

**Preliminary Guidelines for
the Prevention and Control of Influenza-Like Illness
Among Passengers and Crew Members
on Cruise Ships**

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Background

During the 1972 through 1993 influenza seasons in the United States, an average of 20,000 deaths and more than 100,000 hospitalizations each year resulted from complications of influenza infection.¹ Control of influenza in the general population is based on annual fall vaccination programs, along with education about disease risk reduction, and on administration of antiviral agents for treatment or prophylaxis. Special vaccination programs traditionally have targeted certain groups of individuals (e.g., those most likely to experience complications or to transmit influenza to persons at high risk for complications). However, influenza vaccination also may have substantial health-related and economic benefits for healthy, working adults.² In institutional settings or other semi-enclosed environments, these control measures are supplemented with surveillance activities, outbreak investigations, and monitoring the results of interventions.¹

Although influenza has been reported on cruise ships in the past, seldom have prospective control measures interrupting influenza transmission been reported.^{3,4,5} In late summer 1997, an influenza outbreak among elderly passengers at high risk for complications from influenza and crew members was investigated on board a cruise ship. Disease transmission was successfully interrupted by instituting surveillance, cohorting ill persons, vaccinating crew members, and initiating antiviral chemoprophylaxis of both crew members and passengers. Although this voyage took place in the northern hemisphere during the summer, influenza A likely was introduced on board the ship by travelers from the southern hemisphere, where influenza activity was in season. As service providers to passengers, crew members served as a reservoir for influenza infection and transmitted disease to passengers on subsequent cruises.⁶ In summer 1998, a large influenza A outbreak among travelers (including cruise ship passengers) and tourist industry workers occurred in Alaska and the Yukon Territory. Public health agencies identified the outbreak after they were alerted about increased respiratory illness and pneumonia activity by cruise line operators and by passengers who became ill after returning home. In contrast to the 1997 outbreak, it was not possible to control this outbreak because it had already become widespread among land and sea travelers. Cases of illness among tourists to Alaska abated only after the tourist season ended and tour operators and cruise ships left the region.^{7,8}

Such summertime outbreaks among travelers and crew members on cruise ships suggest that traveling in large groups may pose a risk for exposure to influenza viruses in regions of the world where influenza is not in seasonal circulation, particularly if the group contains travelers from areas of the world where influenza viruses are in seasonal circulation. Reported outbreaks highlight the need to develop criteria for determining when an outbreak is occurring and for effective surveillance protocols so that early, targeted prevention efforts may be instituted. Efforts aimed at prevention and control of respiratory diseases, in particular of influenza, among travelers and tourist industry workers should focus on key travel destinations that serve both as a conduit and gathering point for travelers, where disease amplification may occur. Cruise ships are an example of this type of unique environment.

The following preliminary guidelines for the prevention and control of influenza-like illness among passengers and crew members on cruise ships were developed by the Centers for Disease Control and Prevention based on many years of experience in controlling influenza outbreaks in nursing homes and on the experience with travel-related influenza outbreak investigations in 1997 and 1998. While more work is needed to determine the epidemiology of influenza among travelers, these preliminary guidelines are intended to provide a practical approach for influenza prevention and control measures on board cruise ships.

Surveillance, Prevention and Control of Influenza-Like Illness on Cruise Ships

General Considerations

1. Medical staff of cruise ships should routinely be educated about the clinical, diagnostic and treatment aspects of respiratory illnesses and their surveillance, prevention, and control, with particular focus on influenza and pneumonia.
2. A routine annual vaccination program for all crew members should be considered. Presently, no scientific data support or refute the usefulness of administering influenza vaccine more than once a year to healthy adults.
3. Medical staff on cruise ships with itineraries longer than 3 days should conduct passive year-round surveillance for respiratory illnesses among passengers and crew members. This type of surveillance, in which respiratory illness reports are not actively sought, should count the number of passengers and crew members presenting to the ship's infirmary with respiratory illness.
4. In the event of a respiratory illness outbreak, medical staff may not be able to rapidly obtain diagnostic testing kits and medical supplies, including antiviral agents (e.g., amantadine, rimantadine). Therefore, ships should be provisioned year-round with sufficient supplies to respond to an outbreak. All ships should regularly stock diagnostic supplies sufficient to test at least 50-100 persons for influenza (rapid viral antigen detection kits) and 20 persons for legionella (urine antigen testing).

Surveillance Characteristics (Appendices A and B)

1. Surveillance activities consist of the following components:
 - A. knowing who is providing data,
 - B. collecting and tabulating them,
 - C. analyzing and interpreting them, and
 - D. disseminating results to those who need to know so that appropriate action may be taken if necessary.
2. A single cruise line company medical surveillance coordinator, with assistance from other medical staff members, should be responsible for overseeing the ongoing surveillance program at the level of the cruise line company. The surveillance coordinator's name and contact information should be provided to and kept updated with the Division of Quarantine, CDC, at telephone (404) 639-8100. Also, a single medical staff member should be assigned to each ship to oversee each ship's surveillance program and report regularly to the company medical surveillance coordinator.

3. Current surveillance procedures for respiratory illness should be evaluated and, if necessary, updated to incorporate the following components:

A. Data collection and review

1. Surveillance data should be collected by using a standardized form during all commercial operating times.
2. Data that are collected should include, at a minimum: patient age and sex, onset date of respiratory symptoms, respiratory symptoms (cough, sore throat, fever or feverishness/chills), and results of diagnostic testing (e.g., rapid viral and bacterial tests, chest x-ray).
3. Data should be routinely reviewed to assess trends in disease frequency. Ships' medical officers should consider reviewing these data **at least** every 3 days.

B. Case definitions

1. Non-febrile acute respiratory illness (nfARI): cough or sore throat AND **no** measured fever $\geq 100.0^{\circ}\text{F}$ ($\geq 37.8^{\circ}\text{C}$) or self-reported feverishness/chills
2. Influenza-like illness (ILI): cough or sore throat AND measured fever $\geq 100.0^{\circ}\text{F}$ ($\geq 37.8^{\circ}\text{C}$) or self-reported feverishness/chills
3. Acute respiratory illness (ARI): cough or sore throat
4. Pneumonia
 - i. Suspect: cough or sore throat AND clinical signs of pneumonia
 - ii. Confirmed: cough or sore throat AND chest x-ray evidence of pneumonia

Note: ARI includes both nfARI and ILI case definitions.

Note: If a patient is taken off a ship because of pneumonia, the cruise line should follow up with the treating medical facility and should document the disease etiology in the ships' medical log and/or surveillance records. An investigation may be warranted if Legionnaires' disease is diagnosed (refer to #4B below).

C. Sample data forms for influenza-like illness (Appendices A and B)

1. All fields should be completed, with nothing left blank.
2. Dates should be entered by using international nomenclature (i.e., day/month/year).
3. Date on and off ship refers to when a passenger or crew member first boarded the ship and when they disembarked (i.e., at the end of the cruise or medically evacuated).
4. Using case definitions
 - i. nfARI and ILI. Only one case definition should be entered per patient visit (i.e., either nfARI or ILI should be entered). The most specific case definition should be recorded.
 - ii. Pneumonia. In addition to recording nfARI and ILI for each patient visit, pneumonia should be entered as either suspect (Pn-S)

or confirmed (Pn-C), if applicable.

iii. ARI. This category should be used to assess the magnitude of illness on board ship (see Potential Outbreak of Influenza A: Preliminary Alaska region-specific threshold levels). It includes persons meeting either the nfARI or ILI case definitions.

5. Rapid viral testing categories are:
 - i. test not done (ND),
 - ii. positive result (P), and
 - iii. negative result (N).
6. Chest x-ray (CXR) field categories are:
 - i. test not done (ND),
 - ii. positive result (P), meaning that an infiltrate is present, and
 - iii. negative result (N), meaning that no infiltrate is present.
7. The comment field should include information and results for any other testing (even if results are negative), whether another etiologic agent has been identified, and the diagnosis.

D. Timely reporting of surveillance information to appropriate authorities.

1. Routine surveillance data (i.e., data thought to reflect a baseline incidence of ARI and ILI) should be reported to the cruise line medical representative (e.g., medical director's office). Routine reporting of surveillance data to national public health agencies such as CDC or Health Canada is not expected or required, except as stipulated in Section 71.21 of Title 42 of the U.S. Public Health Service Act (42CFR71). Instead, these routine data should be used internally by cruise line operators to better understand the patterns of ARI and ILI among their passengers and crew members. CDC can provide consultation for interpreting surveillance data, if requested.
2. If an outbreak is suspected, surveillance data should be rapidly reported to the cruise line medical representative (e.g., medical director's office) and a national public health agency (e.g., CDC or Health Canada, where applicable). The Division of Quarantine (DQ) at CDC will notify appropriate state and local health officials and consult with appropriate disease-specific experts within CDC. Because cruise ship passengers typically return to various U.S. states and countries after their cruise, which usually takes place in international waters, DQ also will notify appropriate international health agencies.

4. Each vessel's medical clinic should include the following minimum diagnostic capabilities:

- A. Rapid viral antigen detection kits for influenza. Commercially available rapid detection kits in the United States detect both influenza A and B viruses but do not differentiate between them (for therapeutic implications, see

Recommendations for Interrupting Influenza Outbreaks on Cruise Ships: Confirming an Influenza Outbreak). Each ship should have a plan for performing selected viral cultures if an influenza outbreak is suspected.

- B. Urine antigen testing for *Legionella pneumophila* serogroup 1. All persons with suspect and confirmed pneumonia should have a chest x-ray performed, and all confirmed cases of pneumonia should at least be tested for legionellosis. If a legionella test is positive, an investigation may be warranted to identify the source and take appropriate corrective measures to prevent additional cases because this pathogen likely is spread from a contaminated environmental water source.^{9,10} All confirmed cases of legionellosis should be reported to the cruise line medical representative and if appropriate, to national public health agencies (e.g., CDC or Health Canada).

Potential Outbreak of Influenza A (Appendices C, D and E)

1. An outbreak is defined as the occurrence of more cases of disease than expected (higher than an established baseline) occurring in a specific group of people over a particular period of time in a particular place. To define an influenza outbreak, systematic region-specific surveillance should be performed and baseline illness levels determined (see below).
2. Levels of respiratory illness suggestive of an influenza outbreak
 - A. No rigorously confirmed region-specific threshold levels yet exist to determine when an influenza outbreak is occurring on a cruise ship. While knowledge of these levels is critical, they can be determined only through the systematic collection of surveillance data (ARI and ILI) by individual cruise lines.
 - B. Preliminary Alaska region-specific (regional waters of Alaska, British Columbia, and Washington State) threshold levels for passenger illness are proposed based on data gathered during the 1998 Alaska influenza outbreak investigation, which documented high numbers of cases of influenza illness compared with the 1997 summer season. These levels are based on:
 1. the number of passengers meeting the ARI and ILI case definitions,
 2. the total number of passengers on board for a given cruise, and
 3. the cruise duration.
 - C. Threshold levels for illness among crew members, similar to that proposed for passengers, cannot be calculated because data are lacking at this time.
3. Preliminary Alaska region-specific (regional waters of Alaska, British Columbia, and Washington State) threshold levels
 - A. As best can be determined at this time, the proposed preliminary threshold levels will enable ships' medical officers to determine if an influenza outbreak of magnitude comparable with that of the 1998 Alaska outbreak is occurring by

identifying when cases of ARI are approaching 1998 Alaskan outbreak levels. Reaching these threshold levels may require implementation of enhanced surveillance measures and possibly intervention and control measures.

- B. Preliminary threshold levels are based on a 2-year assessment of cases of ARI and ILI during the 1997 and 1998 summer tourist seasons in Alaska. Therefore, these levels should be interpreted with caution because of the following limitations:
1. Baseline levels of ARI and ILI have not been rigorously studied. Summer 1997 was assumed to reflect baseline levels of respiratory illnesses, and summer 1998 to reflect an outbreak year with abnormally high numbers of respiratory illness.
 2. Seasonal patterns of ARI and ILI (e.g., summer versus winter) may differ.
 3. Preliminary threshold levels may underestimate illness because cases of ARI and ILI may reflect medical care-seeking behavior (i.e., older persons may be more likely to seek medical attention than younger persons). Therefore, it is likely that these preliminary threshold levels will not detect all respiratory disease outbreaks.

4. Using and interpreting Alaska region-specific ARI and ILI threshold-level graphs (Appendices C, D and E)

- A. Threshold-level graphs have been calculated by using data from a subset of ships sailing in Alaskan waters in 1998. The majority of these ships carried over 1,000 passengers; therefore, threshold levels can only accurately be extrapolated to ships carrying ≥ 600 passengers.
- B. Use of these graphs should not be restricted to assessing the cumulative number of passengers with ARI or ILI at the end of each cruise. More importantly, they should be used to assess the cumulative number of passengers with ARI or ILI **during** each cruise.

Note: The ARI case definition includes all persons who meet either the nfARI or ILI case definitions.

- C. ARI threshold levels by day of cruise – Alaska region (Appendix C)
1. Determine the total number of passengers on the cruise (horizontal axis).
 2. Determine the day of the cruise (right side of graph).
 3. On the graph, plot the point of intersection of the total number of passengers on the cruise and the line indicating the cumulative number of passengers with ARI by day of cruise, for the cruise day of interest.
 4. Read the number of passengers with ARI on the left vertical axis.
Note: This is the minimum level of cases at which active surveillance for cases of ILI should be initiated and consideration given to selectively using rapid viral antigen

detection kits to rule out influenza. During an influenza outbreak, data have shown that cases of ARI are good markers for cases of ILI.

- D. ILI threshold levels by day of cruise – Alaska region (Appendix D)
1. Determine the total number of passengers on the cruise (horizontal axis).
 2. Determine the day of the cruise (right side of graph).
 3. On the graph, plot the point of intersection of the total number of passengers on the cruise and the line indicating the cumulative number of passengers with ILI by day of cruise, for the cruise day of interest.
 4. Read the number of passengers with ILI on the left vertical axis.
Note: This is the level at or above which an influenza outbreak is likely occurring. Rapid viral antigen detection kits should be used for diagnosis and outbreak confirmation.

- E. Example of ARI threshold levels by day of cruise for a 21-day cruise (Appendix E)

1. Total number of passengers on the cruise: 1500
2. Day of cruise: 10
3. See the dotted black line on the example graph
4. The number of passengers with ARI: 47

Interpretation: If on day 10 of a 21-day cruise, at least 47 passengers meet the case definition for ARI, then an outbreak of influenza should be suspected and active surveillance for cases of ILI initiated. Selective use of rapid viral antigen detection kits to rule out influenza infection also should be considered at this time.

5. Suspected influenza outbreak

Refer to the recommendations for interrupting influenza outbreaks on cruise ships.

Recommendations for Interrupting Influenza Outbreaks on Cruise Ships

Keys to Successful Management and Control of Influenza Outbreaks

1. Early recognition of an outbreak (the occurrence of more cases of disease than expected among a specific group of people over a particular period of time in a particular place).
2. Rapid laboratory diagnosis.
3. Prompt institution of control measures, including the use of antiviral medications for influenza A infection.

Confirming an Influenza Outbreak

1. Once an outbreak of influenza is suspected based on ARI and ILI threshold levels, rapid viral diagnostic testing for influenza and for other respiratory viruses should be performed to ascertain the disease etiology and confirm an influenza outbreak. Rapid influenza diagnostic tests have a higher yield if utilized within 4 days of symptom onset.

In the United States, commercially available rapid influenza diagnostic tests either do not differentiate between influenza A and B viruses (e.g., ZstatFlu[®] [ZymeTx], Flu OIA[®] [Biostar]^{*} or detect only influenza A virus (e.g., Directigen Flu A[®] [Becton Dickinson]^{*}).

A. Implications for antiviral therapy

1. Currently available antiviral agents (i.e., amantadine and rimantadine) interfere only with the replication cycle of influenza A but not influenza B, and therefore are useful only in the treatment and prophylaxis of influenza A infections.
2. Neuraminidase inhibitors, a class of antiviral agents with activity against both influenza A and B viruses, are being tested for licensure in the United States but are not yet available. When these medications will become available is uncertain; however, when they do become available, differentiation between the two influenza viruses may no longer be necessary for purposes of treatment and prophylaxis with this class of agents. Nonetheless, viral cultures should still be performed to assess specific influenza strains for vaccine match purposes (see below).

^{*}Use of product names are for identification purposes only and do not constitute or imply endorsement by the United States government, the Centers for Disease Control and Prevention, or any of its organizational units or employees.

3. If the etiologic agent causing disease is unknown, antiviral medication should not be used because of the potential side effects associated with these medications. Efforts should be made to determine the cause of disease.
2. Each ship should have a plan for performing viral cultures on selected patients if an influenza outbreak is confirmed by rapid viral diagnostic testing or if the disease etiology remains unknown.

Recommendations for Passengers and Crew Members

1. Outbreak notification and education about influenza
 - A. Once an influenza outbreak has been identified, passengers and crew members should be notified of their potential risk of exposure to influenza.
 - B. Passengers and crew members should be educated about the symptoms and signs of disease, complications of infection, groups at high risk for complications, and prophylactic and therapeutic options for influenza A infection. This may be accomplished by distributing fact sheets about influenza and/or offering group counseling sessions.
 - C. Passengers and crew members should be encouraged to report to the ships' infirmary if they have symptoms and signs of respiratory illness.
2. Active surveillance (surveillance for which respiratory illness reports are actively solicited)
 - A. Active surveillance among passengers and crew members should be initiated by ship's medical staff to detect new cases of respiratory illness once an influenza outbreak has been identified. Established case definitions for ARI, ILI and pneumonia should be used, and the date active surveillance was initiated should be recorded.
 - B. Active surveillance should include directly contacting passengers (e.g., passenger surveys) and crew members (see Additional Recommendations Specific for Crew Members: Active Surveillance) to assess whether they have symptoms and signs of respiratory illness. These symptoms include cough, sore throat, and fever or self-reported feverishness/chills.
 - C. Using established ARI, ILI and pneumonia case definitions, the designated medical staff person responsible for ongoing surveillance should review medical log data for both passengers and crew members daily to evaluate illness trends and to initiate or assess control measures.
 - D. Daily case counts should be reported to the cruise line medical representative (e.g., medical director's office).

3. Antiviral medication (e.g., amantadine and rimantadine) for confirmed influenza A outbreaks

A. *Treatment*

1. Ill passengers and crew members who are at highest risk for complications should receive priority (refer to “1999 Recommendations of the Advisory Committee on Immunization Practices [ACIP]: Prevention and Control of Influenza” for risk determination¹). They should be advised of the benefits of therapy in reducing the risk for serious complications and counseled on the potential side effects of antiviral medication.
2. Other ill passengers and crew members.

B. *Chemoprophylaxis, in descending order of priority*

If supplies of antiviral agents are limited, these medications should be offered and dispensed, barring medical contraindications, in the following order of priority:

1. Close contacts of ill passengers and crew members (i.e., those sharing a cabin), particularly those at increased risk for infection and complications. They should be advised of the benefits of prophylaxis (preventing illness and possibly reducing the risk of further transmission of infection) and counseled on the potential side effects of antiviral medication.
2. Other close contacts of ill persons (i.e., those sharing group activities such as meals and travel excursions).
3. Passengers and crew members who are at increased risk for complications of influenza, regardless of vaccination status, but who are not close contacts of ill persons.
4. All other crew members.
5. All other passengers (depending on circumstances).

Additional Recommendations Specific for Crew Members

1. Active surveillance (surveillance for which respiratory illness reports are actively solicited)
 - A. Active surveillance for new cases among crew members should be conducted by supervisors during the affected cruise and continued during the next cruise (up to 21 days following initiation of interventions).
 - B. Crew members should be asked daily if they have any symptoms of respiratory illness (i.e., cough, sore throat, and fever or self-reported feverishness/chills). Crew members who have symptoms suggestive of a respiratory illness should report to the ship’s infirmary for further medical evaluation.
2. Isolating/cohorting ill crew members
 - A. All crew members with respiratory illness (ILI or confirmed influenza) should be isolated from non-infected crew members and passengers. Isolation or cohorting, which limits the spread of infection, consists of confinement to a cabin alone or with another ill crew member for at least 5 days after symptom onset.

- B. Contact with infected crew members should be strictly limited to influenza-vaccinated or recovered persons (no visitors); meals and other items should be brought to their cabins by influenza-vaccinated or recovered persons only.
- C. If the above-described isolation procedure is not feasible due to space or logistic constraints, off-ship isolation measures (e.g., placing affected crew members in a hotel and cohorting them in a manner similar to that described on board ship [refer to #2A and B above]) should be considered.

3. Influenza vaccination

All crew members who are not ill and have no contraindication to vaccination should be offered immunization if they have not been vaccinated within the past year during a routine annual vaccination program. Protective immunity can be expected within 2 weeks of vaccination and can decrease influenza-associated morbidity. Cruise lines should attempt to achieve the highest vaccination levels possible; however, they should aim for at least an 80% vaccination rate among crew members. Presently, no scientific data support or refute the usefulness of administering influenza vaccine more than once a year to healthy adults.

4. Chemoprophylaxis

- A. Crew members who were not vaccinated at least 2 weeks prior to the institution of chemoprophylaxis should complete the entire recommended 2-week course of chemoprophylaxis with antiviral agents to interrupt influenza A transmission. Prophylaxis should be considered for all crew members, regardless of their vaccination status, if the outbreak is caused by a variant strain of influenza A that might not be prevented by the vaccine. This highlights the need for using viral cultures as part of laboratory testing during an outbreak to determine vaccine and outbreak strain relatedness.
- B. If a crew member with unique technical responsibilities could potentially jeopardize the safe operation of a ship by experiencing neurologic side effects from chemoprophylactic agents while on duty, the risks of prophylaxis may outweigh the benefits. If this crew member continues to work, interaction with other crew members and passengers should be limited as much as possible to avoid potential disease transmission.

5. Crew transfers

- A. If a variant strain of influenza A not controlled by the vaccine is circulating, crew members should not be transferred to other ships from a cruise experiencing influenza transmission until after they have completed 2 weeks of antiviral chemoprophylaxis, regardless of their vaccination status.
- B. In an outbreak setting, any crew members joining the ship for the next cruise should be vaccinated with influenza vaccine (refer to #3 above) and placed on chemoprophylaxis for 2 weeks.

Additional Recommendations Specific for Passengers

1. Isolating/cohorting ill passengers

All passengers suspected to be infected with influenza should be encouraged to limit their activities to prevent further spread of influenza among non-infected passengers and crew members. Isolating ill passengers in a similar manner to that described for crew members, while preferred, may not be feasible.

2. Newly embarking passengers

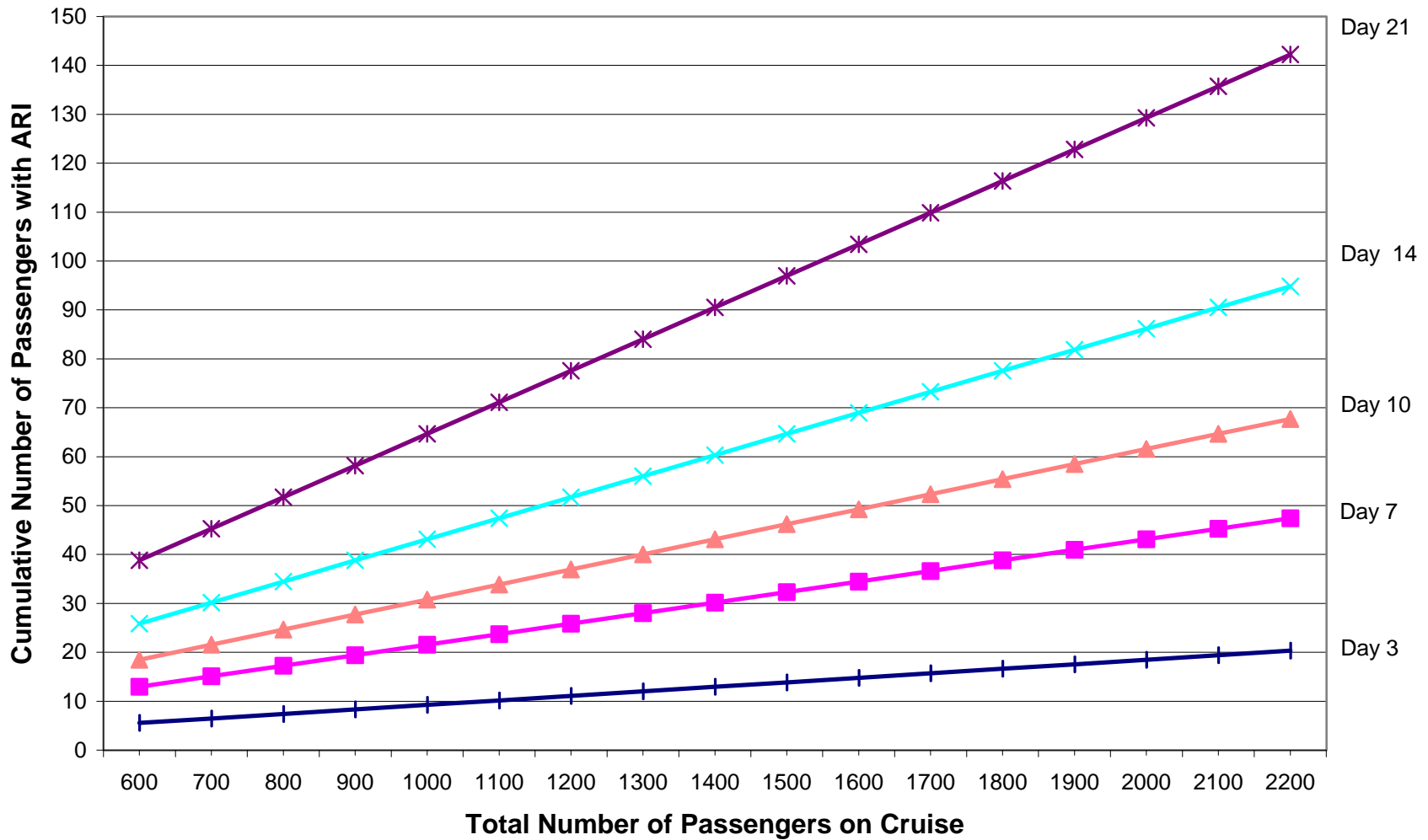
- A. Prior to embarkation on a subsequent cruise, new passengers should be notified of an influenza outbreak during the previous cruise. They should be provided information on the status of the outbreak and measures taken to prevent transmission and treat influenza infection.
- B. Chemoprophylaxis is not recommended for new passengers if the number of respiratory illnesses among crew members has declined or stabilized following chemoprophylaxis and if all crew members have been immunized for influenza. However, passengers in high-risk categories should be advised to consult with the ship's doctor regarding available chemoprophylaxis.

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APPENDIX C

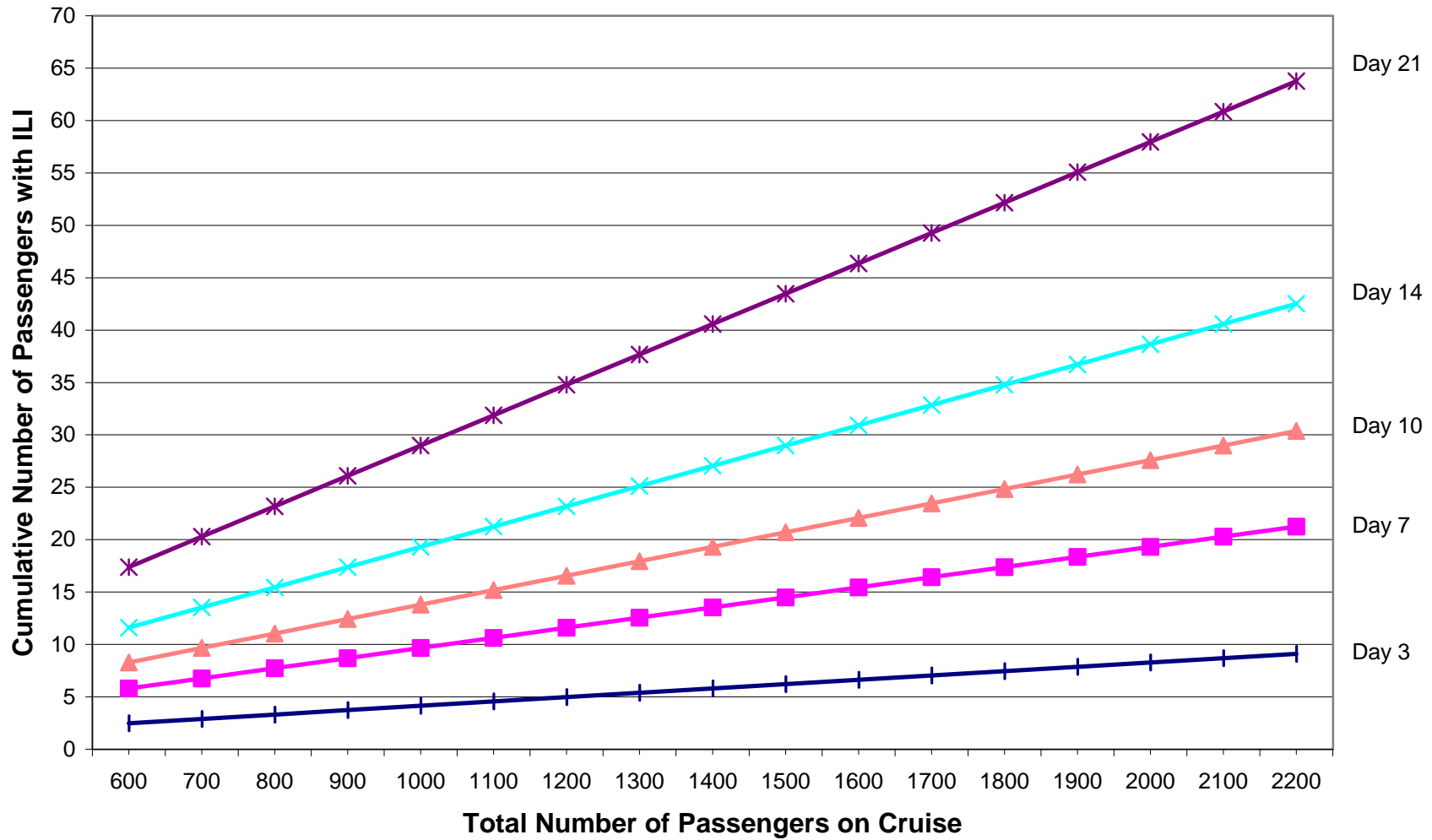
Preliminary ARI Threshold Levels by Day of Cruise -- Alaska Region*
 (rate 3.078 per 1000 passenger days, 1998)



* Includes regional waters of Alaska, British Columbia, and Washington State

APPENDIX D

Preliminary ILI Threshold Levels by Day of Cruise -- Alaska Region* (rate 1.380 per 1000 passenger days, 1998)



* Includes regional waters of Alaska, British Columbia, and Washington State

APPENDIX E

Example: Use of ARI Threshold Levels by Day of Cruise
(rate 3.078 per 1000 passenger days, 1998)

