Norovirus Outbreaks
Issues and Interventions

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Today’s Presentation

• Norovirus (NoV) Biology
• NoV Epidemiology
• Clinical Features
• Why are NoV outbreaks such a problem in healthcare settings?
• Cruise Ship issues
• “Controlling” Healthcare NoV Outbreaks
• What can we do to prevent NoV outbreaks?

NoV Biology

• 1968 Gastroenteritis in school children Norwalk, Ohio
• 1971 Cell free filtrates reproduce disease in prisoners
• Hundreds of strains
• Human infection only

What NoV really looks like

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Or...maybe more like this...

NoV Epidemiology (General)

- Continuously evolving strains
  Error prone RNA
  Recombination between strains
- Influenza - like worldwide
- Fluctuations in disease due to major (2-4 yrs. and minor (continuous) changes in antigenic structure
- Some winter peaks in temperate climates

NoV Epidemiology – Sporadic Cases

- Rarely a true “foodborne illness”
- Virus does not live in food
- Most cases – Fresh foods served uncooked contaminated by food handlers whose hands are contaminated by NoV due to symptomatic or asymptomatic infection
- Exceptions: Shell fish or drinking water contaminated by sewage

NoV Epidemiology – Sporadic Cases

The key reason food gets contaminated

What’s wrong in this Picture?

Susceptibility to NoV Infection

- Immunity and histo-blood group antigens play a role
- Very young, very old and chronically ill people are more susceptible to infection
- Travelers – New strain exposure
- Immunity is short lived

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NoV Infection
- Infective dose – < 10 viral particles
- Incubation period – 10-51 hours
- Shedding precedes illness in 30% of cases
- Asymptomatic shedding continues for weeks in children and months in some patients

NoV Clinical Features
- Nausea/vomiting – often first symptom
  - Vomiting = ALARM SYMPTOM (in outbreak settings)
- Cramps and diarrhea – no blood, no WBC
- Onset often explosive
- Often quite severe
- Fever in ½
- Duration
  - Healthy patients – 2-3 d
  - Chronically ill and elderly – 4-6 d

NoV Epidemiology – Outbreaks
- Hospitals
- Extended Care Facilities
- Cruise Ships
- Schools
- Day Care Centers
- Restaurants
- Hotels
- Concert Halls
- Military instillations

NoV Clinical Features
Complications:
- Necrotizing enterocolitis – infants
- Seizures in children – Japan
- Chronic colitis in immunosuppressed hosts
- Mortality – well recognized but host dependent
Cruise Ships and NoV

First outbreaks in the 1950s
- CDC involvement = >2% with GI illness
- 10 – 20 Outbreaks on U.S. vessels / yr.
- > 20% are serially recurrent on the same vessel
- Passengers continue to be blamed

Clinical Infectious Diseases November 2009

42 Healthcare workers going on a cruise vacation agreed to evaluate daily thoroughness of public restroom disinfection cleaning.
Six objects were covertly marked and evaluated daily for five days in 273 restrooms reflecting 32% of all US cruise ships.

Thoroughness of Cleaning by Cruise Line

Daily cleaning of surfaces in public restrooms on 56 cruise ships

19 Objects on 13 ships were not cleaned for 7 days

Thoroughness of Cleaning and NoV Outbreaks

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Industry Response
CLIA Press release 11/4/09

“We have limited knowledge of the study’s methodology and we are unable to reconcile its conclusions with the industry’s rigorous public health and sanitation procedures and with the excellent vessel sanitation scores our lines receive from the CDC. We have reached out to the authors to learn more about how the study was done....”

Serendipity happens only if you are there for it

Caribbean Cruise March 2010

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Why are NoV outbreaks such a problem in healthcare settings?

- 10. New strains continuously evolving
- 9. No long-term immunity
- 8. No vaccine
- 7. HCW spread – one to many
- 6. Shedding precedes illness
- 5. Extended shedding
- 4. ABHR have limited impact
- 3. Disinfection issues
- 2. Infective dose extremely small
- 1. Environmental survival

“Controlling” Healthcare NoV Outbreaks

PROBLEM
No evidence based intervention has yet been shown to be effective

What about bleach?

Much more potent in lab than other disinfectants against NoV
Several studies have shown slight clinical impact (in comparison to discordant controls)
No studies have evaluated confounders – For example -
Prevalence density
Intensity and thoroughness of cleaning while using bleach has never been evaluated.
For example:
- If thoroughness of cleaning is at 30% and does not change will you see an impact of bleach?
- If thoroughness of cleaning is at 30% and increases to 80% when bleach implemented and NoV in the environment significantly decreased … was it the bleach? Was it the improved cleaning? Was it both?
Outbreaks are outbreaks and by definition are finite.

What about bleach?

Intensity and thoroughness of cleaning while using bleach has never been evaluated.
For example:
A. If thoroughness of cleaning is at 30% and does not change will you see an impact of bleach?
B. If thoroughness of cleaning is at 30% and increases to 80% when bleach implemented and NoV in the environment significantly decreased … was it the bleach? Was it the improved cleaning? Was it both?
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“Controlling” Healthcare NoV Outbreaks

High index of suspicion
Reminders to HCW when outbreaks in community
(Rapid Testing) – Soon
Cohorting ill patients
Personnel control
- Remain out of work if ill + 72 hours
- Need strong administrative support
Return to work 48 hours? 72 hours? More?
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“Controlling” Healthcare NoV Outbreaks
- Soap and water H.H. – Clearly better than ABHR
- Glove use for all patient contact during outbreak?
- Mobile and shared fomite control
- Close to admissions or isolate new admissions?
- Restrict Patient movement?
- Environmental cleaning
- - Disinfectant – bleach recommended. Other?
- Focus on major fomites (forget the clocks)

Are gloves the answer?

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Nice for the HCW…..But

Secondary transfer:
4/10 doorknobs
5/10 Telephone receivers
3/10 Sinks

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What’s wrong with this picture?

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“Controlling” Healthcare NoV Outbreaks

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What can we do to prevent NoV outbreaks?

The Problem
NoV infections “happen”
No vaccine
No early diagnosis (yet)
No confirmed means to “control” an outbreak once recognized

Any Ideas???

Head for the Moon?

How about Mars?

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If these are not attractive options… we have no choice but to….

Control the Amplifier

Control the Amplifier
Optimizing Environmental Hygienic Practice

In general most hospitals and other healthcare settings are not well cleaned

Improve Cleaning of the Environment Surrounding Patients in 36 Acute Care Hospitals

RESULTS

DAZO Solution (AKA – Goo)

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Baseline Environmental Evaluation of 36 Acute Care Hospitals

PROPORTION OF OBJECTS CLEANED AS PART OF TERMINAL ROOM CLEANING IN 20 ACUTE CARE HOSPITALS

Thoroughness of Environmental Cleaning

Cleaning House: A New Metric in the Objective Evaluation of Environmental Cleaning

Approaches to Programmatic Environmental Cleaning Monitoring

Conventional Program
- Subjective visual assessment
- Deficiency oriented
- Episodic evaluation
- Problem detection feedback
- Open definition of correctable interventions

Enhanced Program
- Objective quantitative assessment
- Performance oriented
- Ongoing cyclic monitoring
- Objective performance feedback
- Goal oriented structured Process Improvement model

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### Approaches to Programmatic Environmental Cleaning Monitoring

#### Conventional Program

- **Advantages**
  - An established model
  - Direct evaluation of practice
  - Uses a standardized, consistent, objective and uniform system of monitoring
  - Provides regular and ongoing performance results to ES staff
  - Facilitates the monitoring of many data points to optimize performance
  - Provides positive practice feedback to ES staff
  - Allows for objective remedial interventions
  - Facilitates compliance with JCAHO standards
  - Facilitates compliance with CMS CoP
  - Intrinsic benchmarking

- **Limitations**
  - Inability to evaluate actual practice
  - Based only on negative outcome analysis
  - Limited generalizability of findings
  - Poor specificity and low sensitivity
  - Intrinsically subjective with a high potential for observer bias
  - Poor programmatic specificity
  - Potential for observer bias
  - Only evaluates daily HP
  - Limited ability to demonstrate compliance with CMS CoP 482.42
  - Benchmarking not feasible

- **Conclusions**
  - It is very likely that surfaces in the Patient Zone are highly relevant in the transmission of Healthcare Associated Pathogens.
  - While optimizing hand hygiene and isolation practice are clearly important, there is no reason why the effectiveness and thoroughness of environmental hygienic cleaning should not also be optimized, particularly since such an intervention can be essentially resource neutral.

#### Enhanced Program

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  - Benchmarking reportable

- **Limitations**
  - Requires a new program implementation
  - Ongoing administrative support critical to success
  - Potential resistance to objective monitoring and reporting
  - While useful, the covert baseline evaluation may be difficult to implement effectively
  - Potential monitoring tool issues

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### Thanks for Attending!!

Questions – Comments?  pcarling@cchcs.org

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