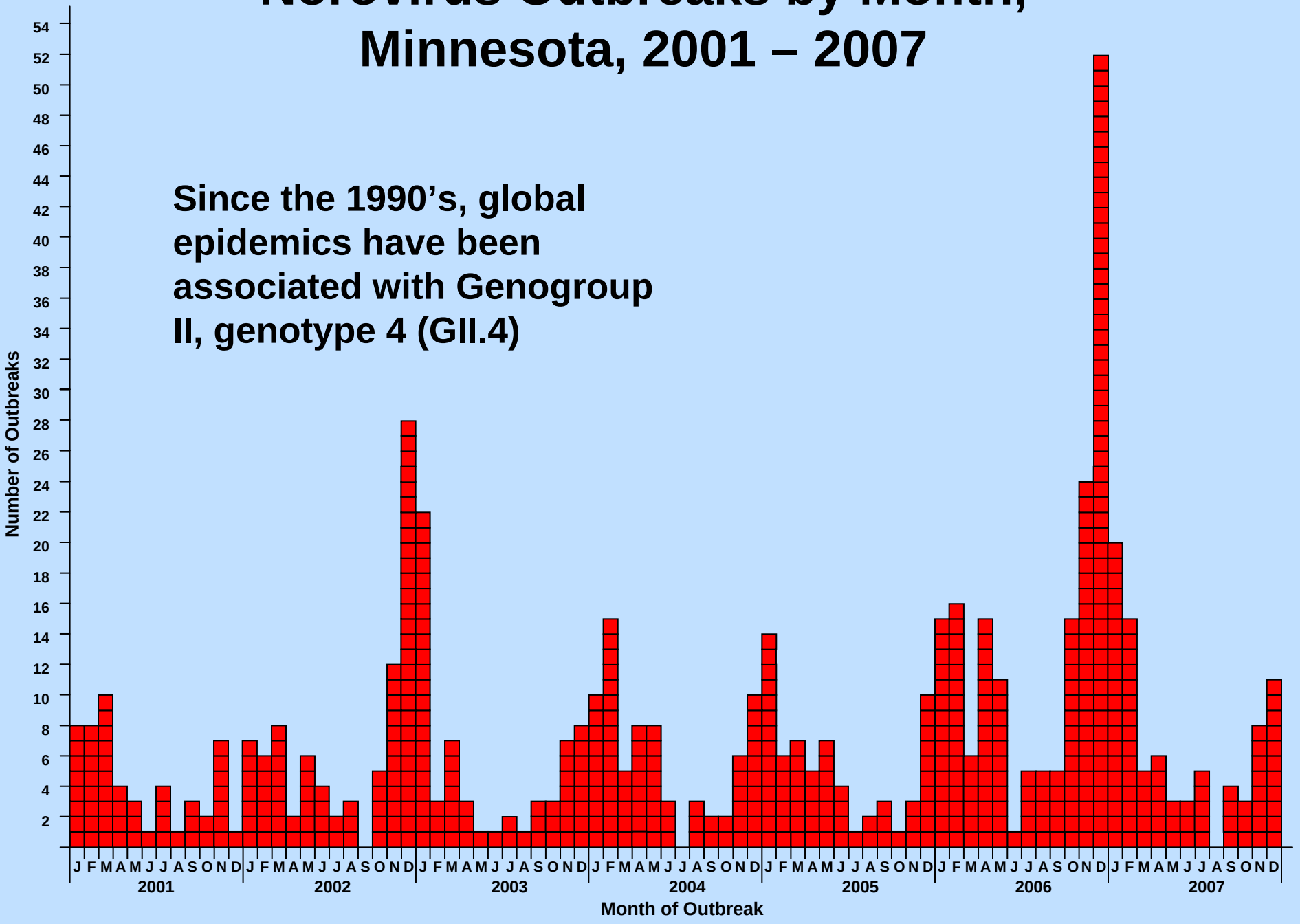
The Amsterdam (left) is being deep cleaned from bow to stern

About 100 passengers aboard a Disney cruise liner are the latest to go down with a severe stomach virus which has been spreading through cruise ships, Disney officials have reported.

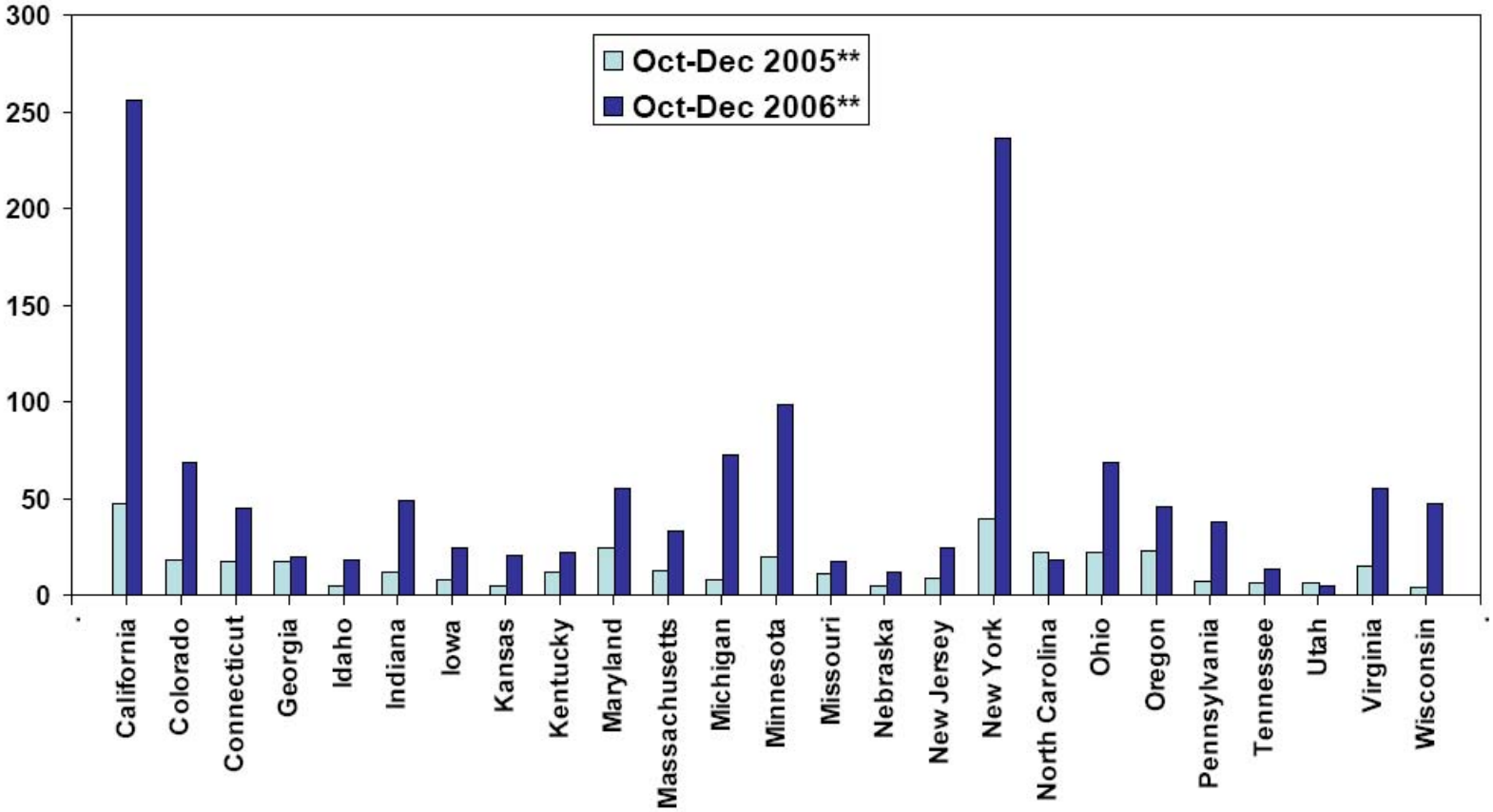
On Thursday, another Miami-based cruise operator cancelled a scheduled trip to the Caribbean after more than 500 passengers contracted the virus over the course of four voyages.

Norovirus Outbreaks by Month, Minnesota, 2001 – 2007

Since the 1990's, global epidemics have been associated with Genogroup II, genotype 4 (GII.4)



Reported outbreaks (n = 1316) of acute gastroenteritis in 24 selected* states, 2005 and 2006



* Inclusion criterion: States had to report at least 5 outbreaks in October to December 2005 and 2006.

MMWR 2007 **Date of outbreak onset

CDC

Norovirus Outbreak Associated with Bakery Items, 1982 - Initial Investigation

- MDH notified of gastrointestinal illness among persons who had attended four social events over one weekend
- The events all had a common dessert caterer
- Bakery sold rolls, breads, cakes, special pastries over the counter
- Cakes for special events

Norovirus Infections Associated with Frosted Bakery Products, 1982

- Ill foodworker prepared 76 L of buttercream frosting for use on ~10,000 products
- Frosting maker during 6-hour shift:
  - 5 episodes of diarrhea
  - 2 episodes of vomiting
- Frosting maker's children had GI illness onset 1, 2, and 3 days prior to his onset of illness

- **Bare arm up to elbow in frosting**
- **Estimated 3,000 illnesses**

Transmission Routes

- Food
  - Foodhandlers
  - Contamination at source
- Person to person
  - Direct fecal-oral
  - Vomitus/"Airborne"
  - Indirect via fomites/contaminated environment
- Water
  - Drinking water - wells
  - Recreational

Person-to-Person

- Vomiting and airborne spread
  - UK restaurant*
    - Sudden vomiting
    - >50 sick
    - Table-specific attack rates
- Environmental contamination
  - Hotel in UK[$]: cases occurring over 4 months
    - Swabs of carpet, light fittings, toilet: Positive
  - Spread on airplane[#]:
    - Associated with contaminated but unsoiled toilets

* Marks et al Epidemiol Infect 2000
$ Cheesbrough et al Epidemiol Infect 1998
# Widdowson et al JAMA, 2005

Clinical Disease

- Incubation period 12-48 hours: median, 33 hours
- “Mild and short-lived”
- Acute onset diarrhea, nausea, vomiting, cramps
- Acute phase lasts 12-72 hours
- No long-lasting immunity: all ages affected

Clinical Disease

- Diarrhea (nonbloody)
- Nausea
- Vomiting
  - More likely in children
  - Can be primary complaint
- Abdominal pain
- Myalgia
- Headache
- Low-grade fever (or none)

Dispelling the “Stomach Flu” Myth

- Term generally used to describe short-term (up to 2 days) gastroenteritis
- Belief that is just something you catch that can’t be avoided
- No idea that you can get it from food, transmit it to others through food
- Pervasive among public, food service industry, and to some extent among health care providers

Epidemiologic Profile for Norovirus Outbreaks

- **Incubation: ~ 24-48 hrs**
- **Duration: ~12-60 hrs**
- **Symptoms:**
  - **≥50% cases with vomiting *or* % vomiting > % fever**

Kaplan, et al 1982
Hedberg, et al 1993

Treatment for Norovirus

- Self-limiting illness
- May require oral or intravenous rehydration
- 10% cases seek health care
- 1% hospitalized
  - hospitalizations rare in healthy children and adults
- More debilitating in elderly or immunocompromised

Estimated Food-Related Deaths Caused by Known Foodborne Pathogens

Agent	Food-Related Deaths	(%)
Salmonella	553	(30.6)
Listeria monocytogenes	499	(27.6)
Toxoplasma gondii	375	(20.7)
Norovirus	124	(6.9)
Campylobacter	99	(5.5)
E. coli O157:H7	52	(2.9)
Hepatitis A Virus	4	(0.2)

Mead, et al 1999

Disease Burden

- 11% of community diarrhea - Netherlands*
- 23 million cases of gastroenteritis/year in US$
- 50% of all foodborne outbreaks@
- 14% of hospitalizations for AGE among children <14 years in Japan^
- 26% of adults hospitalized for diarrhea#

* De Wit et al, American Journal of Epidemiology, 2001
$ Mead et al Emerging Infectious Diseases, 1999
^ Sakai et al, Pediatric Infectious Diseases, 2001
@ Widdowson et al, Emerging Infectious Diseases, 2001
# Joe Bresee unpublished data

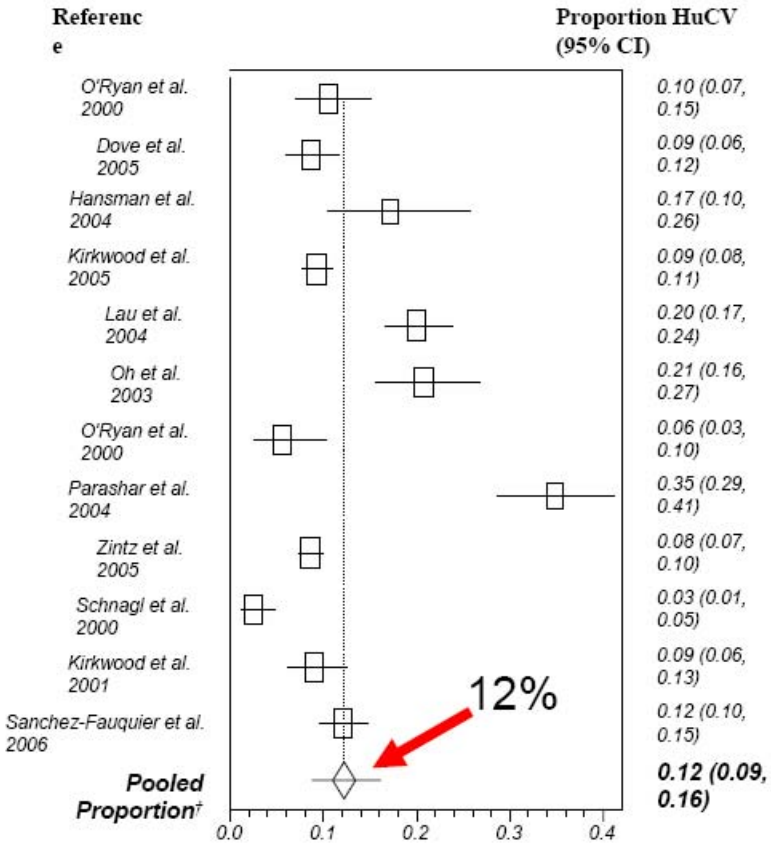
Estimated Cases of Selected Known Enteric Pathogens, United States

Agent	Cases	% Food-Related
Norovirus	23,000,000	40
Rotavirus	3,900,000	1
Campylobacter	2,453,926	80
Giardia	2,000,000	10
Salmonella	1,412,498	95
Shigella	448,240	20
Cryptosporidium	300,000	10
C. perfringens	248,520	100
S. aureus	185,060	100
Hepatitis A Virus	83,391	5
E. coli O157:H7	73,450	85

Estimated Food-Related Cases of Selected Foodborne Pathogens

Agent	Food-Related Cases	(%)
Norovirus	9,200,000	(66.6)
Campylobacter	1,963,141	(14.2)
Salmonella	1,341,873	(9.7)
C. perfringens	248,520	(1.8)
Giardia	200,000	(1.4)
S. aureus	185,060	(1.3)
Shigella	89,648	(0.6)
E. coli O157:H7	62,458	(0.5)
Rotavirus	39,000	(0.3)
Cryptosporidium	30,000	(0.2)
Hepatitis A Virus	4,170	(0.0)

HuCV positive fecal samples among hospitalized and emergency department cases of children < 5 years of age with sporadic diarrhea.



Proportion of HuCV positive cases, hospital and ED children < 5 years (95% CI)

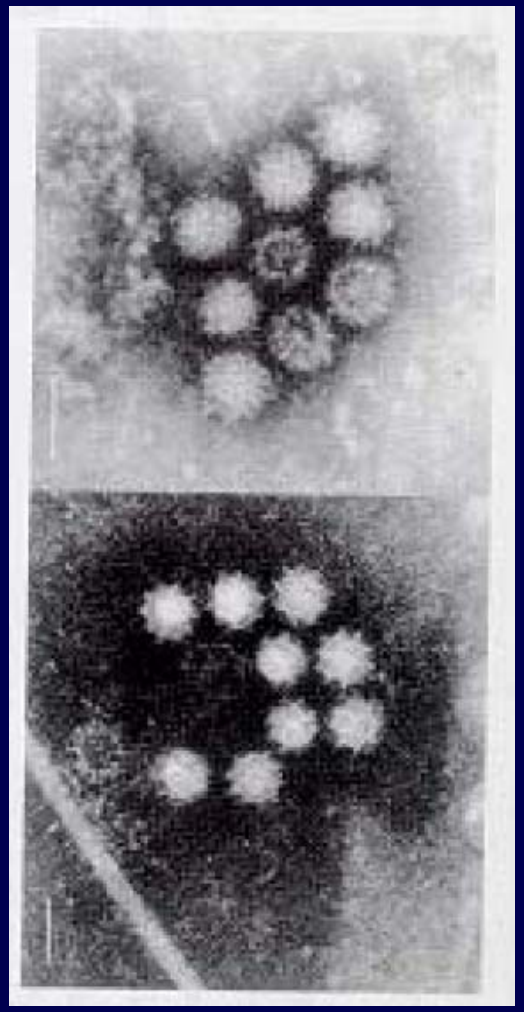
- In children <5 years globally may result in…
  - >200,000 deaths
  - >1,200,000 hospitalizations

Patel et al: in press EIDJ

CDC

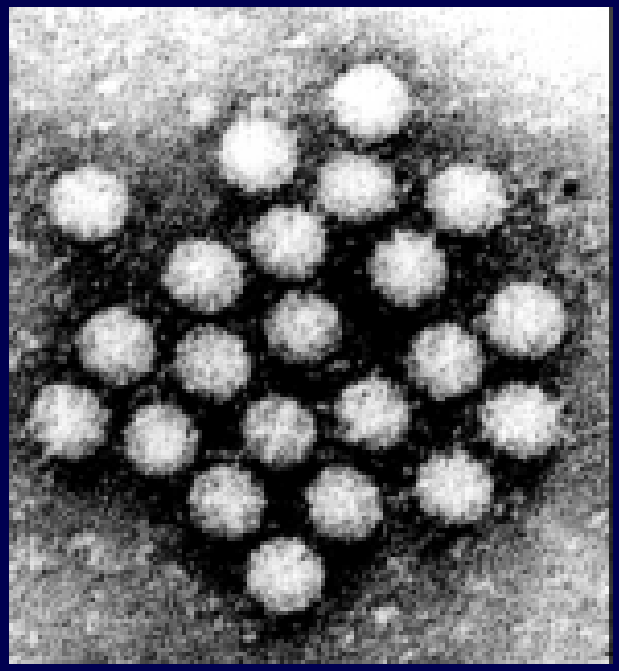
Diagnosis

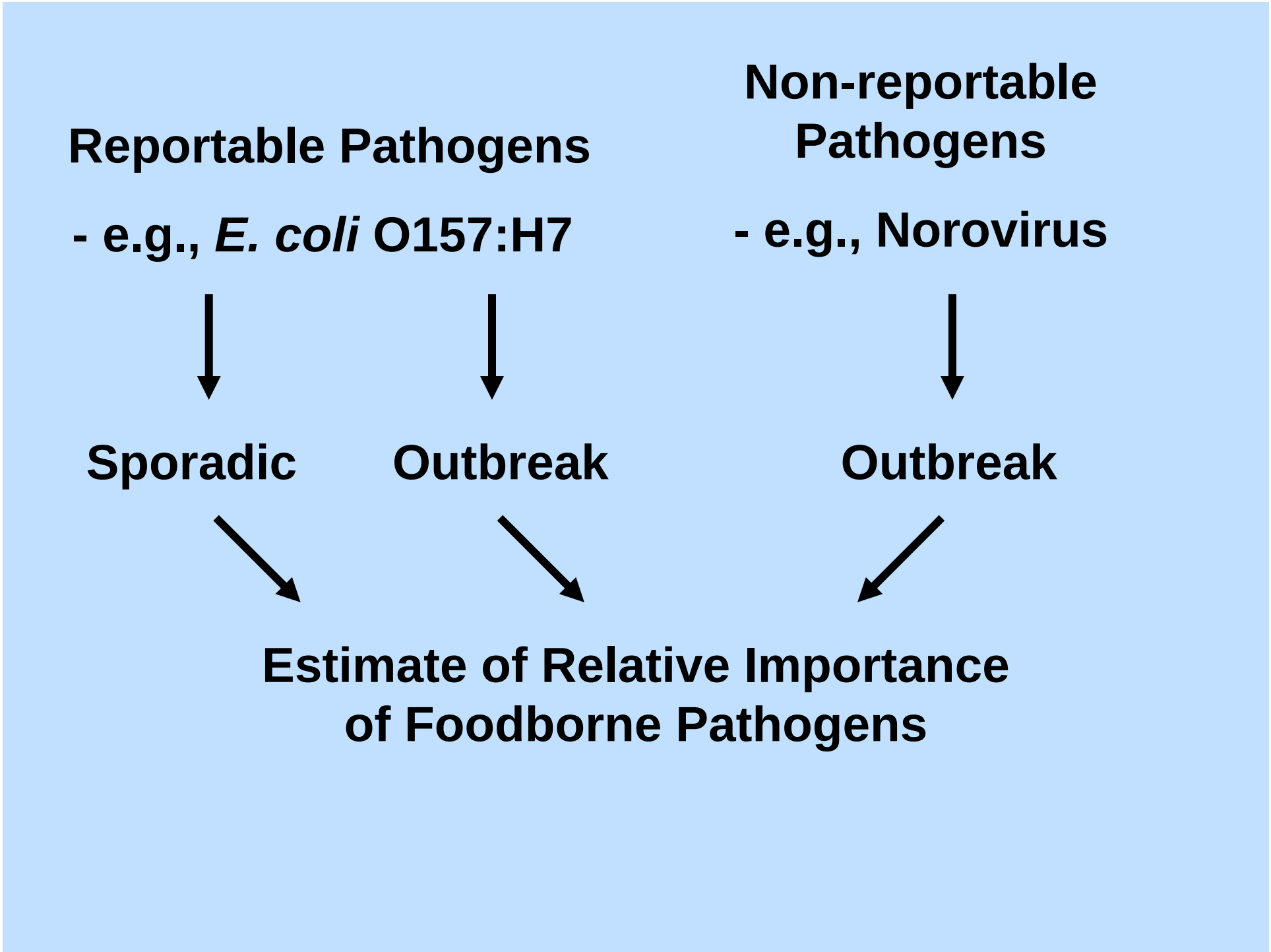
- No cell culture system for human noroviruses
- Diagnosis
  - Immune electron microscopy
  - Serology - paired sera
  - Reverse transcriptase polymerase chain reaction (RT-PCR)



Diagnosis

- RT-PCR
  - Stool
  - Vomitus
- Outbreaks
- Surveillance
- Test not in wide use for clinical diagnosis




Reportable Pathogens
- e.g., *E. coli* O157:H7
Non-reportable Pathogens
- e.g., Norovirus
Sporadic
Outbreak
Outbreak
Estimate of Relative Importance of Foodborne Pathogens

Epidemiologic Profiles Associated with Confirmed Foodborne Outbreaks* United States, 1982-1997

Profile	No. (%) Outbreaks
Norovirus	855 (38)
Salmonella-like	696 (31)
Diarrhea toxin	289 (13)
Vomiting toxin	199 (9)
E. coli	96 (4)
Unknown	141 (6)
Total	2,246 (100)

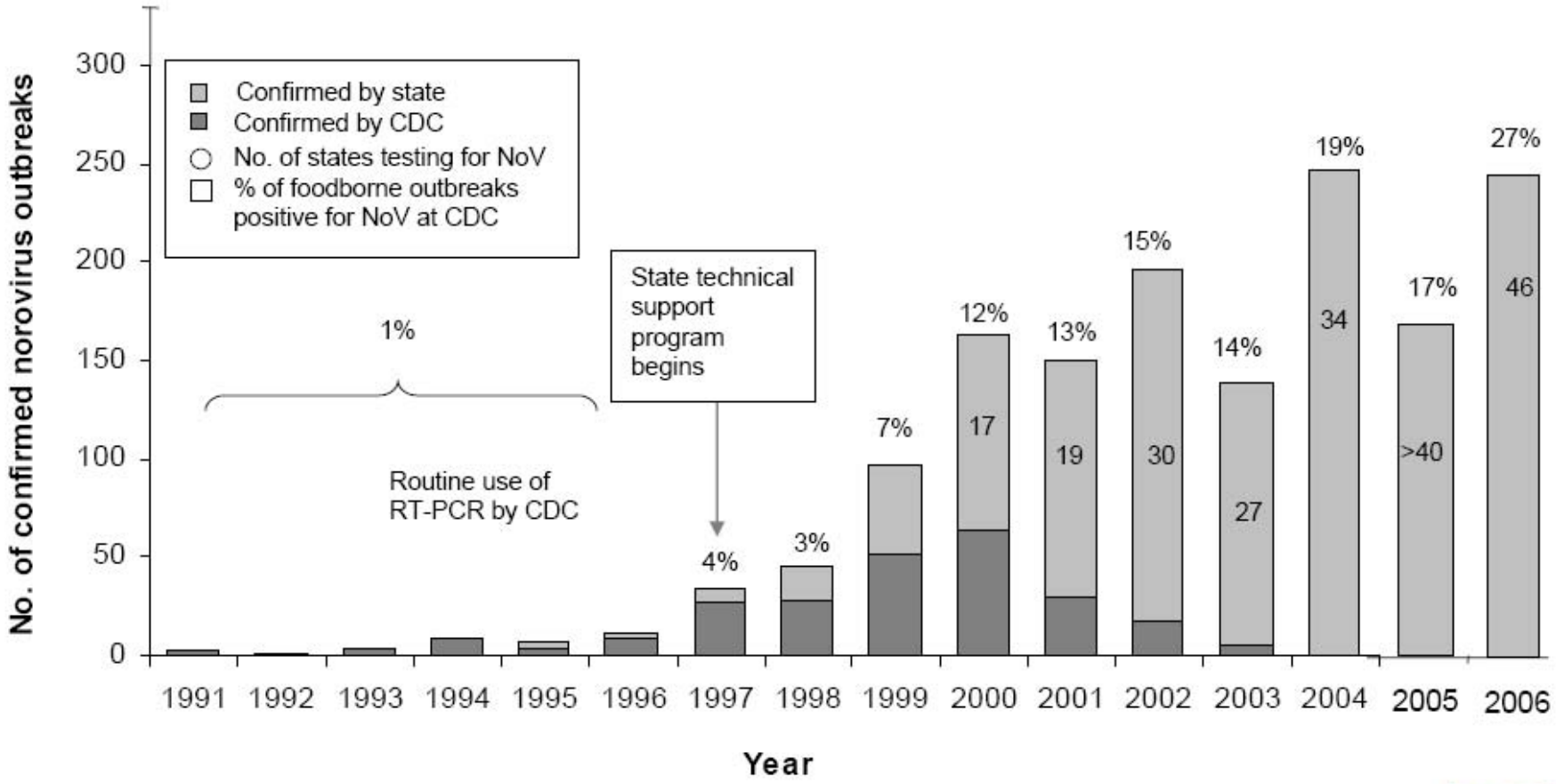
**outbreaks with >= 5 cases, complete information*

Norovirus: The Leading Cause of Nonbacterial Gastroenteritis Outbreaks

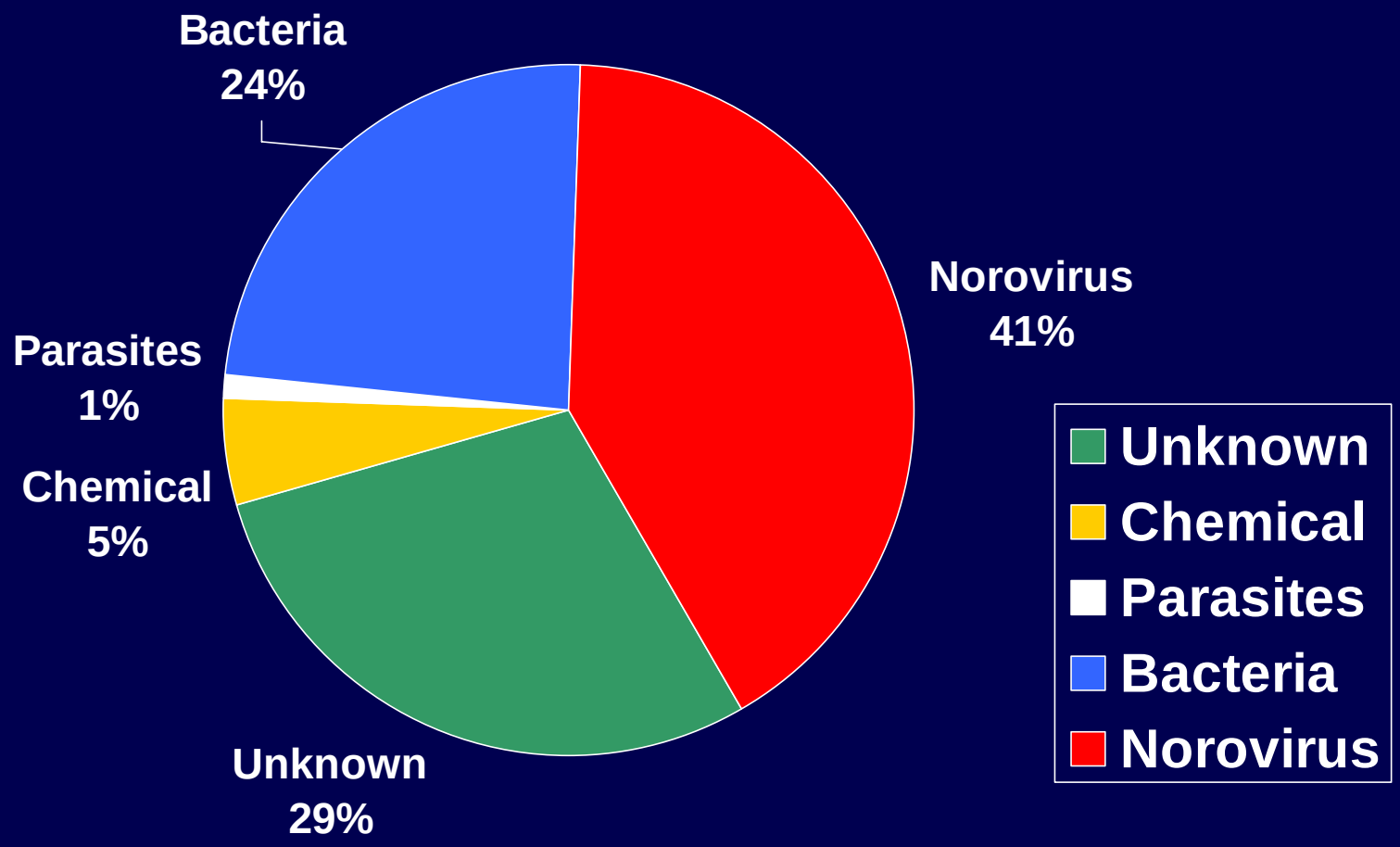
- National study conducted by CDC, 1997-2000
- Stool specimens from 284 outbreaks of nonbacterial gastroenteritis submitted for testing
- Norovirus detected by PCR in **93%** of these outbreaks

Fankhauser et al. 2002

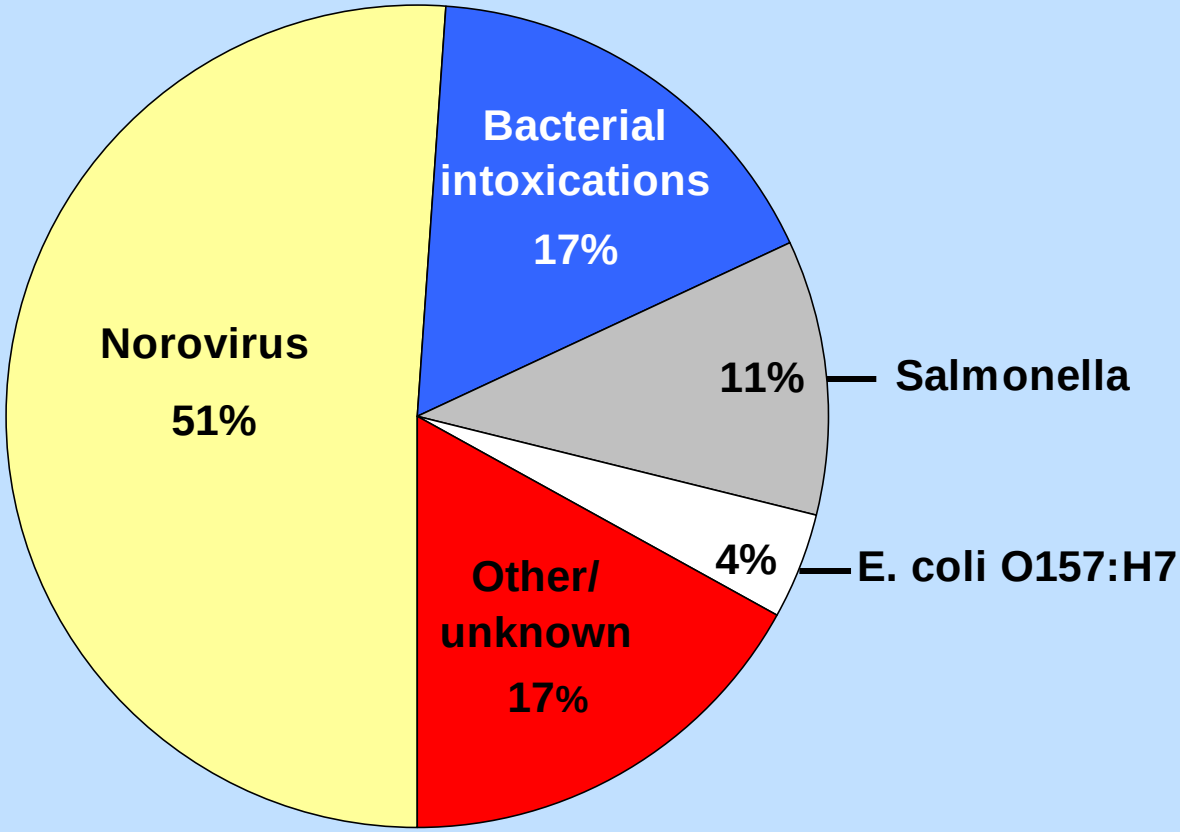
Norovirus (NoV) confirmed foodborne outbreaks reported to CDC, United States, 1991-2006



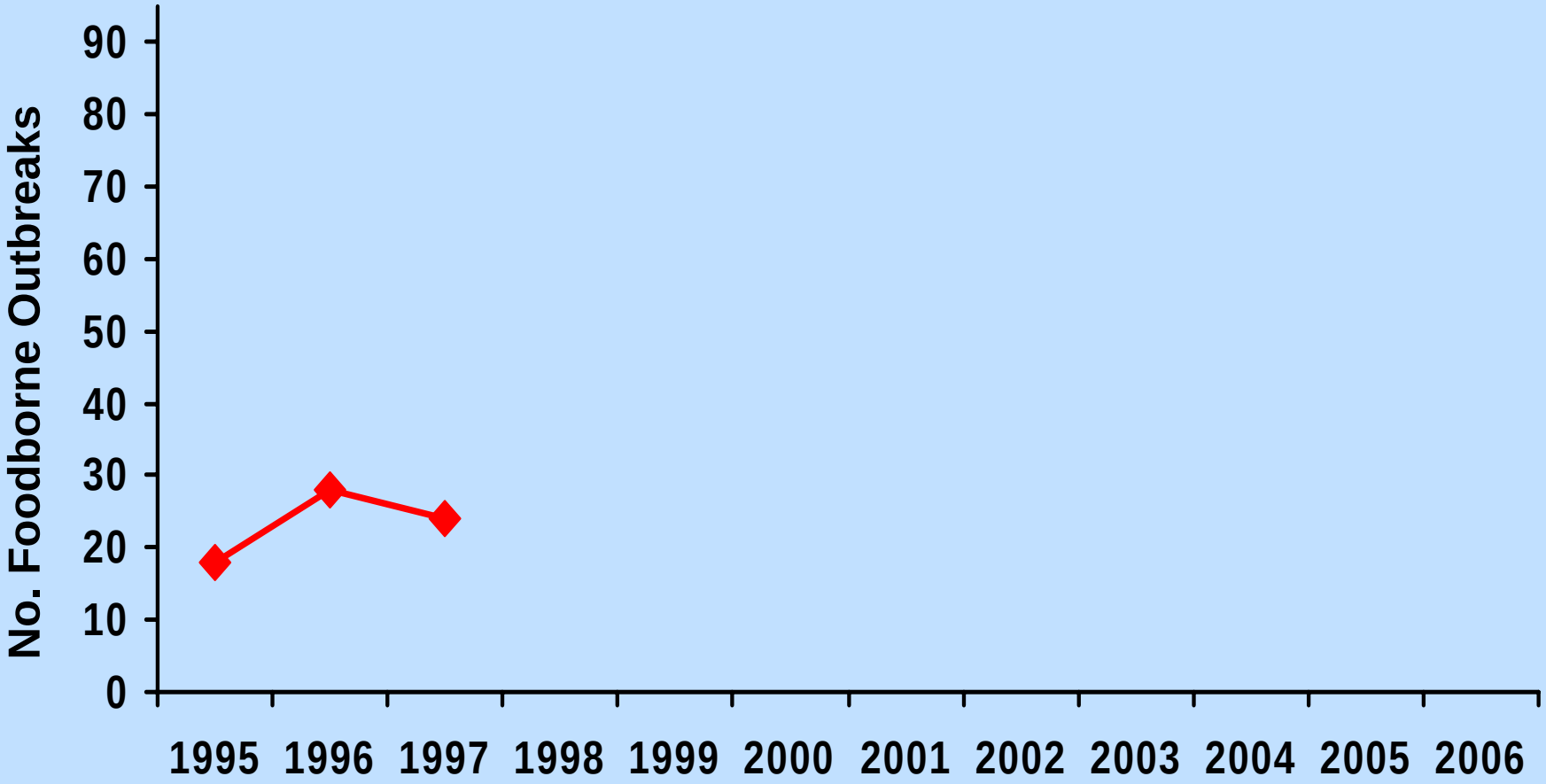
Confirmed and Suspected Etiology of 1,247 Foodborne Outbreaks Reported to CDC in 2006



Confirmed Foodborne Outbreaks by Etiology, Minnesota,1981-2006 (n=669)



Confirmed Foodborne Outbreaks, Minnesota, 1995-2006



Minnesota Foodborne Illness Hotline

Call to report foodborne illness:

(651) 201-5414

Toll free statewide:

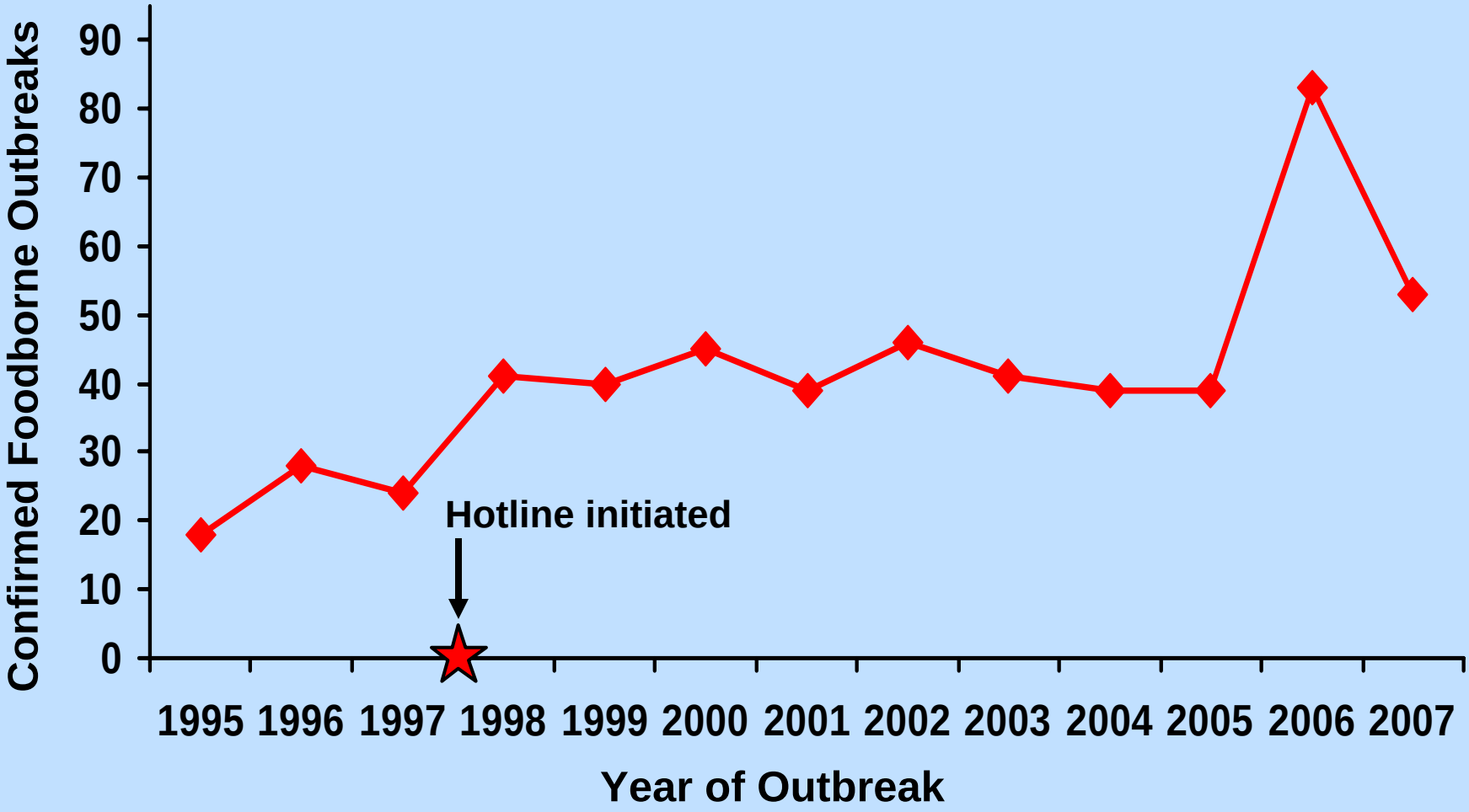
1-877-366-3455

1-877-FOOD ILL

MINNESOTA MDH DEPARTMENT OF HEALTH

625 N Robert St.
St. Paul, MN 55155
www.health.state.mn.us

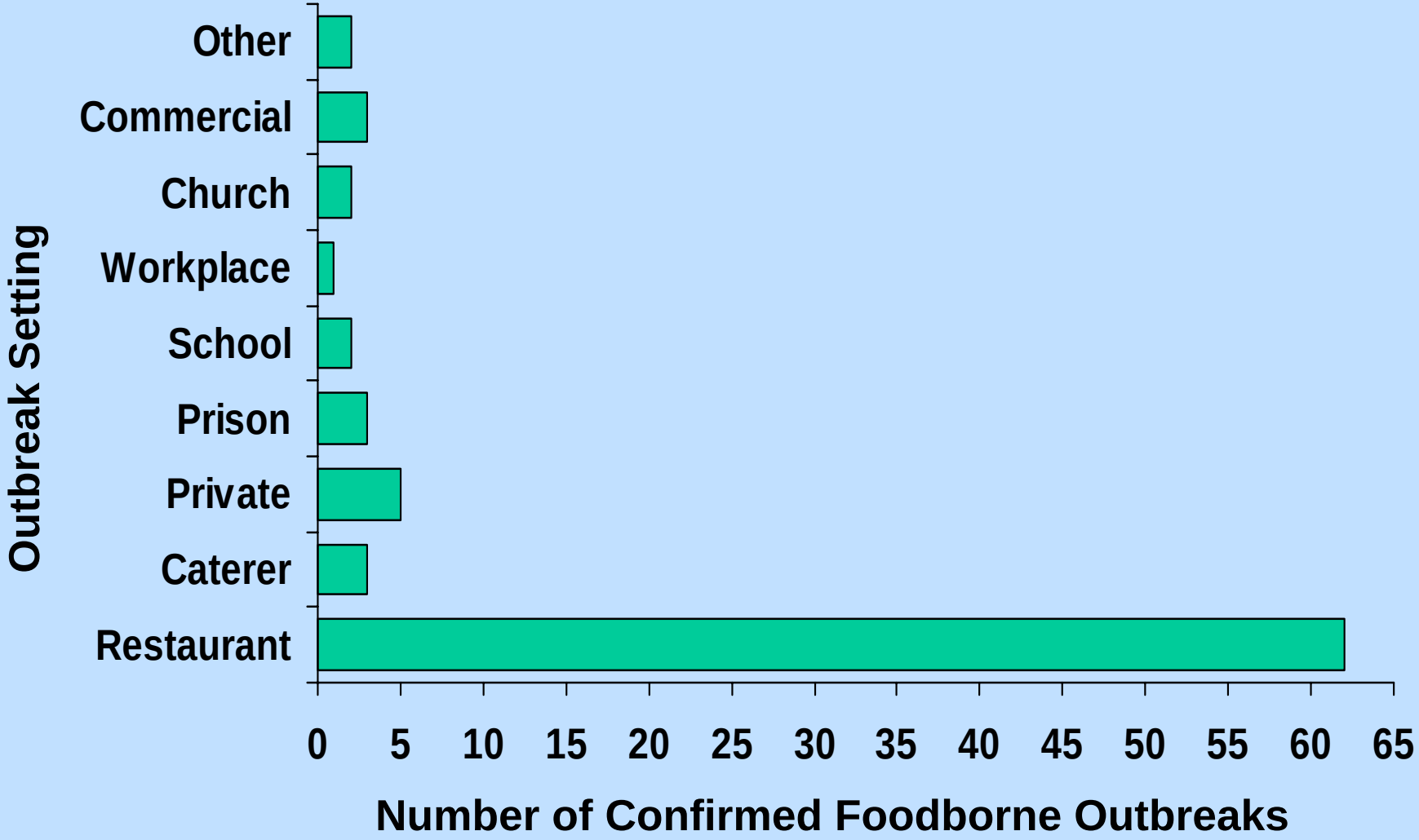
Confirmed Foodborne Outbreaks, Minnesota, 1995-2007



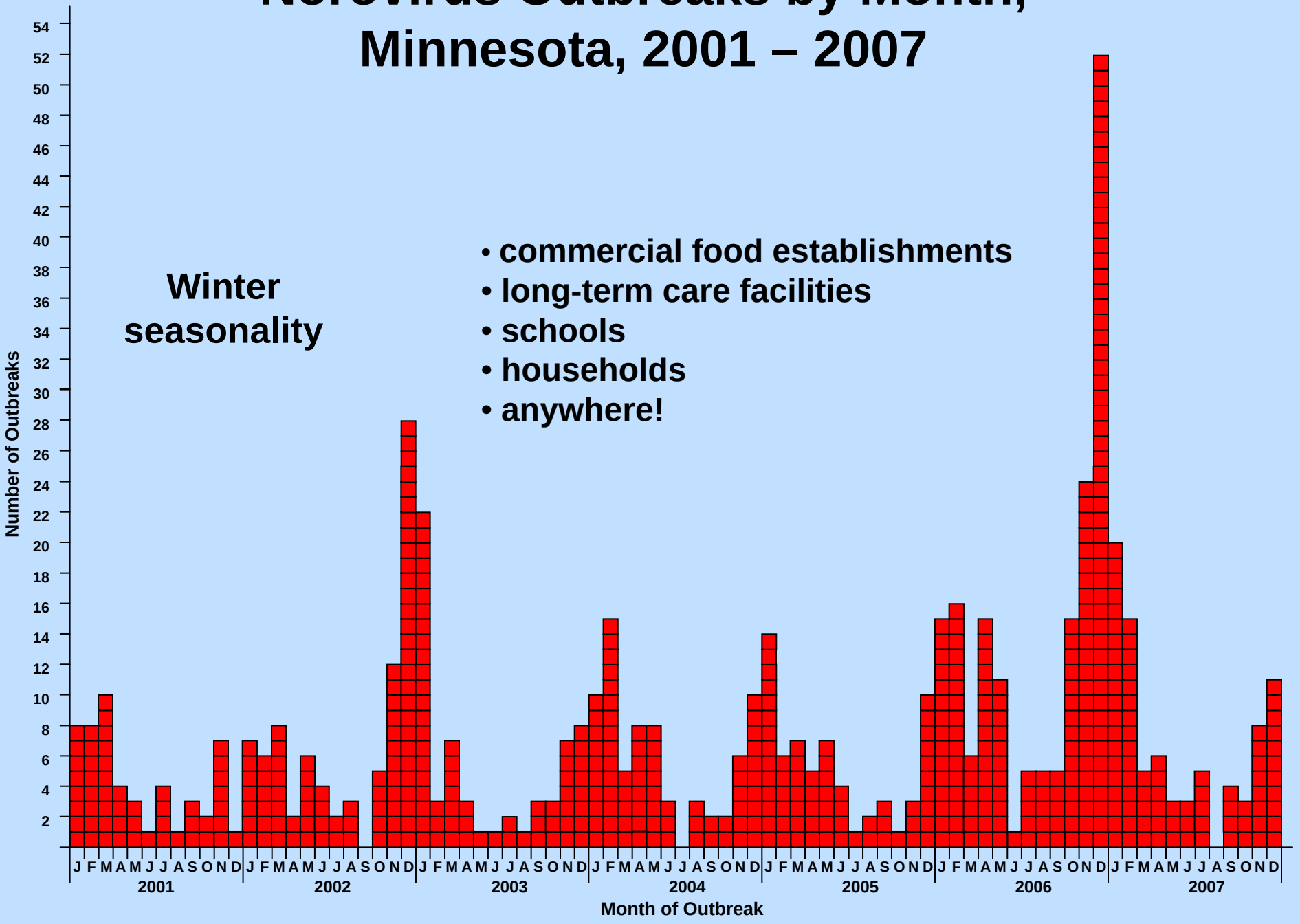
Etiologies of Confirmed Foodborne Outbreaks, Minnesota, 2006 (n=83)

Pathogen	No. (%)
Norovirus	56 (67%)
Salmonella	9 (11%)
Scombroid	5 (6%)
Clostridium perfringens	5 (6%)
E. coli O157:H7	3 (3%)
Shigella	1 (1%)
Staphylococcus aureus	1 (1%)
Cyclospora	1 (1%)
Listeria	1 (1%)
Amatoxin	1 (1%)

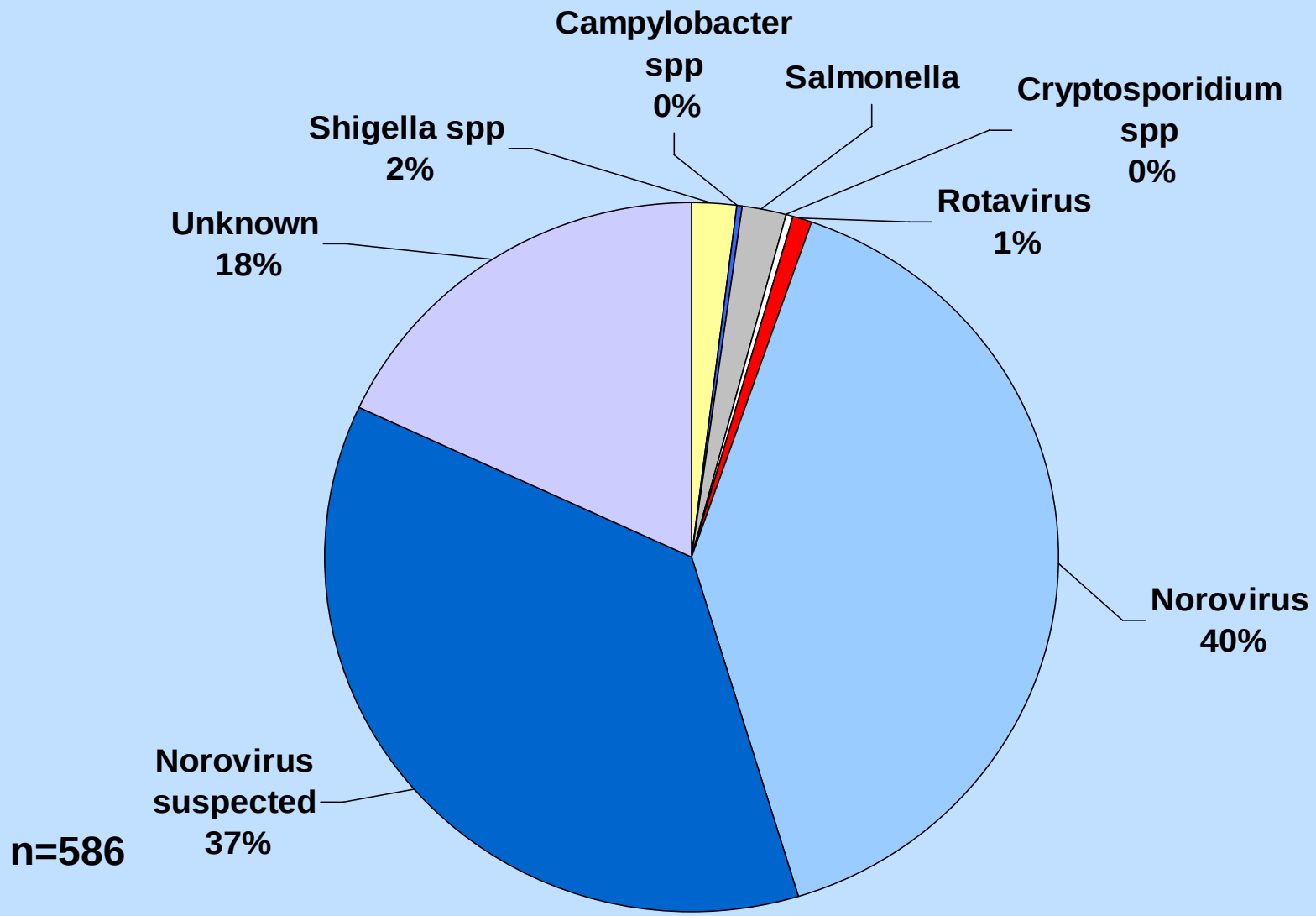
Confirmed Foodborne Outbreaks by Setting, Minnesota, 2006 (n=83)



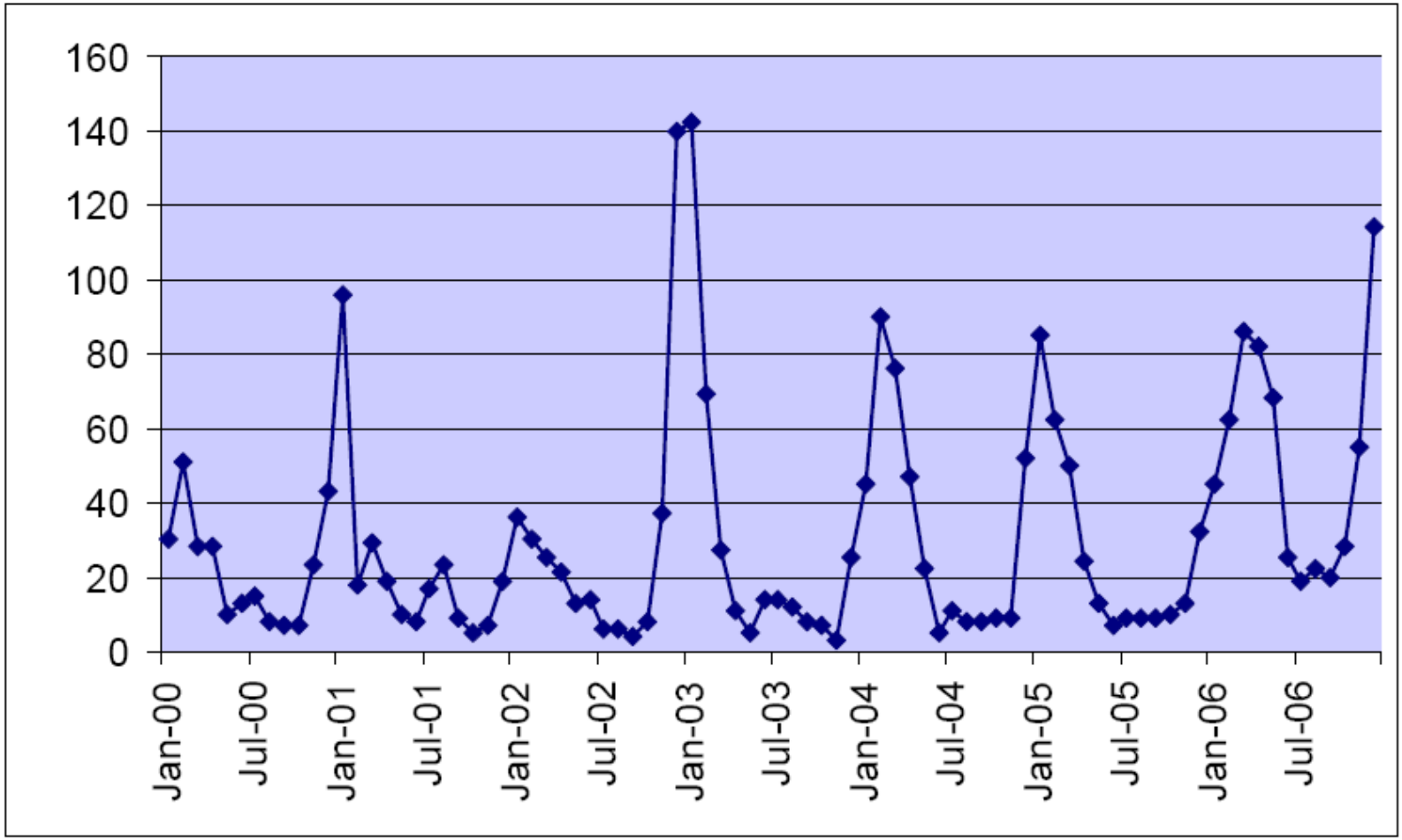
Norovirus Outbreaks by Month, Minnesota, 2001 – 2007



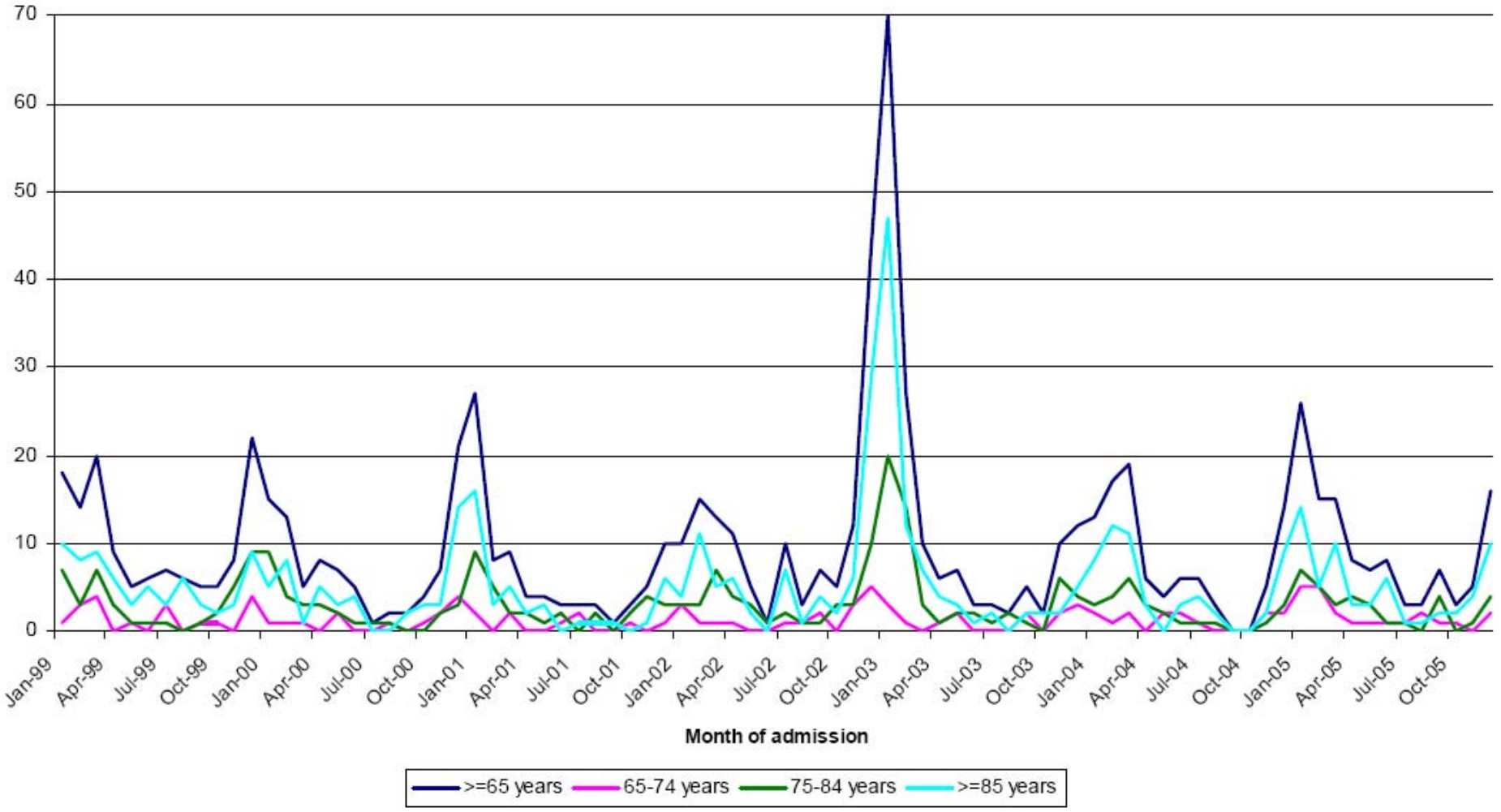
Confirmed and Suspected Etiologies of Person-to-Person Outbreaks in 6 States, 2002-2006



Number of NFB, NWB outbreaks in 6 Foodnet sites

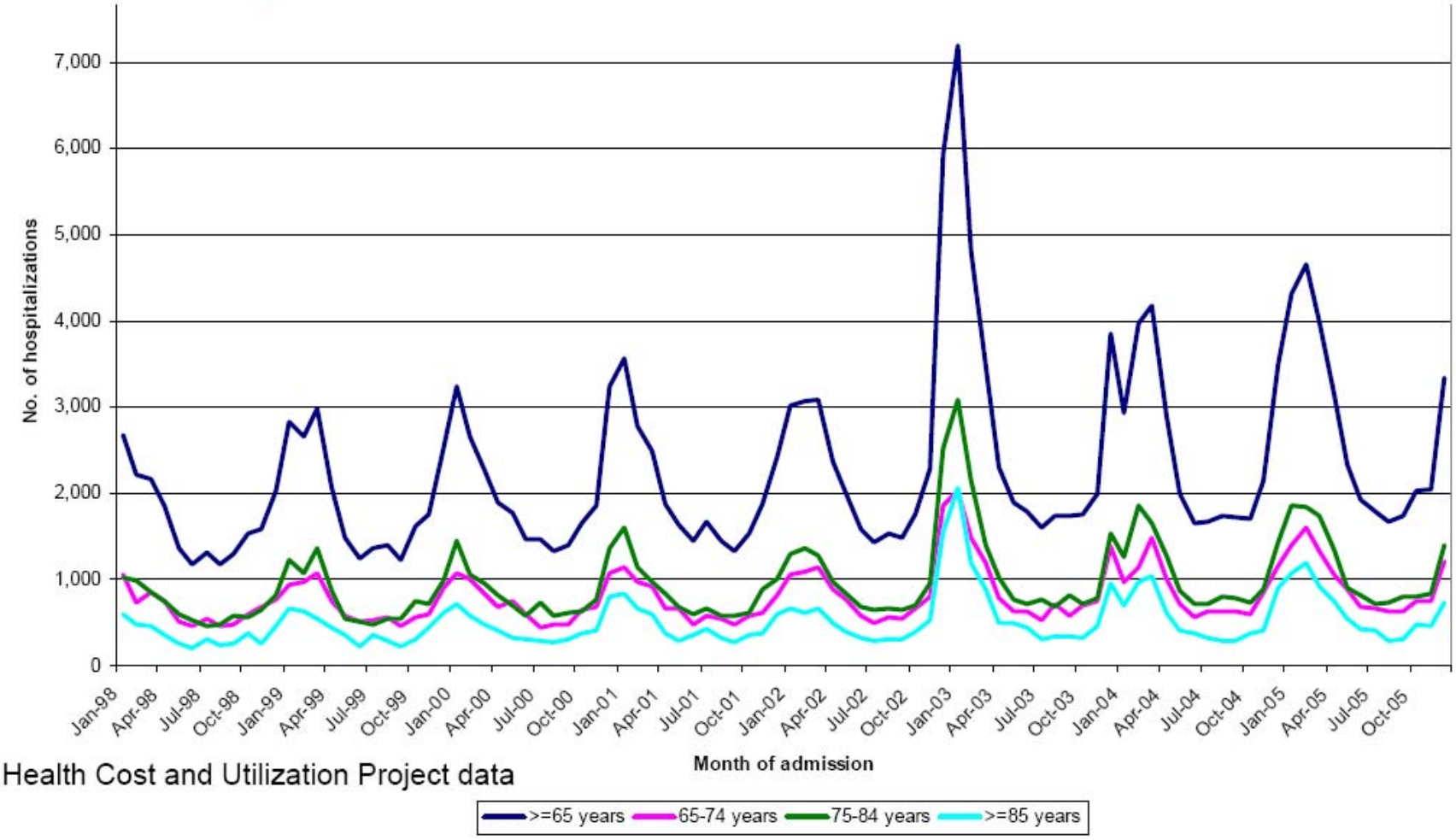


Gastroenteritis deaths among persons >65 years coded as "viral" from 1999 to 2005



Multiple cause of death data, NCHS

Gastroenteritis hospitalizations among persons >65 years coded as "viral" from 1999 to 2005



Health Cost and Utilization Project data

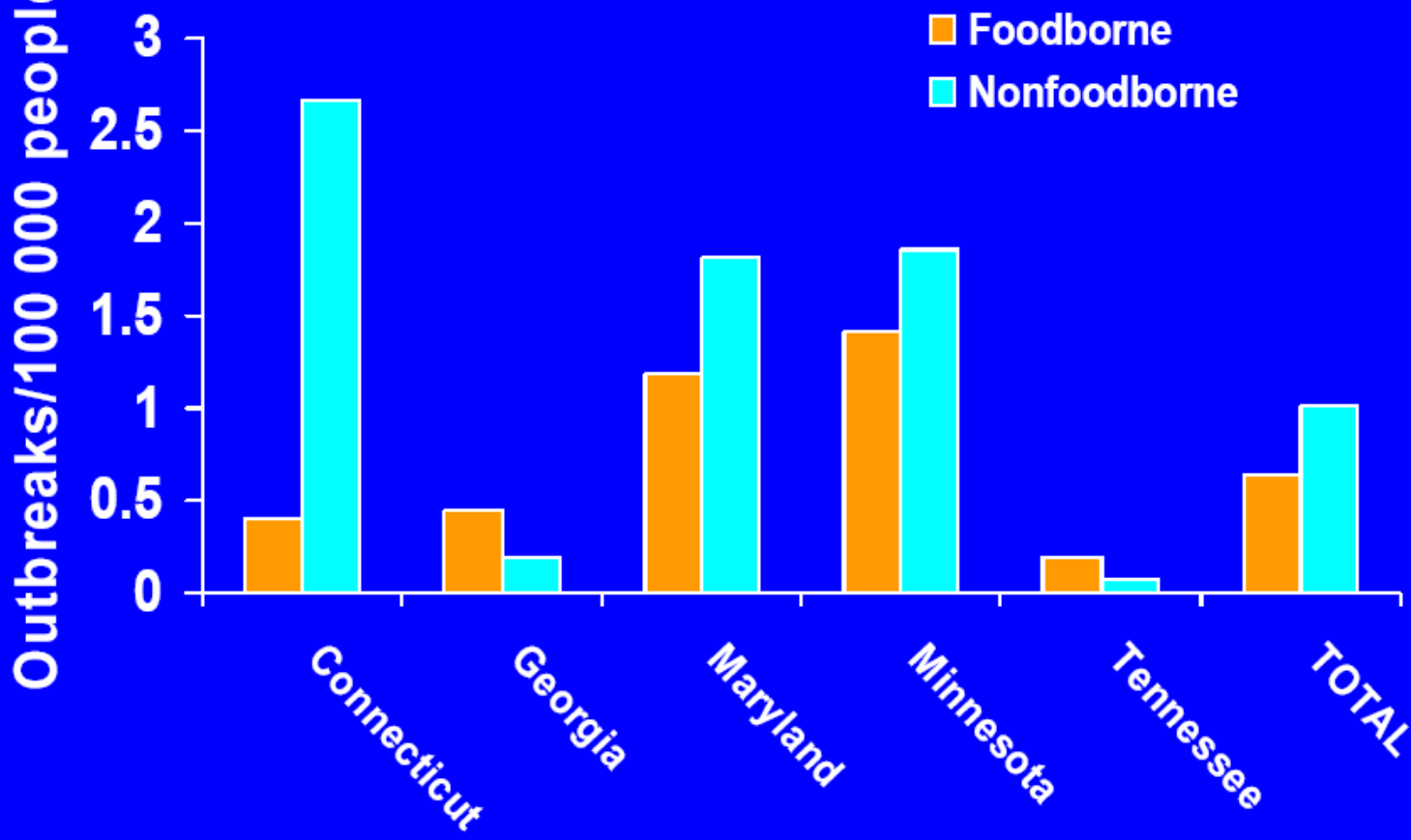
Outbreak Surveillance and Settings

- US, 1997-2000[$] (n=223)
  - 39% food outlets
  - 25% nursing homes and hospitals
  - 13% schools/daycare
  - 10% vacation settings
  - 12% other
- UK, 1992-2000[*] (n=1,877)
  - 6% food outlets
  - 77% hospitals and nursing homes
  - 4% schools
  - 8% hotels
  - 4% other

[$] Fankhauser et al JID, 2002

[*] Lopman et al EIDJ, 2003

‘Non-foodborne’ outbreaks in 6 US states, 2002-2004



CDC unpublished data

What Makes Norovirus So Contagious?

TABLE 1. Characteristics of "Norwalk-like viruses" that facilitate their spread during epidemics

Characteristic	Observation	Consequences
Low infectious dose	<10^2 viral particles	Permits droplet or person-to-person spread, secondary spread, or spread by foodhandlers
Prolonged asymptomatic shedding	≤2 weeks	Increased risk for secondary spread or problems with control regarding foodhandlers
Environmental stability	Survives ≤10 ppm chlorine, freezing, and heating to 60 C	Difficult to eliminate from contaminated water; virus maintained in ice and steamed oysters
Substantial strain diversity	Multiple genetic and antigenic types	Requires composite diagnostics; repeat infections by multiple antigenic types; easy to underestimate prevalence
Lack of lasting immunity	Disease can occur with reinfection	Childhood infection does not protect from disease in adulthood; difficult to develop vaccine with lifelong protection

Source: CDC

Potential Transmission Level of Norovirus

- NoV is shed in the feces at levels up to 10,000,000 viral particles per gram
- One projectile vomiting incident can include up to 30,000,000 viral particles
- Reminder: Infectious dose of NoV is estimated to be 10 – 100 viral particles

Duration of Symptoms and Shedding of Norovirus

- Community-based cohort study of 99 cases in the Netherlands
  - all age groups represented
- Median duration of symptoms: 5 days
- Shedding (virus detected in stool)
  - Day 1: 78%
  - Day 8: 45%
  - Day 15: 35%
  - Day 22: 26%

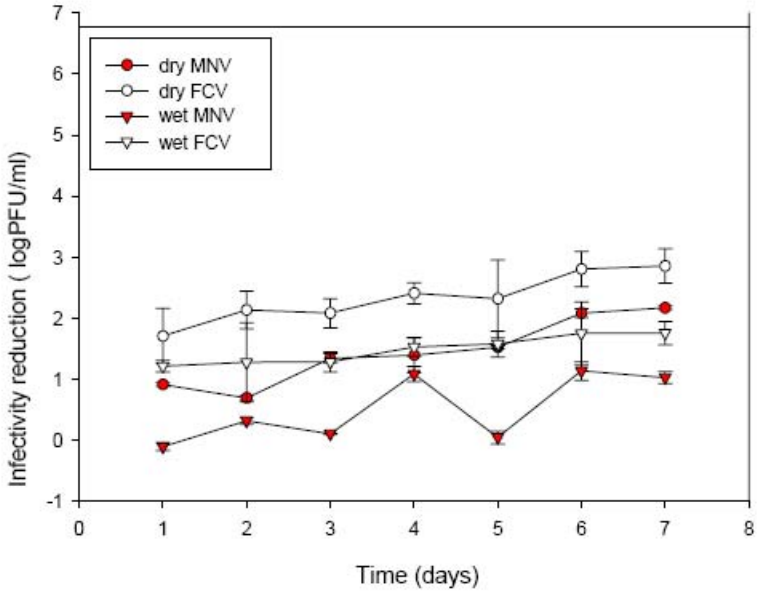
Rockx et al., 2002

Transfer of Norovirus from Contaminated Fingers

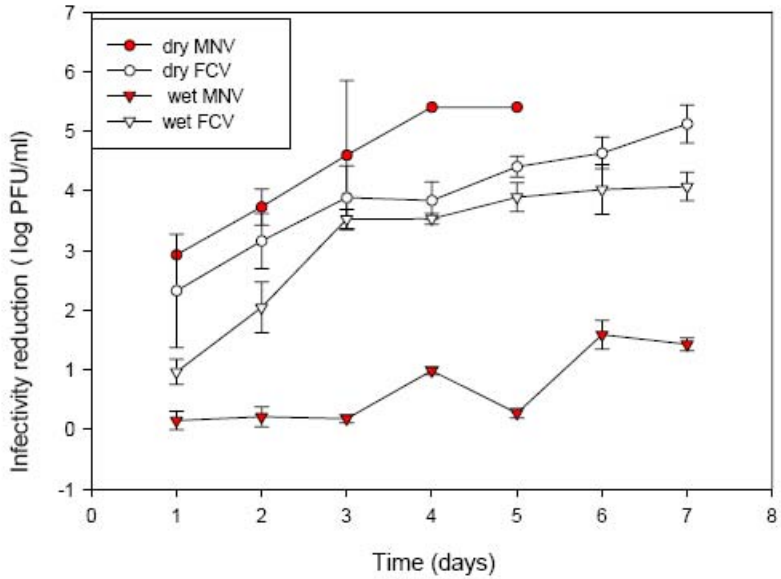
- NoV can transfer from contaminated fingers, sequentially to 7 different environmental surfaces
- Secondary transfer of NoV (from contaminated surfaces → clean fingers → other surfaces): can transfer sequentially to 4 different surfaces
- Detergent cleaning, followed by rinsing was not effective in cleaning contaminated surfaces (unless followed by a disinfectant)

Survival of MNV and FCV in the environment

4°C



20°C



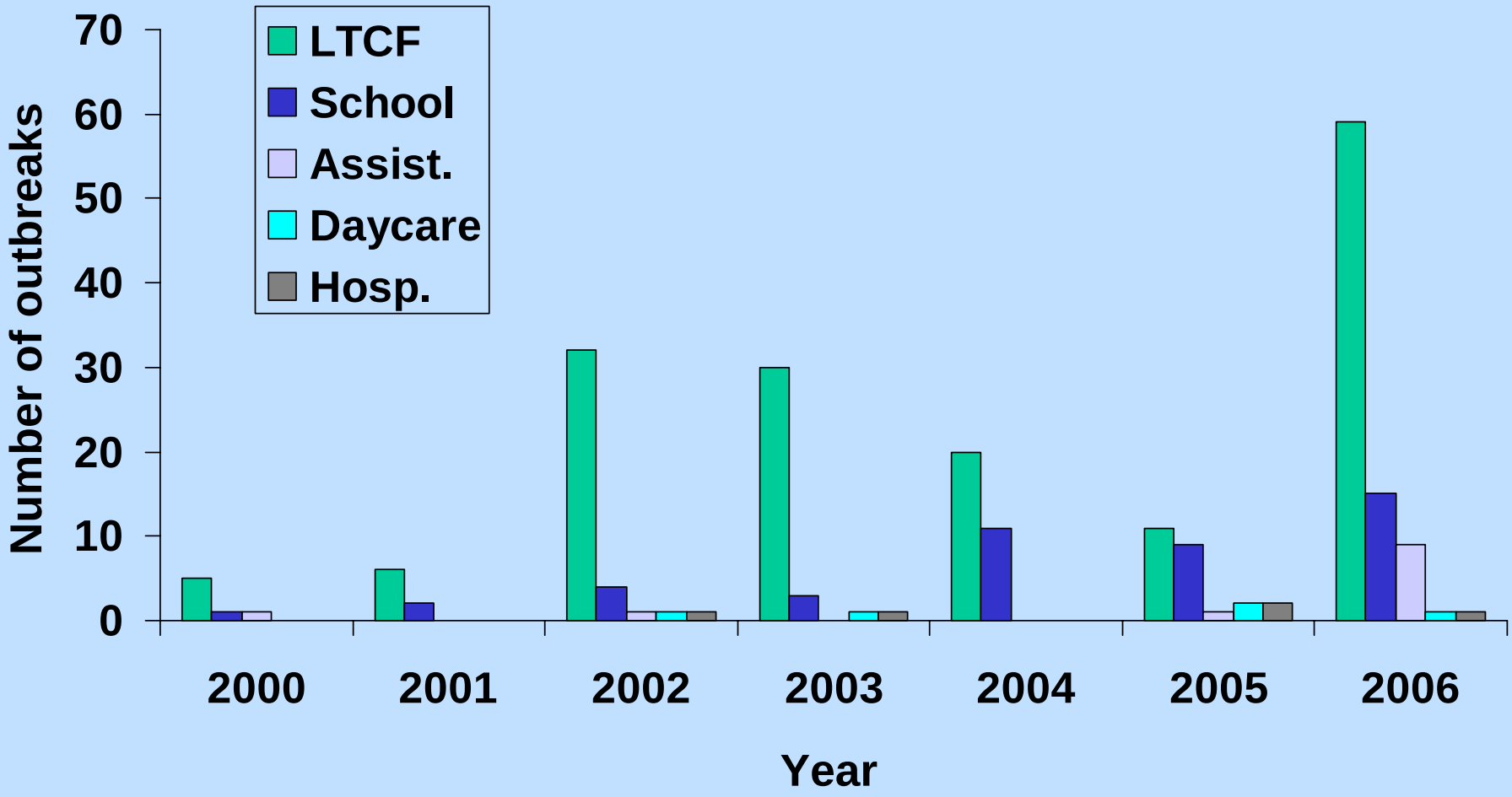
Cannon et al., 2006 J. food Prot.

CDC

Norovirus in Long-Term Care Facilities (LTCF)

- Majority of gastroenteritis outbreaks in LTCF are due to norovirus
- Usually person-to-person spread
- Some food-related outbreaks have been traced to ill food service employees
- Spread may be amplified by ill employees, e.g., aides passing medications
- Winter seasonality

Non-foodborne Norovirus Outbreaks in Institutional Settings, Minnesota, 2000-2006



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Protecting, maintaining and improving the health of all Minnesotans.

Checklist for Nursing Homes/Long Term Care Facilities when Outbreaks of Gastroenteritis are Suspected

Question - How do you know if there might be an outbreak of gastroenteritis at your facility?

Answer - Outbreaks can generally be defined as an increase in illness above the expected, or "normal" rate. For general surveillance purposes, you should establish a baseline rate for illnesses characterized by vomiting and/or diarrhea. Once you have a baseline established, it should be readily apparent when a sizeable increase in illness occurs. If you think there might be an outbreak, but you're not sure, please have a low threshold in contacting public health authorities for advice.

Question - Whom should I call when there is (or I think there might be) an outbreak of gastrointestinal illness in my facility?

Answer – You have a couple of options. Call your local (i.e., city or county) health department, or call the Minnesota Department of Health (MDH) at 651-201-5414. If called, MDH will relay the necessary information to the appropriate local health authorities.

When an outbreak is suspected, the following checklist of actions need to be completed:

1. **Gather information to characterize the outbreak – provide as much of the following as possible:**

   A. Number of residents and staff ill with vomiting or diarrhea.
      - For *residents*, provide this information by room number and floor (or wing, if applicable)
      - For *staff*, provide this information by work station, including floor and/or wing

   B. Number of residents and staff in facility.
      - provide this information by floor and/or wing

   C. Date of onset of symptoms for each ill individual.

   D. Type of symptoms for each ill individual. When combining data from all ill individuals, be able to provide:
      - % of individuals that have had vomiting
      - % of individuals that have had diarrhea
      - % of individuals with diarrhea that have bloody diarrhea
      - % of individuals with fever, including the highest temperature recorded for each individual with fever
      - average duration of illness (and range of duration, e.g., shortest to longest)

   E. A list of food service staff (those who have been ill, and those who have not).

F. Document special meals/patient feeding, extracurricular activities, clubs, special events that were held during the 2 weeks prior to the first illnesses (including birthday or holiday treats distributed to individual floors/wings).

G. When specifically requested, a dietary menu (breakfast, lunch and dinner) for the 2 weeks prior to the first illness.

H. If further investigation is deemed necessary, it likely will involve contacting ill and well residents and staff to determine specific sources of illness. To do this, the health department will need a roster of all residents and staff, including home and work telephone numbers.

2. **In conjunction with the cooperating health department, implement interim outbreak control measures while the investigation is ongoing:**

   A. Restrict ill employees (including volunteer workers) from patient care and food handling duties for 72 hours *after* their vomiting/diarrhea has ended. Food service staff should not handle food if they have been recently ill with any gastrointestinal symptoms until they can be interviewed or further evaluated by public health professionals.

   B. Consideration should be given to separating ill residents and staff from those who have not experienced illness as well as restricting access to rooms with ill residents. In large outbreaks, consideration should also be given to halting new admissions until the outbreak has ended.

   C. Stop using self-service food bars and don't let residents/staff serve themselves in any manner which might promote direct hand contact with shared foods (including self-service foods using tongs or other serving utensils). Eliminate common events such as birthday, holiday, and special celebrations until the conclusion of the outbreak.

   D. Redouble efforts to promote hand hygiene. Educate residents, staff, and visitors on proper technique and promote handwashing prior to patient contact, snacks, and meals. Alcohol-based hand rubs (gel or foam) used in conjunction with proper handwashing may provide additional protection. However, the rubs are not considered a substitute for proper handwashing.

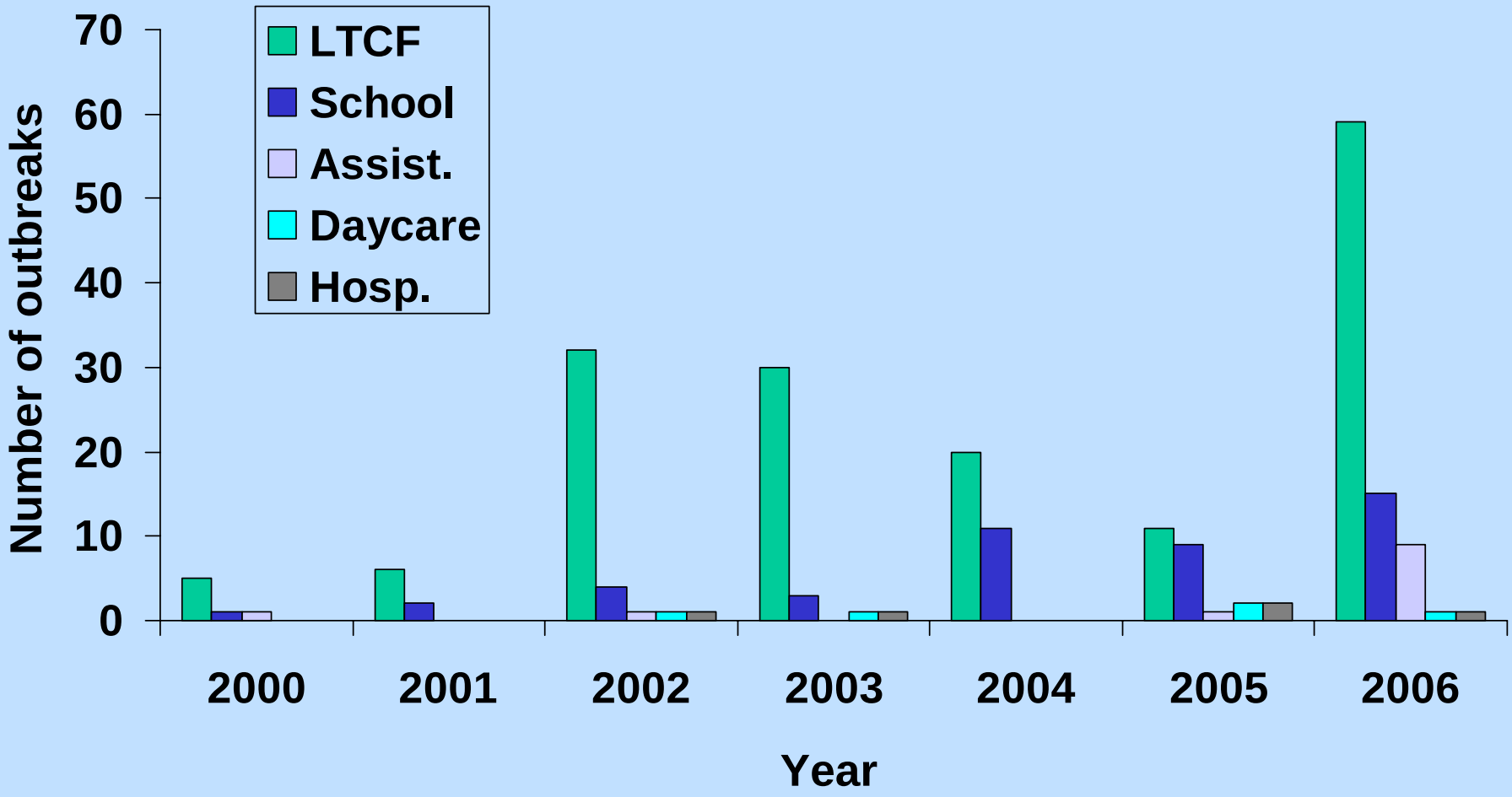
   E. Restrict sharing of communal food/snack items and foods brought from home.

   F. Environmental surfaces, especially areas where residents and staff have become ill, and common areas such as restrooms, handrails, and dining facilities, should be thoroughly cleaned and sanitized. Staff members with these duties should pay particular attention to their hygiene so they do not become ill.

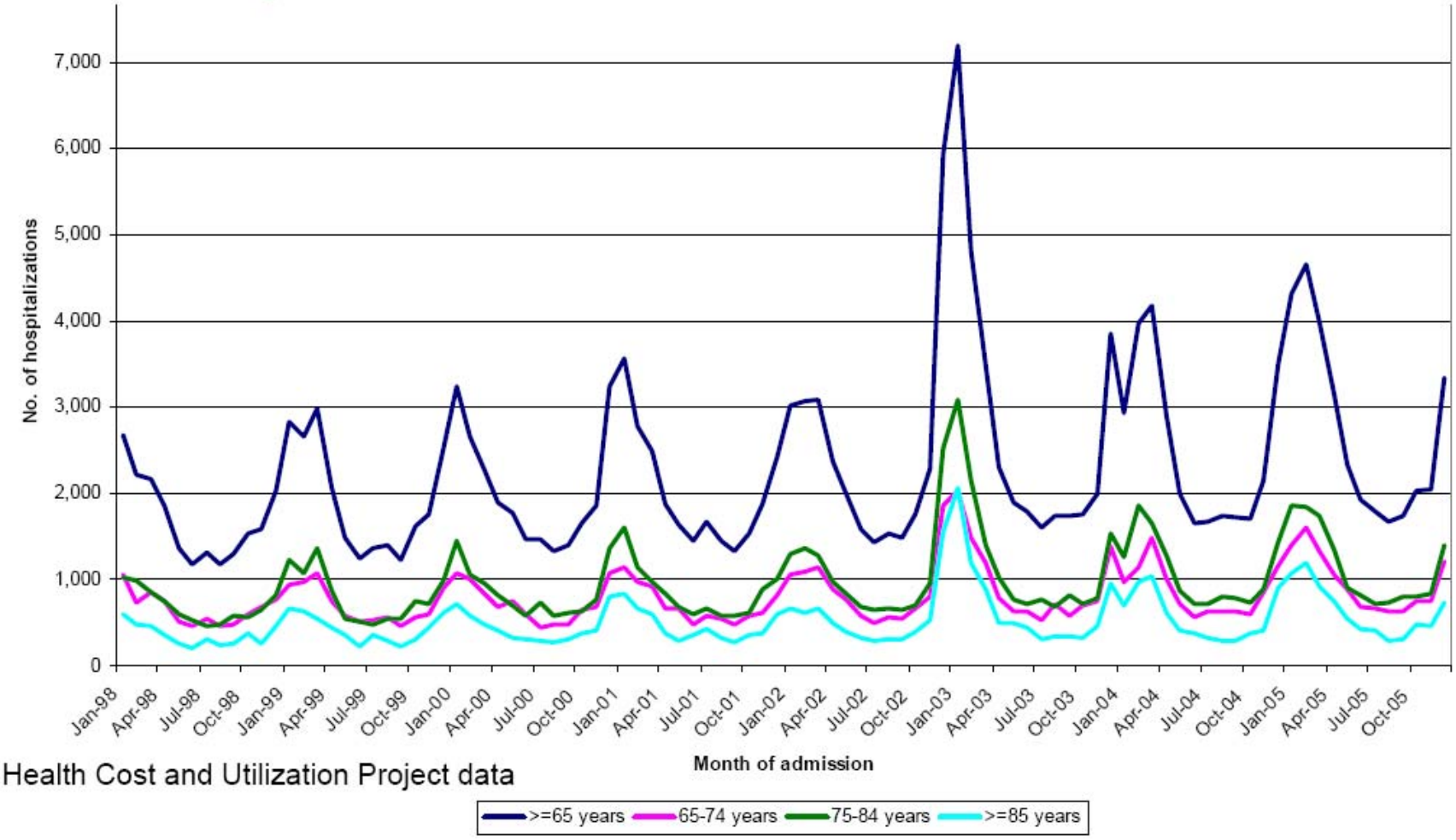
3. **Obtain clinical specimens.**

   Stool specimens should be collected from up to three recently ill individuals. Your local health department and the Minnesota Department of Health will provide collection kits and testing of these specimens.

Non-foodborne Norovirus Outbreaks in Institutional Settings, Minnesota, 2000-2006



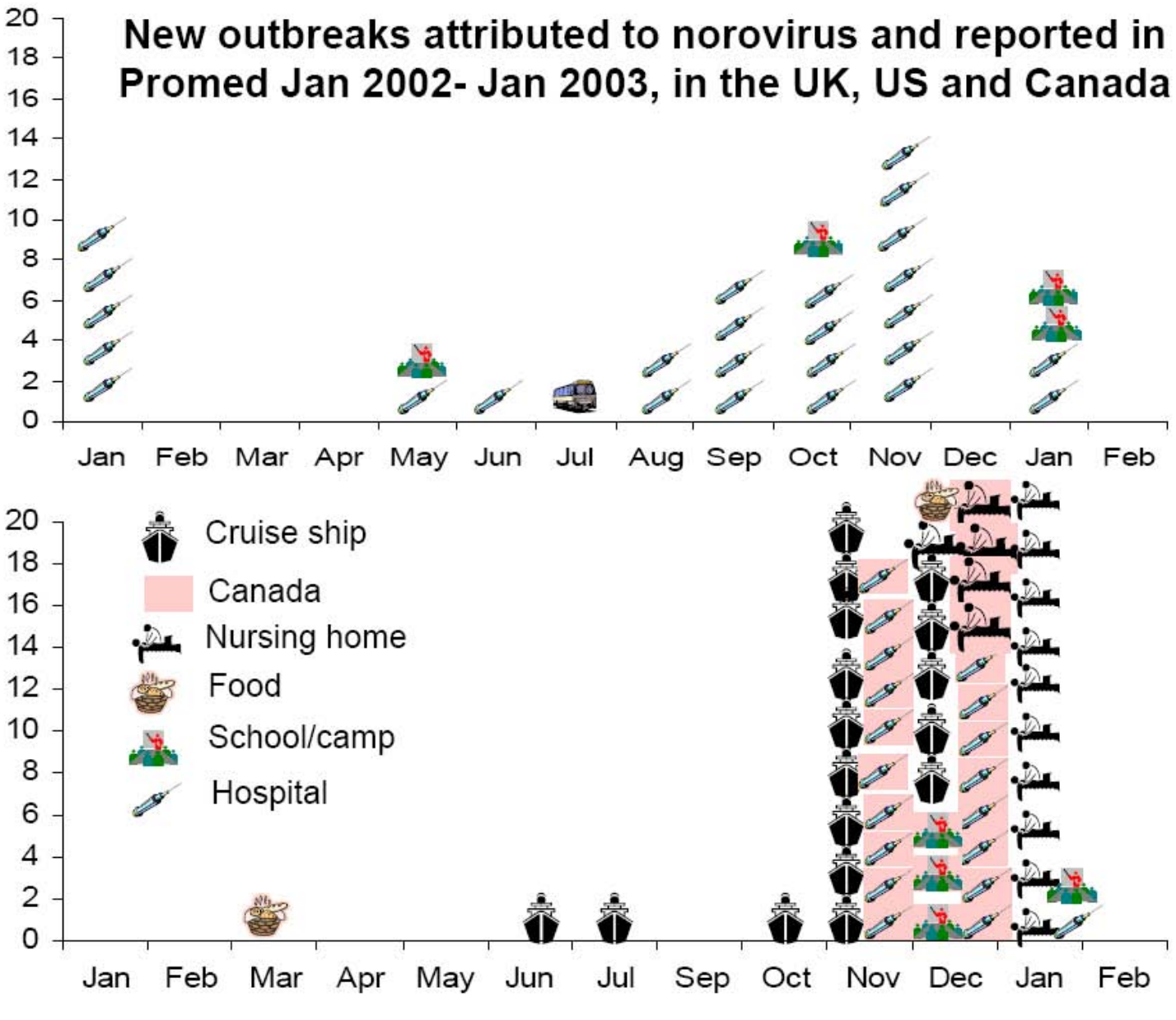
Gastroenteritis hospitalizations among persons >65 years coded as "viral" from 1999 to 2005



Health Cost and Utilization Project data

UK

North America



Hospital Outbreaks in U.S.

- Survey of 163 hospitals in Georgia,
  - Jan 2002 - July 2004
- 55 respondents reported 11 outbreaks
- 3 outbreaks confirmed/suspected norovirus

Characteristics of GI Outbreaks

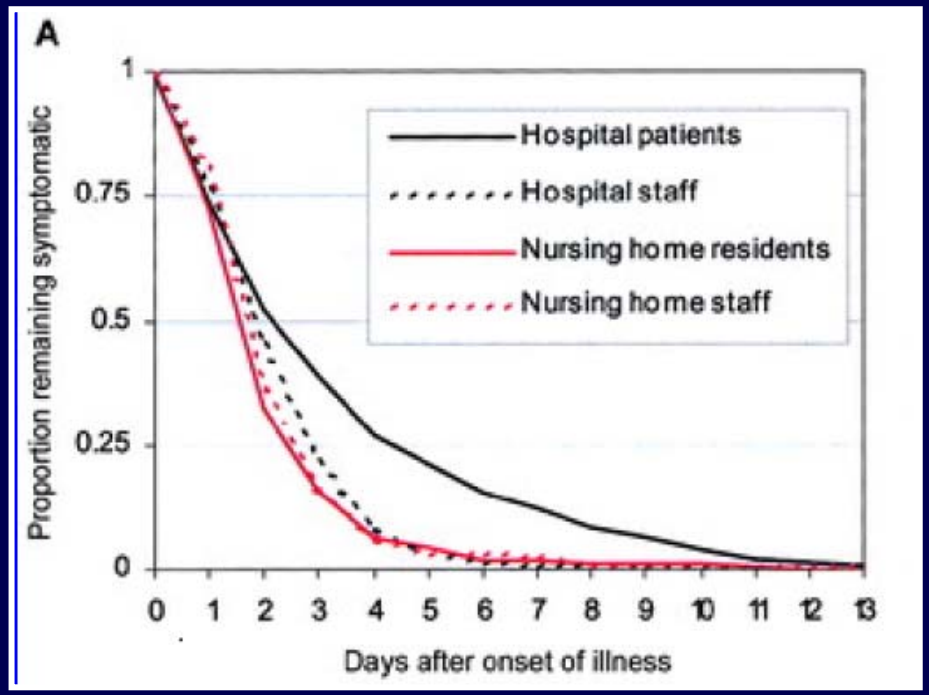
Etiologic Agent	Mean Number Affected		Average Duration of Outbreak
	Patients	Staff	
Clostridium difficile n=5	5	0	7-14 days
Rotavirus n=3	5.7	Unknown	>15 days
Norovirus n=1	7	42	≥ 29 days
Suspected Norovirus n=2	10.5	28	15-28 days

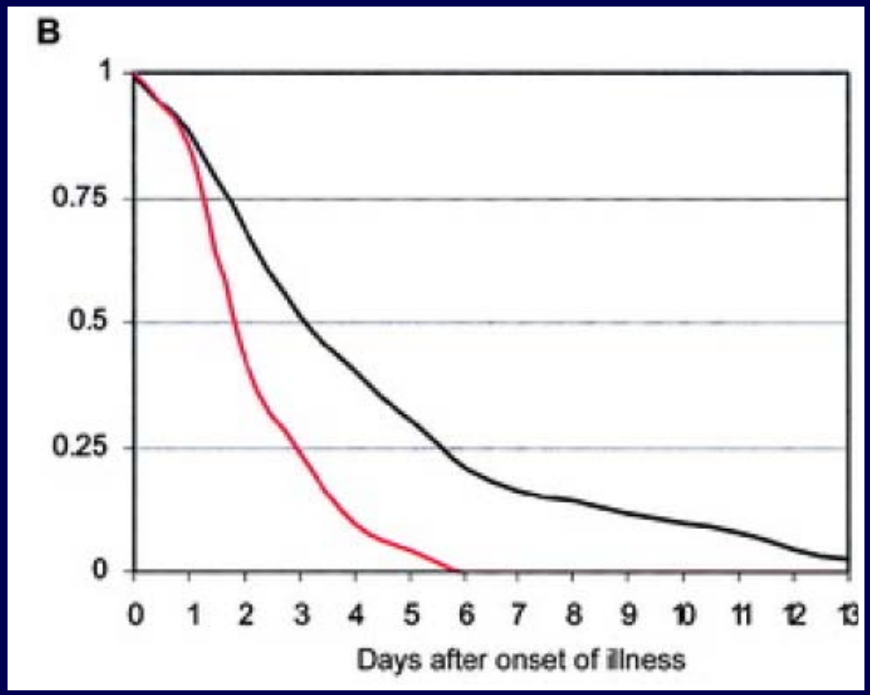
Lau et al: CDC unpub data

Consequences of Outbreaks

Etiologic Agent	Ward/Unit Closure	Staff Sick Leave	Relocation of Case-Patients	Patient Discharge Delays
Clostridium difficile n=5	0 (0%)	0 (0%)	3 (60%)	3 (60%)
Rotavirus n=3	0 (0%)	2 (66%)	0 (0%)	3 (100%)
Norovirus n=1	0 (0%)	1 (100%)	0 (0%)	1 (100%)
Suspected Norovirus n=2	1 (50%)	2 (100%)	1 (50%)	2 (100%)

Duration of Norovirus Illness among Staff, Patients and Residents of Hospitals and Resident Homes





Lopman et al CID 2005

Disinfectants

- Human noroviruses not culturable yet
- Surrogate to date: feline calicivirus (FCV)
  - 32 disinfectants with EPA-approved claim against FCV (List G*) including chlorine, peroxides, phenols and quaternary compounds
- Difference in ‘ecological niche’ more important than phylogenic relationship?
  - E.g., differences in lability to acid
  - Rhinoviruses and enteroviruses (e.g., polio)

* http://www.epa.gov/oppad001/list_g_norovirus.pdf

Norovirus – Surface Decontamination with Chlorine Bleach

- 200 ppm for stainless steel, food/mouth contact items, toys
  - 1 tablespoon bleach / gallon water
- 1,000 ppm for non-porous surfaces, tile floors, counter-tops, sinks, toilets
  - 1/3 cup bleach / gallon water
- 5,000 ppm for porous surfaces, wooden floors
  - 1 & 2/3 cup bleach / gallon water

Norovirus – Surface Decontamination other Disinfectants

- Glutaraldehyde (0.5%)
- Iodine (0.8%)
- Accelerated peroxide compounds

  (15% peroxyaceteic acid and 11% hydrogen peroxide)
- Phenolics (eg., Lysol, Pinesol)
  - 2-4x concentration over manufacturer's recommendation
  - Caution!!
- Quaternary ammonia with alcohols

Norovirus Disinfection

- Clean soil before disinfection
- Use fresh solution - especially for bleach: daily
- Disinfection ‘everywhere’
- Use clean materials or will spread virus

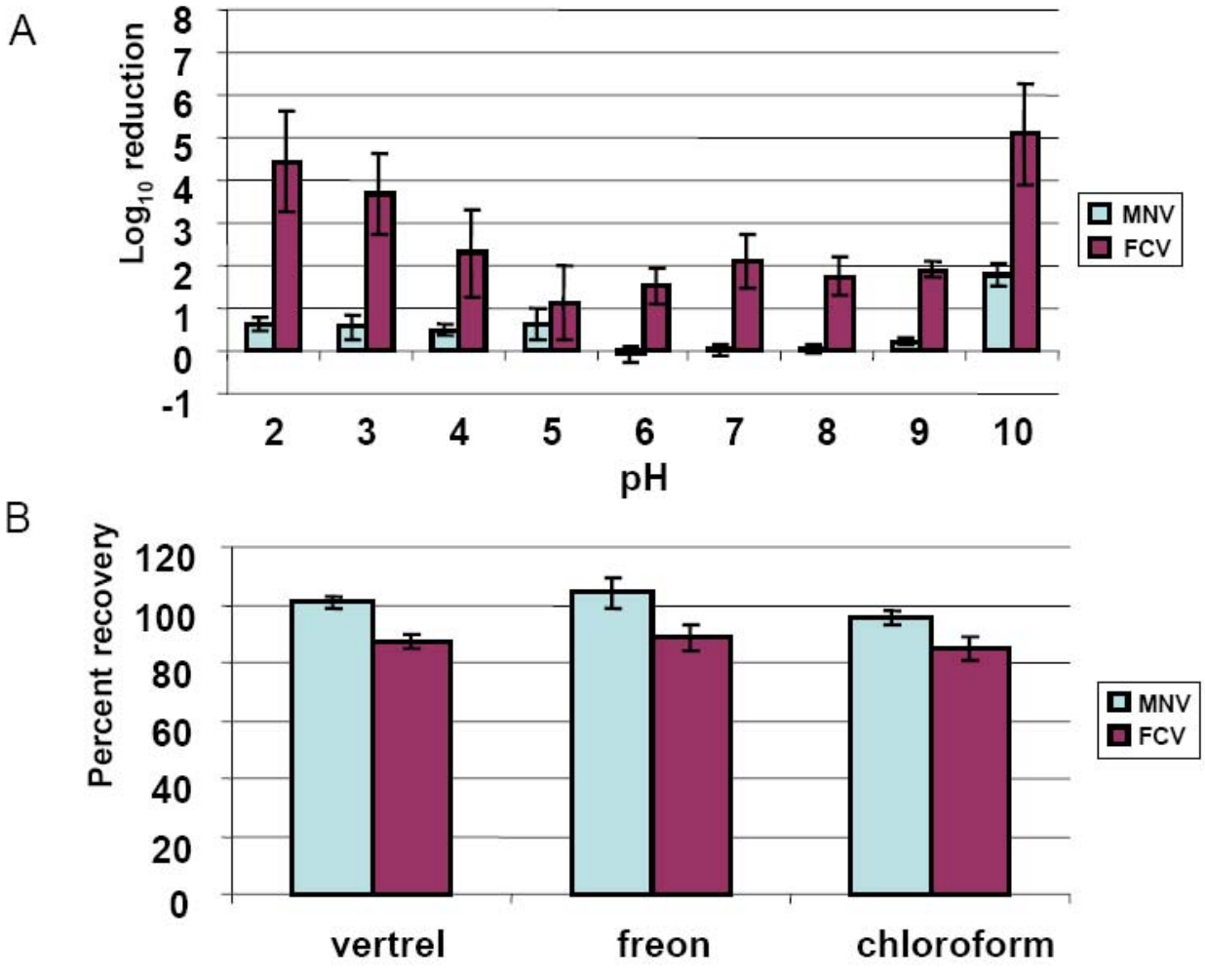
Norovirus Disinfection

- For bleach:
  - 5000 ppm bleach for suspect case or in outbreak
    - Concentrate on high contact surfaces, bathrooms, soiled areas
  - 1000 ppm for more widespread use in ward
  - Leave on to dry (care with 5000 ppm may leave irritant residue?)
- Use EPA disinfectants for now

Comparison of Members of Two Human Genera of Picornavirus Family

- **Rhinovirus**
  - Acid instable
  - Heat resistant
  - 60% ethanol - >3 log reduction
- **Poliovirus**
  - Acid stable
  - Not heat resistant
  - 70% ethanol - 1.6 log reduction

Survival of MNV and FCV at different pH and organic solvents



Cannon et al., 2006 J. food Prot.

Comparisons of the efficacy of commercial surface disinfectants against MNV and FCV

Active ingredients	Contact time (min)	Reductions in virus titer ^{10}log			
		MNV		FCV	
		Q-RT-PCR	Infectivity assay	Q-RT-PCR	Infectivity assay
Sodium hypochlorite (1000 ppm)[a]	10	0[b]	0.5	0[b]	1.5
Sodium hypochlorite (5000 ppm)[a]	3	1[b]	2.6	1[b]	4.6
Phenol groups	10	0	0	1.27	> 4.6
Quaternary Ammonium Compounds	10	0	0	1.08	> 4.6
Hydrogen peroxide	10	ND	0	3.71	> 4.6

a: Carrier test, 10% stool suspension as organic loads, Park et al ASM 2005
b: end point dilution assay using conventional RT-PCR

Park, Barclay and Vinjé et al ICEID 2008

CDC

Comparison of the efficacy of commercial hand sanitizers against MNV and FCV

Active ingredients	Contact time (min)	Reductions in infectivity titer			
		MNV		FCV	
		Q-RT-PCR	Infectivity assay	Q-RT-PCR	Infectivity assay
Alcohol groups (60-70%)	10	2.87	> 3.5	0	0
	10	0.45	3.5	0	0.4
	10	0.11	> 2.4	0	>3.4
	10	2.76	2.8	0	0.19
Triclosan	5	1.22	> 3.4	>3.4	> 4.4
	5	0.17	0.2	0.1	> 4.4
Chlorhexidine	10	0.41	0	0.25	0

Park, Barclay and Vinjé et al ICEID 2008

CDC

Comparisons of the efficacy of commercial hand sanitizers/surface disinfectants against MNV and FCV

Active ingredients	Contact time (Min)	Reductions in infectivity titer (Log_{10} PFU/ml)	
		MNV	FCV
$HClO_2$ (1000 ppm)[a]	1 min	Not done	5
$HClO_2$ (5000 ppm)[b]	3 min	2.6	4.6
Phenol groups	5 min	0	> 4.6
Quaternary Ammonium Compounds (QAC)	5 min	0	> 4.6
Hydrogen peroxide	5 min	0	> 4.6
Alchohols, product A	5 min	> 3.5	0
Alchohols, product B	5 min	3.5	0.4
Alchohols, product C	5 min	> 2.4	>3.4
Alchohols, product D	5 min	2.8	0.19
Triclosan	5 min	> 3.4	> 4.4
Chlorhexidine	5 min	0	0

[a] Doultree et al. J Hosp Infect 1999
[b] Carrier test, 10% stool suspension as organic loads, Park et al. ASM 2005
[c] Park et al. unpublished data

CDC

Handwashing

- Alcohols may have virucidal activity against non-enveloped viruses*
  - Exact efficacy even for FCV remains unclear
  - 70% vs. 90% alcohol?
  - Ethanol vs. isopropanol?
  - Effect of organic load very important#
- OK for prevention
  - Additional soap/water handwashing in outbreaks?
- Similar guidelines for *C. difficile* - importance of consistency

* APIC Guidelines for Hand Hygiene in Health-Care Settings, 2002

Kampf et al, J Hosp Inf, 2005

Factors to Consider in Control of Norovirus Outbreaks

- 25% of cases shed virus 3 weeks post recovery*
- Resistant to common disinfectants…?
- Widespread and persistent environmental contamination
- Very low infectious dose (10 viral particles?)
- Staff infected and contagious
- Up to 30% asymptomatic infections - contagious?
- Constant introduction

* Rockx, CID, 2003

Control of Norovirus Outbreaks (CDC)

- Cohort patients
  - Dedicated bathrooms, facilities, medical equipment
  - Separate airspace
- Furlough staff
  - While symptomatic PLUS
  - For 24 h after recovery as per FDA Food Code?
  - Cohort to sick patients or positions with no patient contact

Chadwick et al, J Hosp Infect 2000

Control of Norovirus Outbreaks (CDC) (cont.)

- Restrict movements of staff and visitors
- Close ward/hospital
  - How long?

Chadwick et al, J Hosp Infect 2000

Norovirus and Foodborne Disease

- In virtually every foodborne disease outbreak, the cause is passage of fecal particles from the hands of a foodhandler to ready-to-eat foods because they didn't wash their hands as well as they should have (if at all).
  - usually, this person is or has recently been ill
    - may transfer from ill household member

Controlling Norovirus

- **MEANS PREVENTING TRANSFER OF VIRUS**
- **Handwashing!**
- **Prohibiting bare-hand contact with RTE food items**
- **Removing food workers with active vomiting and/or diarrhea**
- **Restricting recently ill foodworkers (for 72 hours after symptoms subside)**
- **Sanitizing**

Handwashing

- **Every step of handwashing is important!**
- **Scrubbing with soap = 1 log virus reduction**
- **Rinsing under strong velocity and volume of water = increased effect in physically removing virus**
- **Drying hands with paper towels = 1 log virus reduction**

You Can Help Prevent These Outbreaks!

"Well, as we thought, it's something gross."

- **The key to implementing a solid employee health program is communication.**
- **Talk to foodworkers about the hazards of vomiting and diarrhea.**
- **Work as a team to find innovative ways to keep ill foodworkers out of the restaurant.**

You Can Help Prevent These Outbreaks!

- **Inform foodworkers that they MUST report GI symptoms to the PIC.**
- **Educate foodworkers about the need to:**
  - **Report GI symptoms to the PIC**
  - **Comply with strict handwashing requirements**
  - **Comply with the no-bare hand contact requirements**
- **Use teachable moments to communicate key facts about handwashing, illness, foodsafety**

You Can Help Prevent These Outbreaks!

- **Foodworkers reporting vomiting and/or diarrhea should be sent home immediately:**
  - **Exclude ill employees for 72 hours after symptoms resolve**
- **Consider restricting foodworkers with ill household members until household member symptoms resolve**

Norovirus – Prevention Plan for Health Care Facilities

- **Educate staff at start of high risk season**
  - **November - December generally a good timeframe**
  - **form/review policies for handling individual sick employees**
  - **review policies for handling sick in-patients/residents**
  - **form/review policies for handling in-patients/residents and staff in outbreak situations**

Norovirus – Prevention Plan for Health Care Facilities

- Education of staff
  - "stomach flu" during November-March likely = norovirus
  - Stay home from work while ill, even if relatively mild
  - Can pass to others for several days, maybe longer, after symptoms resolve
  - When return to work, increased attention to handwashing critical
- Redouble infection control measures and disinfection practices

Norovirus – Prevention Plan for Health Care Facilities

- At start of apparent outbreak
  - Call public health!
  - Screen/educate employees regarding illness
    - Exclude/restrict as practical
      - 72 hours after symptom resolution
  - Evaluate food service workers
    - If they weren't the source, could amplify outbreak greatly if affected
  - Avoid shared/communal food, food brought from home, any self service-type set-ups

Norovirus – Prevention Plan for Health Care Facilities

- **Be aggressive**
  - **Try to prevent outbreak**
  - **If outbreak starts, do everything you can to try to nip it in the bud**

Acknowledgement

- Marc-Alain Widdowson, PhD
  - Centers for Disease Control and Prevention
    - Viral gastroenteritis team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Norwalk Virus Hits Minnesota
State health officials say there have been at least 25 large outbreaks of illness, afflicting more than 1,000 people, in Minnesota attributed to Norwalk-like viruses since November first. The illness, part of a class of diseases called gastroenteritis, causes intense vomiting, cramps and diarrhea — usually for one or two ...
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