

# Emergence of New Norovirus Variants on Spring Cruise Ships and Prediction of Winter Epidemics

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PH 253B

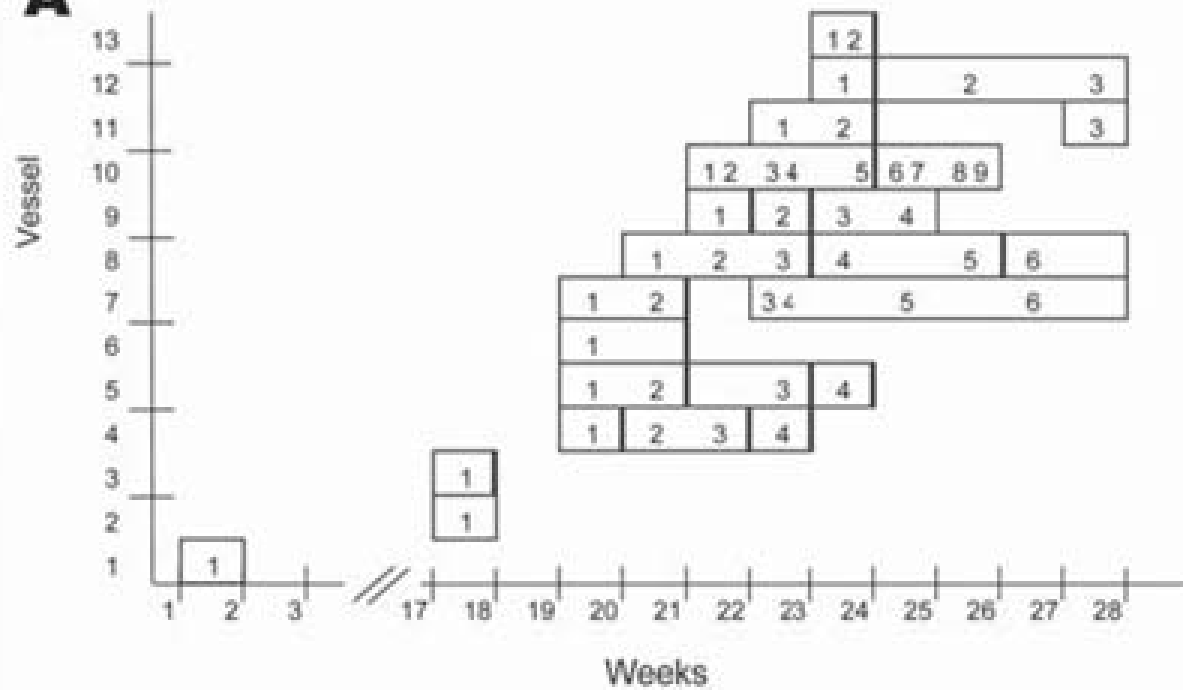
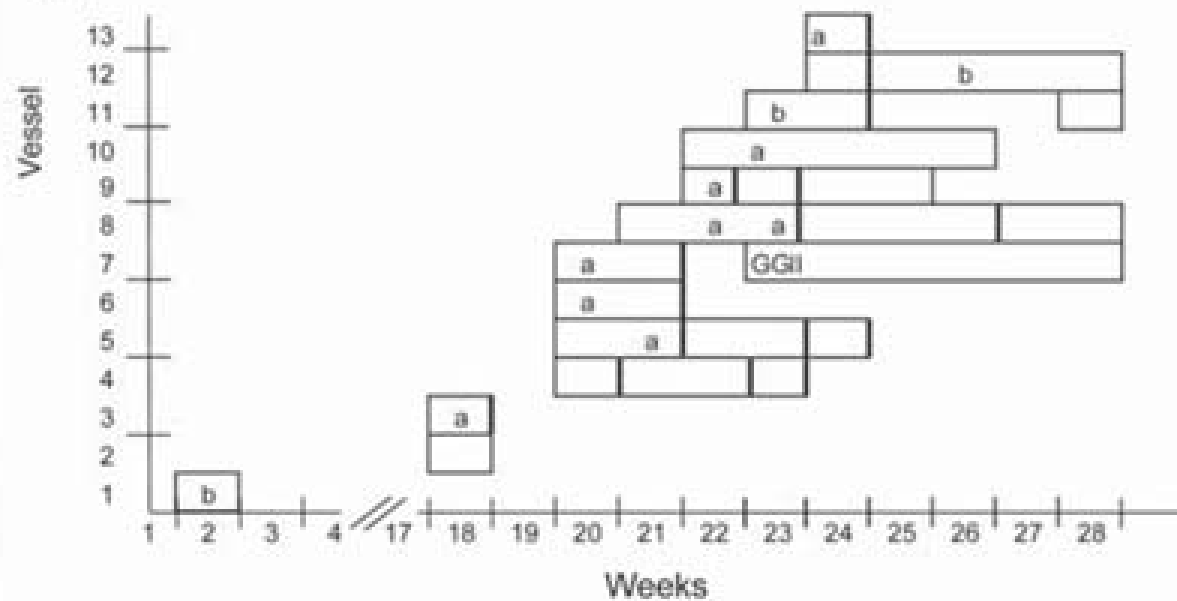
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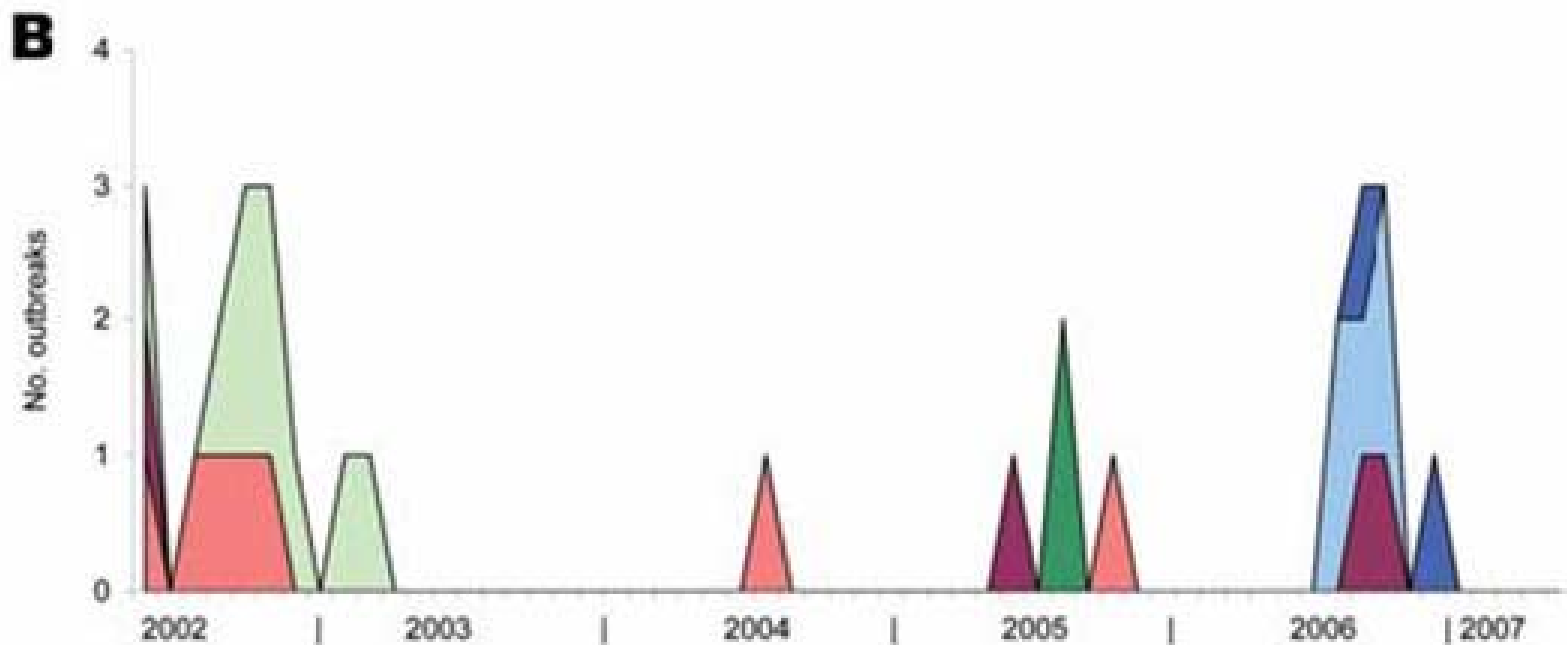
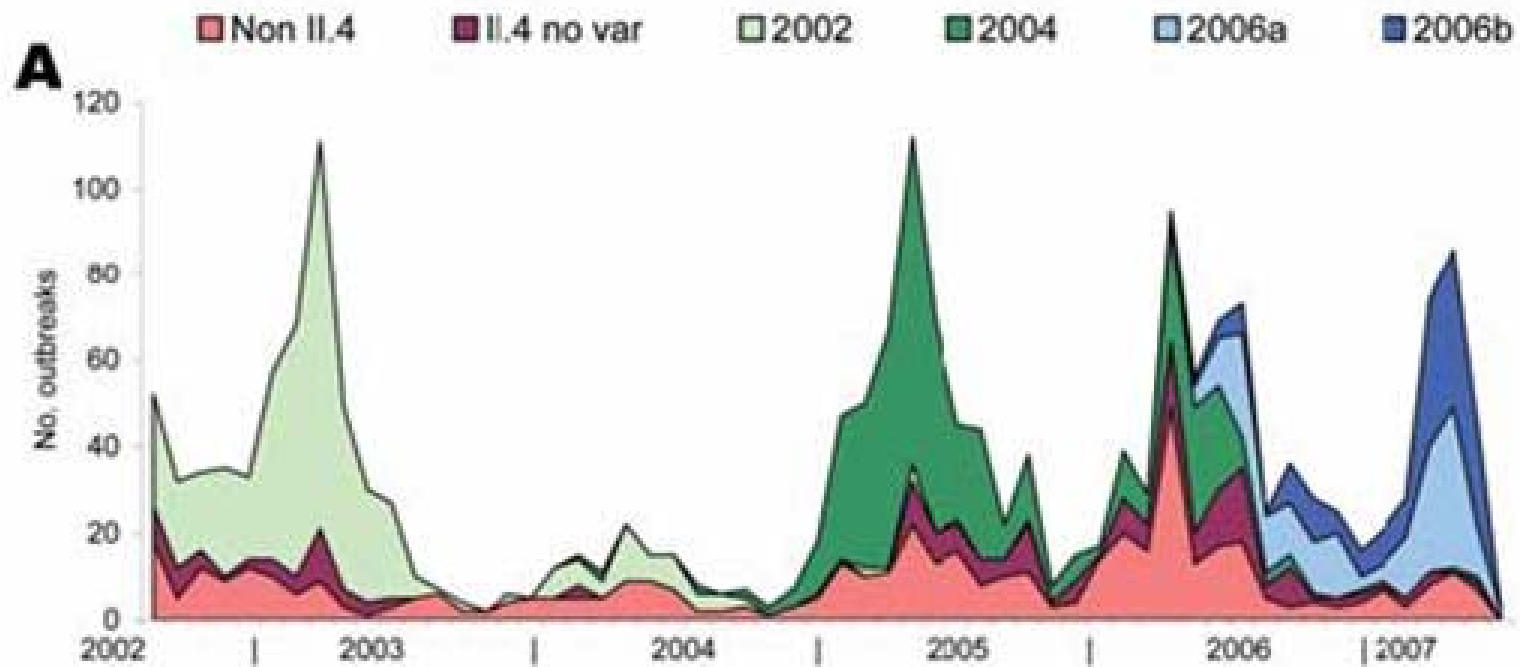
# Study Design

- In Europe, norovirus outbreaks are highly seasonal, occurring primarily from October through April.
- However, in June 2006, suspected norovirus outbreaks were reported on 3 cruise ships. The ECDC and the FBVE investigated to find a common source.
- Epidemiologic analysis used outbreak data from January 1, 2006 to August 1, 2006
- Study hypothesis = Rise in reported outbreaks was due to:
  - Reporting bias resulting from media attention and active investigation.
  - An actual increase specific for cruise ships by means of common source.
  - A reflection of actual increased norovirus activity in the community.

# Results

- 43 single outbreaks from 13 vessels.
- Possible risk factor: contact between boarding and disembarking passenger groups and cleaning with inappropriate materials for norovirus elimination during the first outbreak.
- A common food source could not be identified for all ships.
- Two distinct variants of the GGII.4 virus were found, named GGII.4-2006a and GGII.4-2006b.

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# Study Conclusions

- Reporting bias may be influencing the number of outbreaks reported.
- The increase in norovirus activity on the cruise ships was most likely due to an actual increase in norovirus activity in the community.
  - Probably related to the emergence of two new strains of the pathogen.
- Results could not find a point source or a common link through food or water.
- The frequency of summer cruise ship outbreaks can be used as a predictor for winter epidemics.

# Transmission Mechanisms

- Reservoir = humans
- Mode of transmission = fecally-contaminated food/water or person-to-person contact
- Portal of entry and exit = Gastrointestinal
- Norovirus infection is an example of colonization, disease, then elimination.
- Incubation time = 8-72 hours, contagious from the moment symptoms are apparent to up to two weeks after recovery.
- Symptoms only last for 2-3 days.

# Transmission Dynamics

- Because an index case was not identified, the reproductive number could not be calculated.
- The constant close-contact environment that exists in cruise ships increases the contact rate as well as the probability that a source is infectious.
- Attack rates for the crew were mostly lower than attack rates for passengers, which may have been due to short-term immunity. This serves to lower the pathogen's reproductive number over time.

# Transmission Containment

- Contact rate could be decreased by limiting social gatherings such as socials and dances.
- Transmission probability could be decreased through frequent hand-washing and avoiding touching mouth with hands.
- The probability that the source is infectious,  $P(t)$ , could be decreased by isolating cases when symptoms arise.

# Summary

- Norovirus is introduced into an environment from a food, water, or foreign person source and then subsequently spreads easily from person-to-person.
- Cruise ships and other semi-closed environments increase the transmission likelihood of norovirus.
- A surveillance system for cruise ship-related gastroenteritis outbreaks may function as an early warning system for high-epidemic winters.

Thank you.