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# Communicable Diseases on Aircraft

*R. Wesley Farr, MD, MPH*

*CAPT, MC, USN (ret)*

*Lecturer, Department of Public Health*

*[wfarr@uwf.edu](mailto:wfarr@uwf.edu)*

# Objectives

- Assess potential of infectious agents to be transmitted to airline passengers, and aircrew
- Evaluate intercontinental transport of infectious agents
- Identify passengers and aircrew at risk
- Discuss risk factors



- Routes of transmission
- Airline outbreaks
- SARS, Influenza, Tuberculosis
- Military Response to 2019-nCoV

# Days to Circumvent the Globe

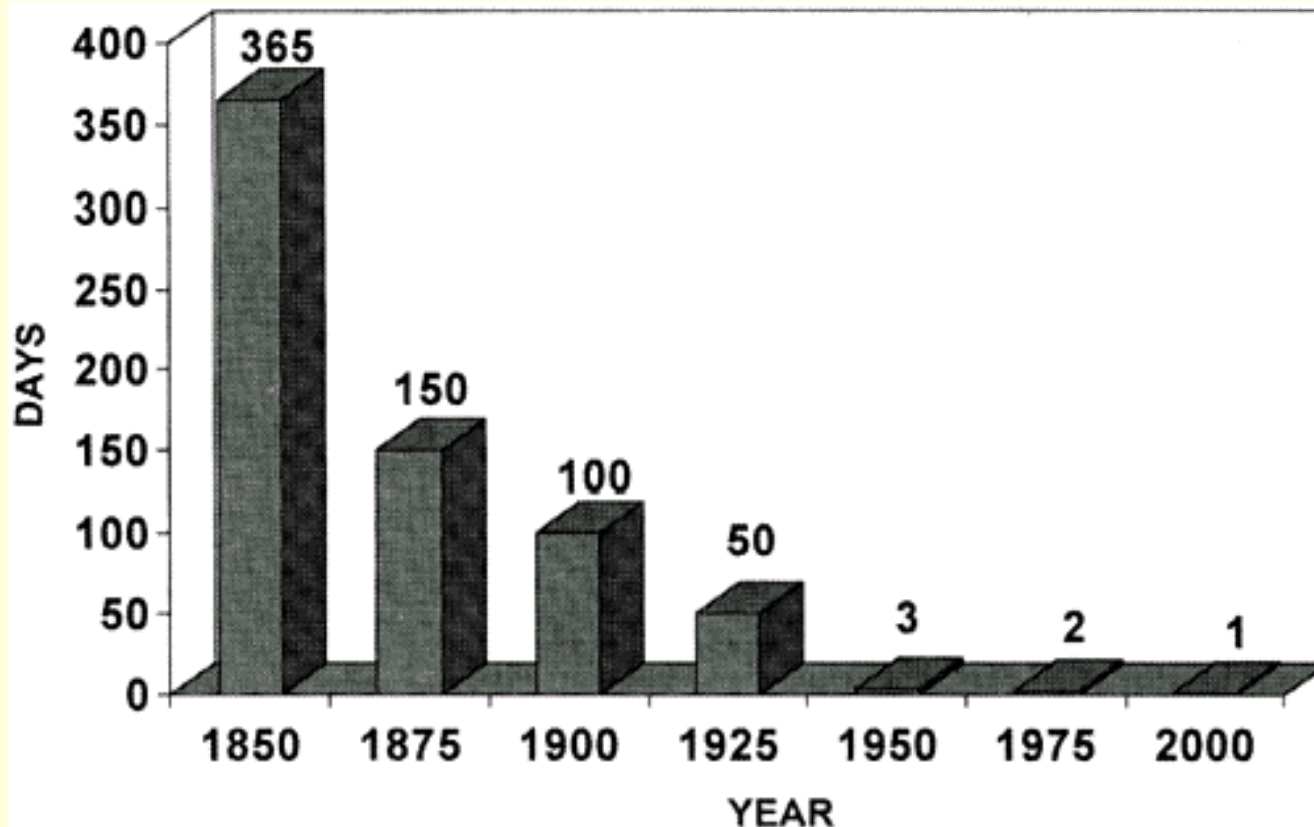


Fig 5. Time required to circumnavigate the globe. From World Health Organization. Tuberculosis and air travel: guidelines for prevention and control. Geneva, Switzerland: World Health Organization.

*From:* Sattar. Am J Infect Control, Volume 27(6).December 1999.S4-S21

# Routes of Transmission

- Food-borne
  - Cholera, 1992
- Vector-borne
  - Insects transmitted malaria and others
- Indirect contact- Airborne
  - Tuberculosis, measles, influenza
- Direct Contact- droplet
  - SARS, meningococcus

# Factors in Outbreaks

- Communicability of pathogen
- Proximity to source patient
- Duration of exposure
- Severity of disease in source patient
- MWR. 2001;50:485-9

# SARS- Rapid Worldwide Spread

- Severe acute respiratory syndrome
- First recognized in FEB 2003
- Causative agent- coronavirus
- Highly communicable
- Infected persons traveled on commercial airlines
- Evidence of in-flight transmission on airlines

# SARS 2003 Outbreak

- Entered human population in Guangdong Province, China NOV 2002
- 6 major outbreaks by JUL 2003
  - China, Hong Kong, Taiwan
  - Singapore, Vietnam
  - Canada
- 20 additional sites following major airline routes
- Spread in hospitals- family and HCWs

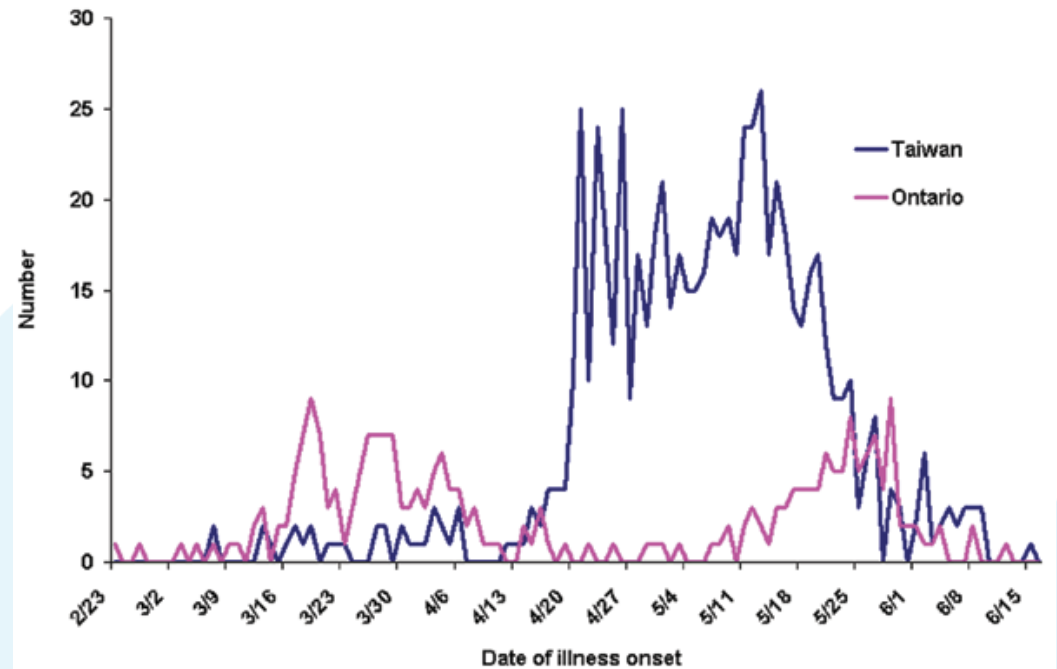
# SARS 2003 Outbreak

- Outbreak ended July 2003
- 8,098 cases in 26 countries
- 774 deaths
- \$18 billion lost to GDP
- Airline traffic decreased 100K to 20K in Hong Kong

- Taiwan- 2 phases
  - Sporadic transmission among travelers
  - Nosocomial outbreak
- Toronto- 2 phases, both nosocomial
  - Unrecognized SARS in contact of traveler
  - Unknown transmission of SARS among patients when HCWs were wearing PPE



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  - Unknown transmission of SARS among patients when HCWs were wearing PPE

# SARS- Transmission

- Person-to-person by close contact
- Respiratory secretions or body fluids
- Droplets or fomites
- Environmental vehicles- aerosolized sewage

# In-Flight Transmission of SARS

- Early outbreak, 9 of first 11 patients in Taiwan traveled from affected areas in China to Taiwan
- Investigated 8 flights of concern
- 3 flights- clear link to lab-confirmed case and full manifest
- Flight 2- SARS developed in 22 of 119 other persons
  - Boeing 737-300
- Olsen. NEJM 2005;349:2416-22

# SARS- In-Flight Transmission

**Table 1.** Frequency of Transmission on Three Aircraft Carrying One or More Persons Given a Diagnosis of a Probable Case of SARS.\*

Flight No.	Model of Aircraft	Date of Flight	Duration of Flight	Phase of Illness (no. of patients)	No. Believed to Have Become Infected/Total No. of People on Aircraft (% [95% CI])	No. Who Became Ill/No. Interviewed (% [95% CI])†
1	777-300	Feb. 21, 2003	90 min	Incubation (1)‡	0/315 (0 [0–1.2])	0/74 (0 [0–4.9])
2	737-300	Mar. 15, 2003	3 hr	Fever with cough (1)	22/120 (18.3 [11.9–26.4])	18/65 (27.7 [17.3–40.2])
3	777-300	Mar. 21, 2003	90 min	Fever (2); fever with cough (2)	1/246 (0.4 [0–2.2])	1/166 (0.6 [0–3.3])§

\* The 95 percent confidence intervals (CIs) given are the exact binomial 95 percent confidence intervals around point estimates. SARS denotes the severe acute respiratory syndrome.

† Illness was defined as fever with cough, shortness of breath, or difficulty breathing. The number of patients who became ill excludes the index patient or patients.

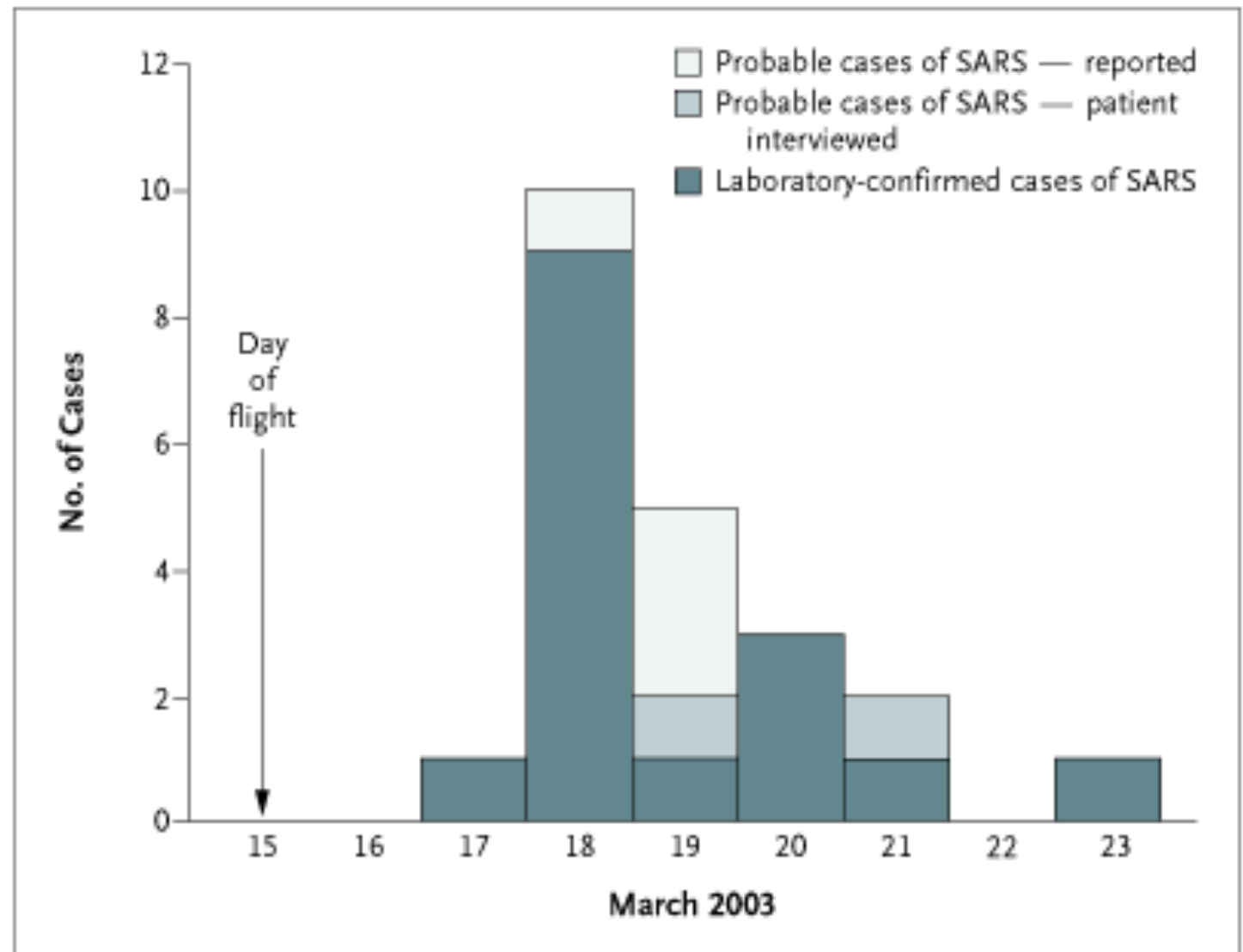
‡ The incubation phase is defined as the 10 days before the onset of fever.

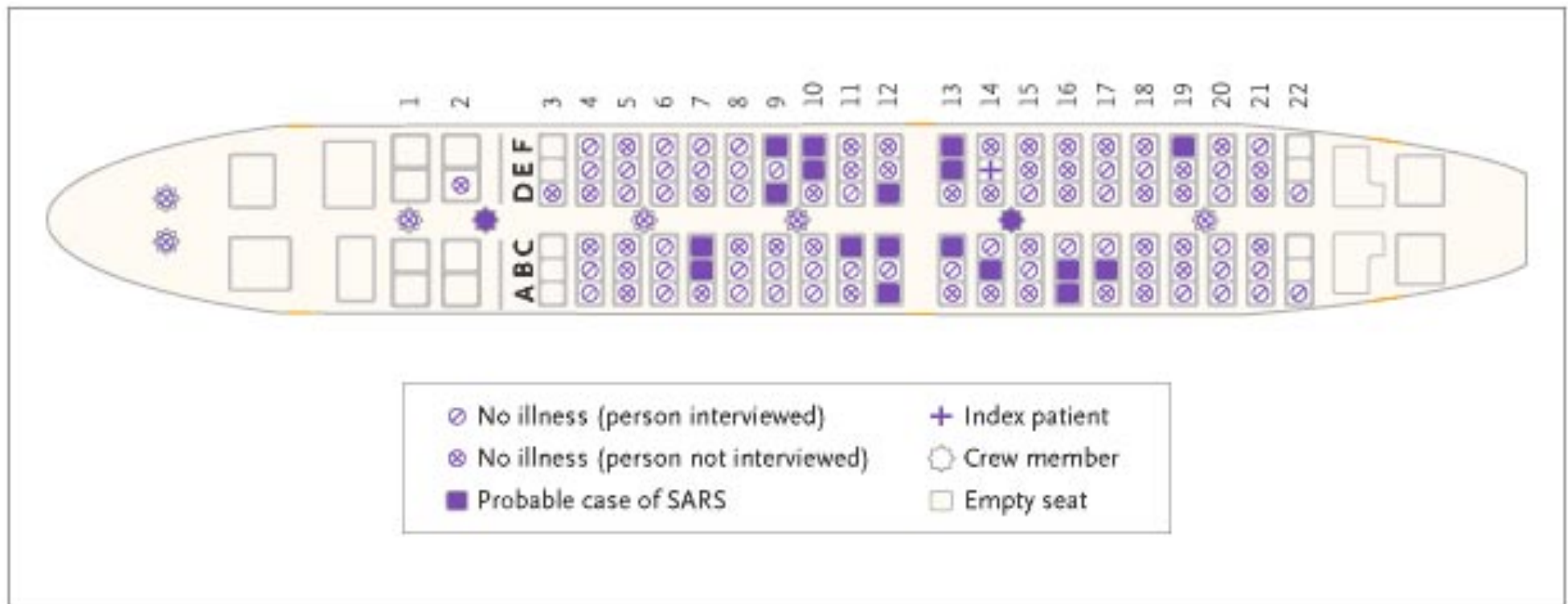
§ Illness in the one passenger who became ill met the WHO criteria for a suspected case of SARS; no chest radiograph was obtained.

- Olsen. NEJM 2005;349:2416-22

# SARS- Incubation Period

- Olsen.  
NEJM  
2005;349:  
2416-22





- Figure 2. Schematic Diagram of the Boeing 737-300 Aircraft on Flight 2 from Hong Kong to Beijing
- Olsen. NEJM 2005;349:2416-22

- Illness in 8 of 23 passengers in same row as index or 3 rows in front
  - Versus 10 of 88 other passengers
  - RR 3.1 (95% CI .4-6.9)
- WHO definition of contact
  - Passenger seated in same row or 2 rows in front of or behind index
  - 11 of 35 vs. 9 of 84 (RR 2.1 [95% CI 1.3-6.5])
- No difference in aisle vs window or middle seat

# Risk Factors in SARS 2003

- Proximity to index patient
  - Same row and 3 rows in front
  - Role of coughing- combination of aerosol and small droplet spray
- Symptomatic phase of illness
- (Duration of flight)
  - Olsen. NEJM 2005;349:2416-22



# Risk Factors in Other Outbreaks

- Varies widely
  - Proximity to index patient
  - Duration of flight
  - Stage of illness
  - Air ventilation system
  - Size of aircraft
  - Number of infected persons on board
  - Host factors- Super Spreader
-

# Summary- SARS

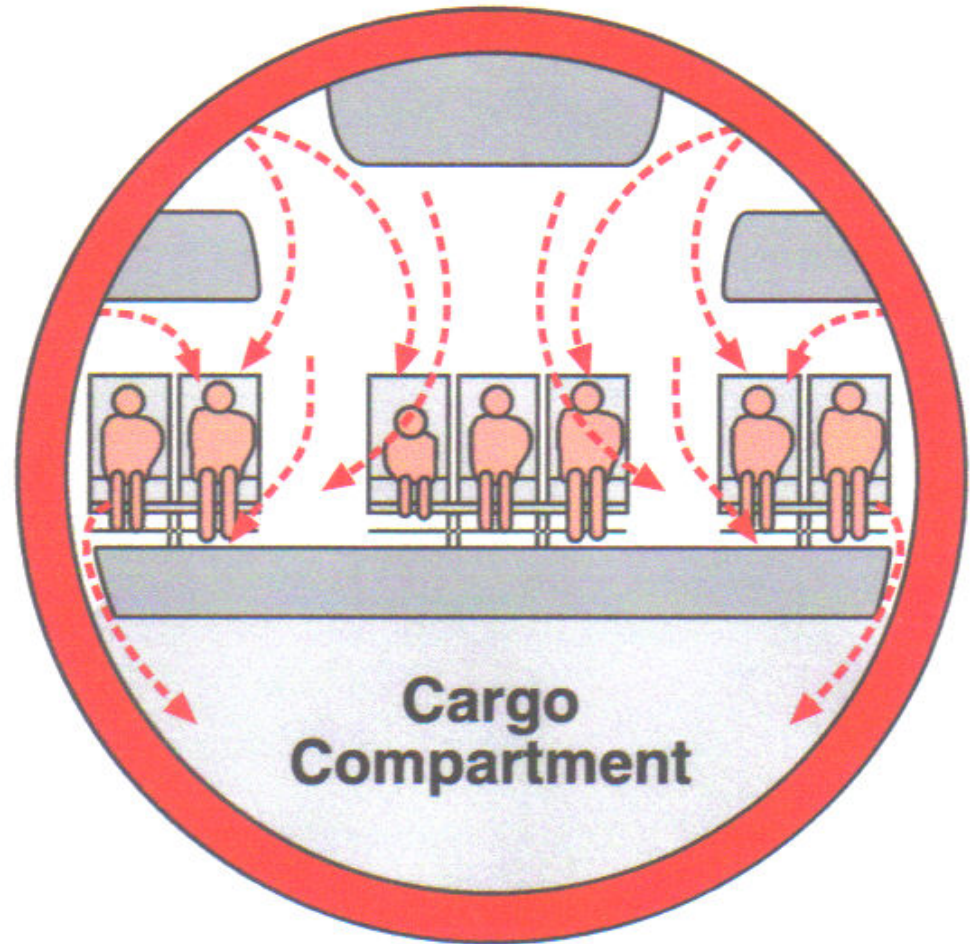
- Severe respiratory infections
- Rapid spread in health care settings
- Potential for rapid international spread and pandemic
- Surveillance and reporting are keys to preventing epidemics/pandemics

# Respiratory Illness on Airlines

- Why are outbreaks so infrequent?
- Physical decay- large droplets
- Biologic decay
- Engineering controls
- Administrative controls

- Ventilation system
  - Mix of exterior bleed air (hot) and recycled air
  - 50% of air recycled
  - 20-30 air exchanges per hour
  - HEPA (high-efficiency particulate air) filters

- Lamellar airflow
  - Vents beneath overhead lockers
  - Downward in two contra-rotating circles
  - Exits through vents under seats
- Airflow stays mostly on one side and does not travel far forward or backward



# Administrative Controls

- Pre-flight (exit) screening for fever, cough
  - Effective in SARS pandemic
- Post-flight (entry) screening
  - Detect people who become symptomatic in flight
  - Unlikely to be effective – incubation period longer than duration of flight
- Quarantine of exposed persons if one case detected
- Pitman. BMJ 2005;331:1242-3.

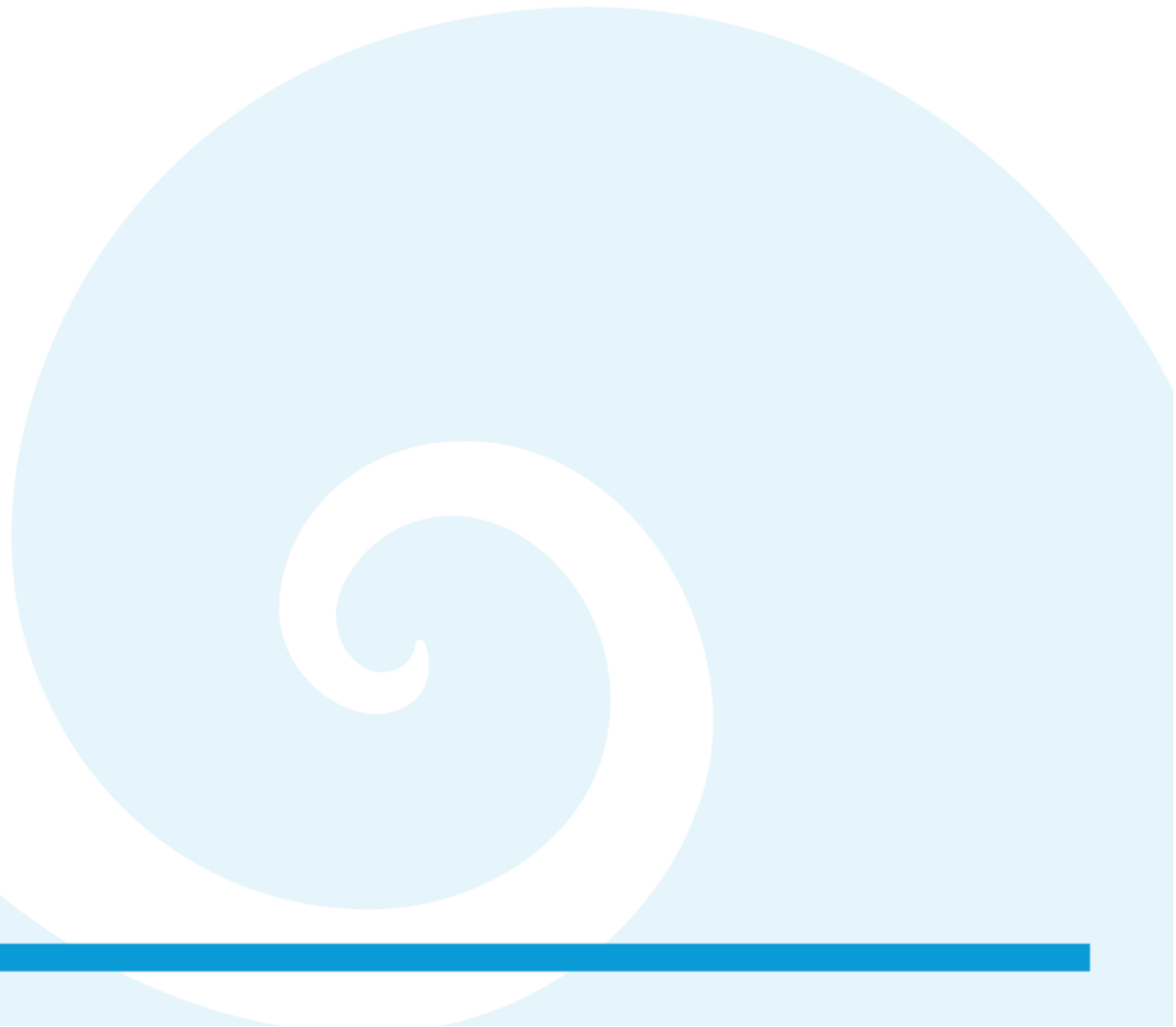




- Navy and Marine Corps Public Health Center
  - [2019-nCoV Guidance](#)
  - [DoD Force Health Protection Guidance](#)
  - CDC Travel Health Notice
  - 2019-nCoV Reporting- Disease Reporting System internet (DRSi)
  - Navy Environmental Preventive Medicine Units (NEPMU) Threat Assessment
-



- Influenza like illness (ILI)
  - Operational Units
    - Disease Non-Battle Injury (DNBI) surveillance
  - Military Medical Treatment Facilities (MTF)
    - ESSENCE
  - 2019–nCoV Reporting
    - Public Health Emergency Officer (PHEO)
    - Infection Control Officer (MTF)
    - NEPMU
    - State and Local Health Department
-



- Separate ill person by 3-6 feet
- Paper or gauze surgical mask
- Tissues if mask unavailable
- Gloves, hand washing
- Report illness to nearest US Quarantine station
- [http://www.cdc.gov/travel/other/avian flu ig airlines 021804.htm](http://www.cdc.gov/travel/other/avian_flu_ig_airlines_021804.htm)

- Factors for communicable diseases
  - Infectiousness of agent
  - Proximity
  - Duration of exposure
  - Severity of illness in source patient
- Controls
  - Engineering
  - Administrative
  - Pre- and post-exposure prophylaxis

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- Paper or gauze surgical mask
- Tissues if mask unavailable
- Gloves, hand washing
- Report illness to nearest US Quarantine station
- <http://www.cdc.gov/ncidod/sars/pdf/airpersonnel.pdf>

- Severe respiratory infections
- Rapid spread in health care settings
- Potential for rapid international spread and pandemic
- Surveillance and reporting are keys to preventing epidemics/pandemics

- The epidemic stops with good infection control







- Influenza more contagious than bacterial diseases
- Transmission
  - Aerosol
  - Direct contact
- Young children- most likely to be infected and transmit
- Musher, D. M. N Engl J Med 2003;348:1256-1266

- Introduction of influenza A into a family
  - 20-60% have virologic or serologic evidence
  - 50% of infected develop syndrome
- Introduction of influenza on naval cruiser
  - 42% develop illness
- Musher, D. M. N Engl J Med 2003;348:1256-1266

- Boeing 737 with 56-passenger compartment (49 passengers and 5 aircrew onboard)
- Engine failure on takeoff led to 3-hour delay
- Ventilation system inoperable
- Many passengers remained on-board- moved freely throughout the cabin
- Some waited in terminal
- Moser. Am J Epidemiol 1979;110:1-6.

- 38 (72%) persons became ill
- 1 person identified as index patient- ill on plane
  - Adult hosts prior to flight and their child developed influenza-like illness
- Cough, fatigue, fever, chills, myalgia
- Moser. Am J Epidemiol 1979;110:1-6.

- Attack rate varied with time on aircraft
- <1 hour- 8/15 (53%)
- 1-3 hours- 5/9 (56%)
- > 3 hours- 25/29 (86%)
- Chi square 6.657 ( $p < 0.05$ )
- Moser. Am J Epidemiol 1979;110:1-6.

- Influenza is more contagious and can be transmitted on aircraft
- Contributing factors
  - Duration of exposure on aircraft
  - Inoperable ventilation system
- Moser. Am J Epidemiol 1979;110:1-6.

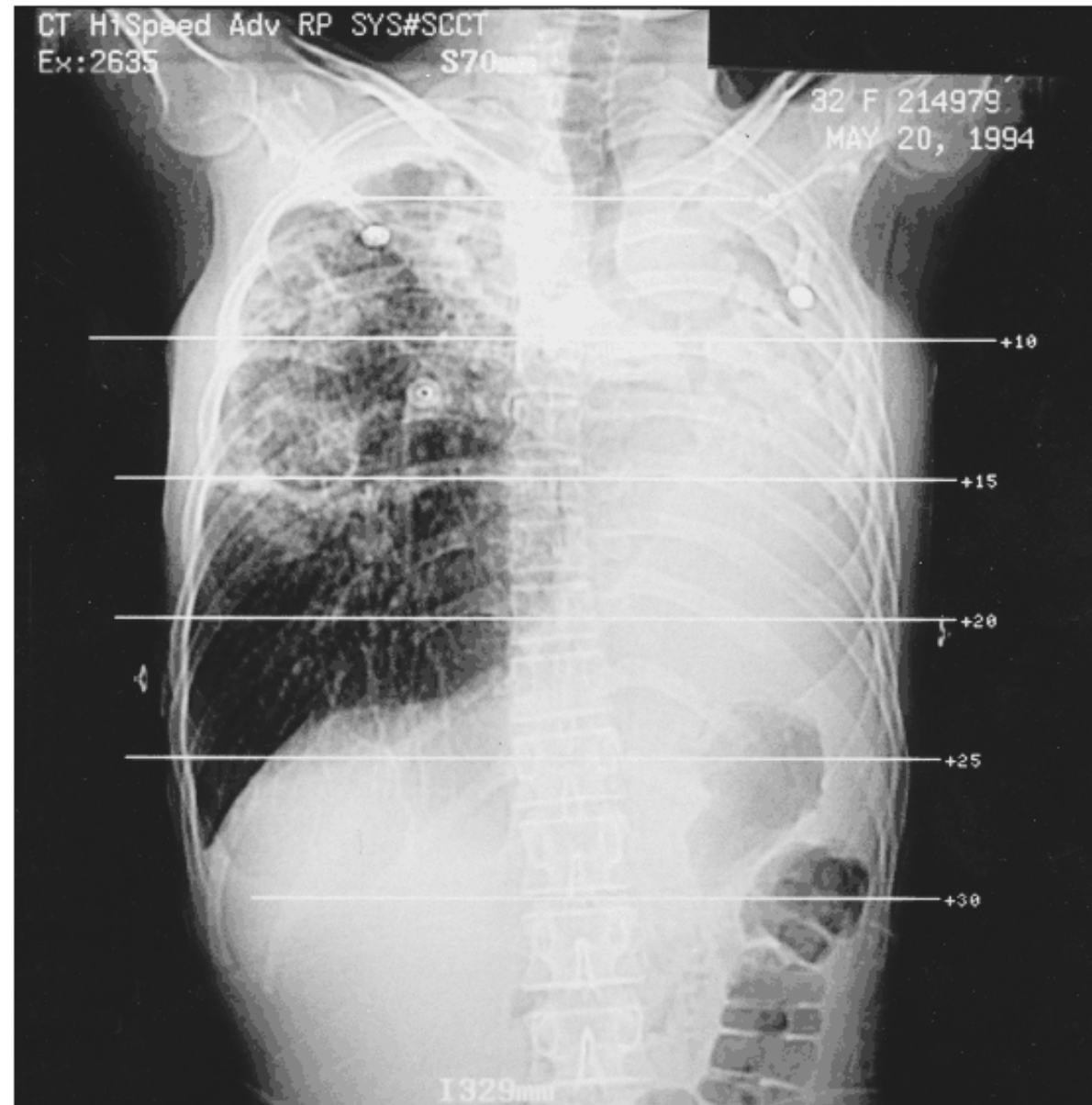
- Potential for transmission
  - Tiny droplet aerosol transmission
  - Recirculated air
  - Long duration flights
- Journal review
  - Kenyon TA et al. Transmission of multidrug-resistant *Mycobacterium tuberculosis* during a long airplane flight. NEJM 1996;334:933-8.

- Index patient- 32-y-o Korean woman
- TB meds as adolescent in Korea and previous 2 years in Japan
- Arrived in Honolulu in APR 94- symptomatic
- Flights-
  - Honolulu to Chicago and Chicago to Baltimore in APR
  - Return flights in MAY

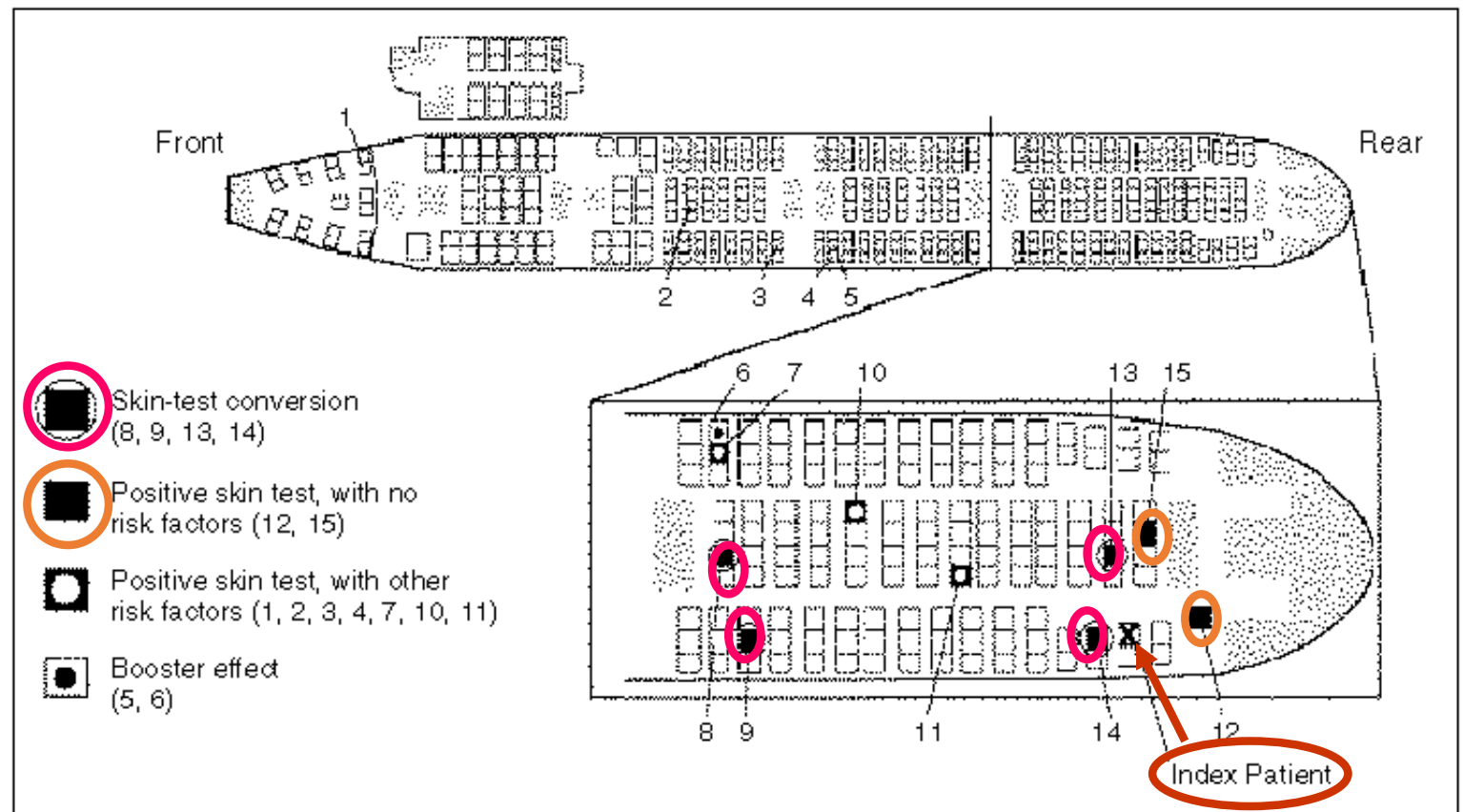


- Index patient- Hemoptysis on return to Honolulu
- Extensive pulmonary disease
- Sputum AFB 3+ and culture positive for MDR-TB
- Died 5 days later

- Index patient 8 days after flight
- Cavitory
- NEJM  
1996;334:933-8



- 925 of 1042 (88.8%) passengers and aircrew notified
- 15 contacts on MAY Chicago to Honolulu flight in May had positive PPD
- 6 contacts had no other risk factors
  - All sat in same section ( $p=0.001$ )
  - Increased risk if within 2 rows of index patient



- Seats of passengers with positive PPD
- NEJM 1996;334:933-8

Table 3. Seat Locations in Aircraft and Results of Tuberculin Skin Tests of Passengers and Crew Members on Flight 4 Who Had No Risk Factors.\*

SEAT LOCATION	No. WITH POSITIVE SKIN TESTS/No. TESTED (%)	RATE RATIO (95% CI)†	P VALUE
Not same cabin section as index patient	0/136	Reference value	—
Same cabin section as index patient	6/68 (8.8)	Undefined	0.001
Within 2 rows	4/13 (30.8)	8.5 (1.7–41.3)	0.01
Elsewhere in same section	2/55 (3.6)	Reference value	

\*Data for the flight crew exclude seven flight attendants who could not recall their work assignments on flight 4; all had negative tuberculin skin tests. Risk factors for a positive tuberculin skin test included having been born or having lived in a country where the rate of tuberculosis is at least 10 times higher than in the United States,<sup>7</sup> having had possible occupational exposure, having received the bacille Calmette–Guérin vaccine, or having had exposure to a family member or friend with tuberculosis.

†CI denotes confidence interval.

- NEJM 1996;334:933-8

- Boeing 747-100 on transoceanic flights (8 and 8.75 hours)
- Airbus 320-200 on domestic flights (1.75 and 2.0 hours)
- No flight delays
- Air-recirculation and HEPA
- Boeing 747- 50% air recirculation
  - 6-20 air exchanges per hour

- Compelling evidence for transmission on Flight 4
  - Long duration
  - Index more symptomatic in May
- Absence of transmission through air recirculation system
- NEJM 1996;334:933-8

- Crew member with TB MAY-OCT 1992
- Contacts- 212 aircrew and 59 passengers
- Higher rates of positive PPD AUG-OCT
- Risk increased with increased hours of exposure to index case
- Clustering in OCT- index more infectious
- Driver CR. JAMA 1994;272:1031-5.



- Persons with infectious TB
  - Travel by private aircraft vs. commercial
  - Sputum negative before commercial travel
  - 3 negative sputum smears while on effective TB meds
- MMWR 1995;44:137-40

- Notification guided by 3 criteria
- Person with TB was infectious
  - Smear positive, cavitory, laryngeal
- Exposure was prolonged (>8 hours)
- Proximity to index case
  - Same cabin section
- MMWR 1995;44:137-40

- TB transmission on aircraft is uncommon
- Risk factors- infectiousness, duration, proximity
- Restrict flying of infectious patients
- Notification of persons in same cabin section

- Airlines shorten period to transport infected persons around the world
- In-flight transmission can occur but is infrequent
- Transmission of respiratory pathogens is major concern
  - Direct contact- large droplets
  - Indirect contact- airborne- aerosol and small droplets

- Why are outbreaks so infrequent?

- Highly communicable with adequate duration of exposure
- Risk of PPD conversion in close contact 25-50%
- Transmission- tiny droplet aerosol
- Recirculated air- risk of TB is increased equally for all in facility
- Navy ship- 45% TST (tuberculin skin test) conversion
- Musher, D. M. N Engl J Med 2003;348:1256-1266

- 1966- USS Richard Byrd
  - Sailor with cavitary TB
  - 48% conversion rate
- 1987- USS Saipan
  - 24.5% conversion rate
- 1998- LHD
  - Ships company- 18.3% conversion rate
  - MEU- 34.3% conversion rate
  - 21 cases of active TB

- LHD- Large deck amphibious ship
  - Ship's crew- 1000
- MEU- Marine Expeditionary Unit
  - 2,200 personnel
    - 1,350 on LHD
    - 450 on LPD; 290 on LSD
- Military Medicine 2003;168:523-7.



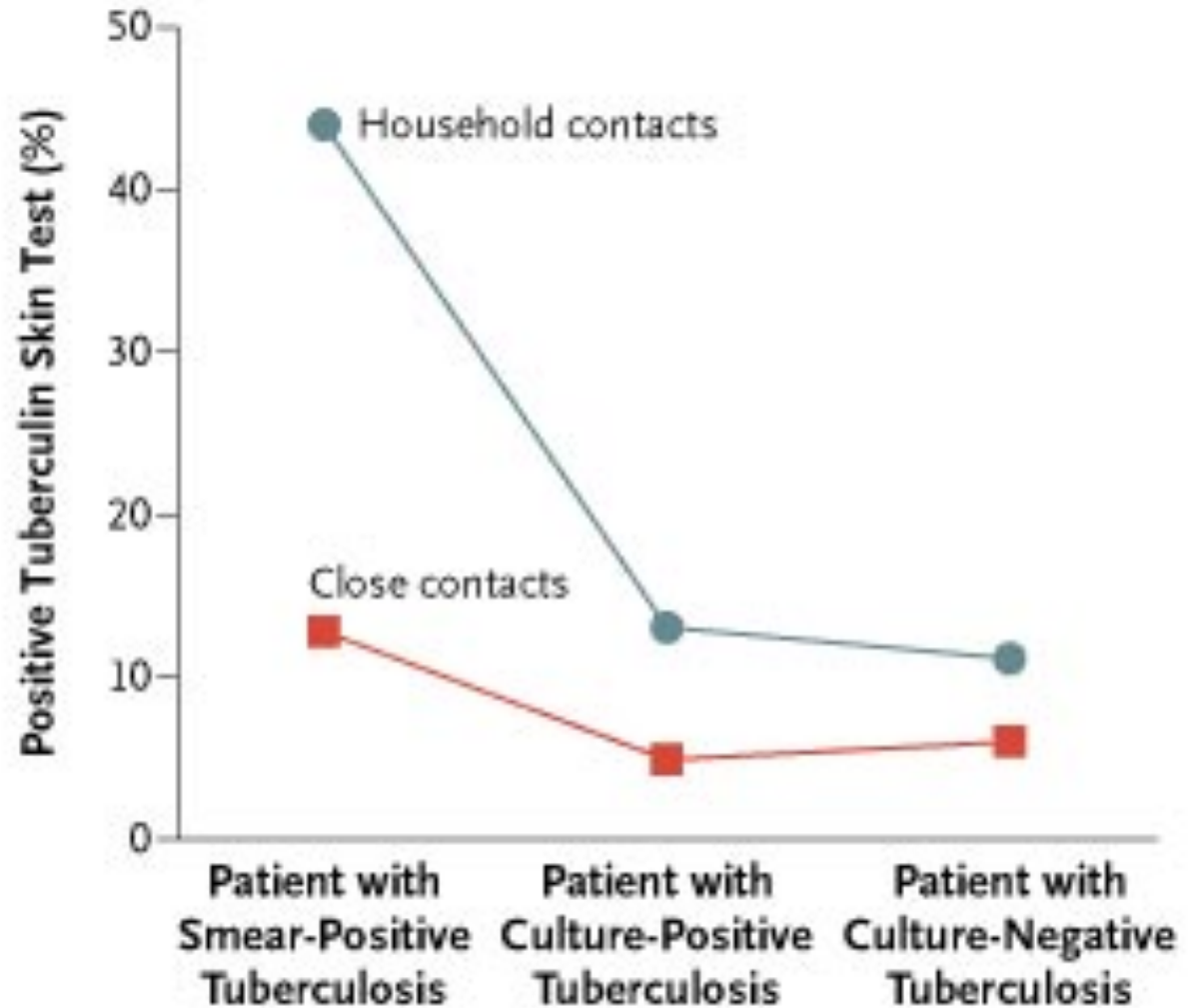
- 21-y-o white male Marine with MEU
- Berthing area
  - 100 Marines
  - Stacked 4 high
- Routine TST
  - JAN 1997- 0-mm
  - MAY 1998
    - Initial 16-mm
    - Repeat 0-mm

- MAY 1998- Symptomatic
  - Productive cough, SOB
  - CXR- bilateral diffuse infiltrate
  - Azithromycin
- JUN- 2 follow-ups
  - CXR- diffuse interstitial infiltrates
  - Albuterol MDI for DOE
  - Azithromycin
  - Pneumococcus on sputum C&S

- JUL 20- Admit to ward for perianal abscess
  - Fever 105
- JUL 25- return to port
  - Naval Hospital
- JUL 27- Pulmonary TB
  - CXR- evolution of cavitary lesion in right apex
  - 3 sputa- TNTC AFB
  - Sensitive *M. tb*
- Contact investigation- 684 cases of LTBI and 20 cases TB

Group	Tested	Positive TST, n (%)	Relative Risk
Ship's Crew- LHD	934	171 (18.3)	0.83
MEU- LHD	1,304	447 (34.3)	3.01
MEU- LPD	436	28 (6.4)	0.28
MEU- LSD	245	5 (2.0)	0.09
Community Contacts	319	16 (5.0)	0.22

Group	Tested	Active TB, n (rate/10 <sup>5</sup> )	Relative Risk
Ship's Crew- LHD	934	7 (749)	1.23
MEU- LHD	1,304	14 (1,074)	2.973.01
MEU- LPD	436	0	0
MEU- LSD	245	0	0
Community Contacts	319	0	0



- Musher, D. M. N Engl J Med 2003;348:1256-1266

- Index case
  - 32-y-o AD male Sailor
  - Attached to Carrier Air Wing Fourteen
  - Born in Philippines
  - Latent TB infection (LTBI) diagnosed in 1995
  - 6 month course of INH
  - Smear- and culture-positive, cavitary, pulmonary TB diagnosed on 13 JUL 06
- MMWR 2007;55:1381-2.  
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5551a3.htm>

- Deployed 4 JAN- 6 JUL 06
- Ship's company- 3,350 Sailors
- Air wing- 1,630 Sailors and Airmen
- Tiger Cruise- 29 JUN- 6 JUL
  - 1,225 family and friends
  - Hawaii to San Diego
  - Slept in same quarters as Sailors

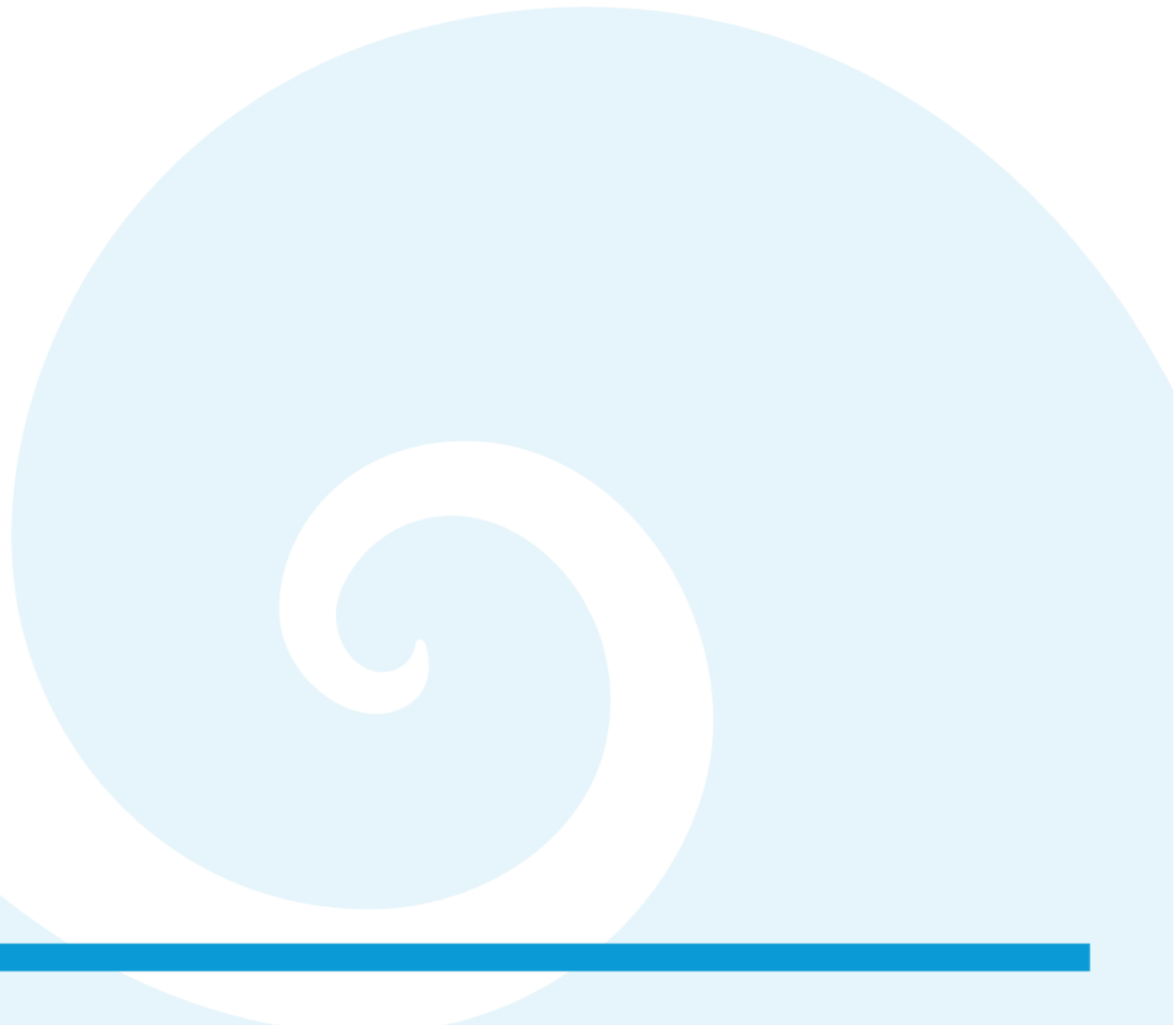


- Close contacts
  - 12 (4%) of 320 had new positive TST
- Expanded to all Sailors and civilians onboard >48 hours after 20 FEB 06
- Case-  $\geq 5$  mm increase in TST
- Control-  $< 5$  mm increase in TST
- Sailors with previous positive TST excluded
- No secondary cases of active TB

- 139 (3%) Sailors- new positive TST
  - INH
  - 123 (88%) met case definition
  - 47 (38%)- Ship's company (3,350)
  - 76 (62%)- Air wing (1,630)
- Risk Factors
  - Born outside US- AOR 2.8
  - Member of air wing- AOR 2.9

- Patient and other air wing Sailors
  - Open bay compartment with similar adjoining compartment
  - 120 bunks in stacks of 3 in each
- Patient's bunk- 18 feet from air intake that exhausted overboard
- Limited transmission of TB on ship outside berthing area

- 38 slept in same (31), or adjacent (7), berthing compartment as index patient
- 36 of 38 screened
  - 33 (92%)- negative TST
  - 2 (6%)- previous positive TST
  - 1 (3%)- 15-mm TST 18 days post exposure



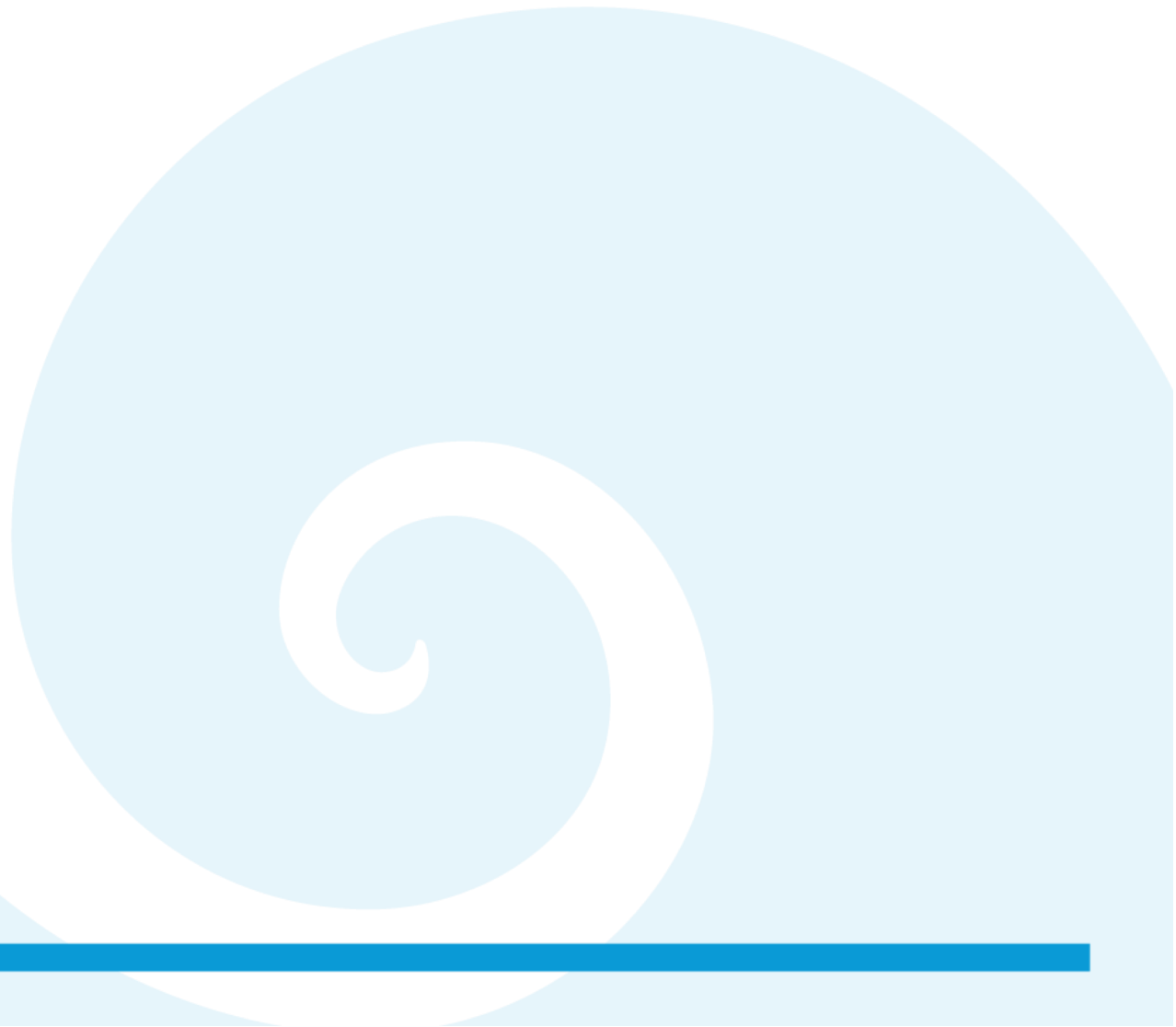


Table 1. Results of Tuberculin Skin Tests for the 760 Passengers and Crew Members, According to Flight.\*

TEST RESULT	FLIGHT 1 (N= 298)	FLIGHT 2 (N= 104)	FLIGHT 3 (N= 109)	FLIGHT 4 (N= 249)	TOTAL (N= 760)
	<i>number (percent)</i>				
Positive	7 (2.3)	4 (3.8)	3 (2.8)	15 (6.0)	29 (3.8)
No previous test†	7 (2.3)	4 (3.8)	3 (2.8)	9 (3.6)	23 (3.0)
Conversion	0	0	0	6 (2.4)	6 (0.8)
Negative‡	291 (97.7)	100 (96.2)	106 (97.2)	234 (94.0)	731 (96.2)

\*Flight 1 was from Honolulu to Chicago in April, flight 2 from Chicago to Baltimore in April, flight 3 from Baltimore to Chicago in May, and flight 4 from Chicago to Honolulu in May.

†These contacts had no results of previous skin tests in their medical records.

‡All 10 contacts who were exposed on two connecting flights had negative tuberculin skin tests.

- NEJM 1996;334:933-8

- NEJM  
1996;334:933-8

Table 2. Characteristics of the Passengers and Crew Members on Flight 4 Who Had Positive Tuberculin Skin Tests.

CONTACT No.	AGE	RACE OR ETHNIC GROUP*	SEX	ROWS FROM INDEX PATIENT	TUBERCULIN SKIN TEST		RISK FACTORS†	INFECTION STATUS‡
					FIRST	SECOND		
	yr				mm			
1	55	W	M	49	10	—	Uncle with tuberculosis	Previous
2	43	A	M	31	11	—	Foreign-born	Previous
3	76	W	M	26	10	—	Lived in Southeast Asia	Previous
4	30	W	M	24	4	18	Friend with tuberculosis	Previous
5	28	W	F	24	20	—	Friend with tuberculosis, health care worker	Previous
6	57	W	M	13	0	20	Foreign-born	Previous
7	51	W	F	13	18	—	Foreign-born	Previous
8	55	W	F	13	0	11	None identified	New
9	37	W	F	12	0	12	None identified	New
10	38	A	M	9	14	—	Foreign-born, received BCG	Previous
11	29	H	M	6	20	—	Foreign-born, received BCG	Previous
12	47	W	F	2	11	—	None identified	New
13	41	W	M	1	0	15	None identified	New
14	36	W	M	1	0	19	None identified	New
15	41	W	M	0	17	—	None identified	New

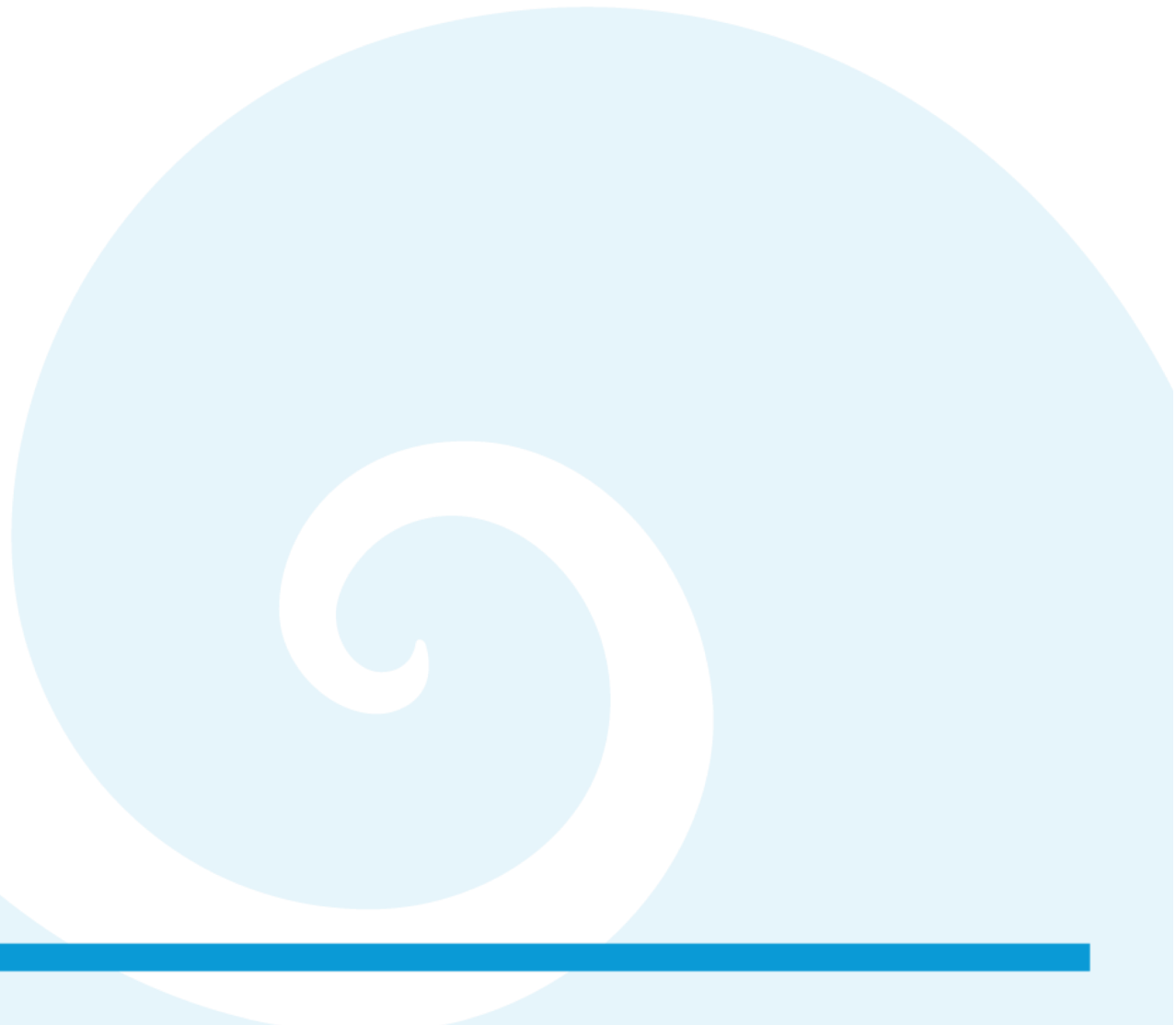
\*W denotes white, A Asian, and H Hispanic.

†Foreign-born denotes birth in a country where the rate of tuberculosis is at least 10 times higher than in the United States and where bacille Calmette–Guérin (BCG) vaccine is routinely used.

‡The investigators' determinations were based on the results of the skin tests and on the risk factors.



- Separate ill person by 3-6 feet
- Paper or gauze surgical mask
- Tissues if mask unavailable
- Gloves, hand washing
- Report illness to nearest US Quarantine station
- <http://www.cdc.gov/ncidod/dvrd/spb/mnpages/dispages/ebola/airline.htm>



- Male mine worker with influenza-like illness
- 3 hour 20 minute flight with co-workers on full BAe146 (capacity 175) returning to mine in north-western Australia
- 15 workers with acute influenza-like illness over 3-4 days
- Marsden. Med J Aust 2003;179:172-3.

- 5 other ill workers identified by phone on day 6
- Fever, cough, nasal congestion, anorexia, prostration
- No serologic tests done
- No illnesses in aircrew
- Marsden. Med J Aust 2003;179:172-3.

- 18 sat within “plume” around index 11 G
  - Within 6 rows forward or 4 back
  - Within 4 seats to side decreasing with distant rows
- 1 F- Conducted raffle
- 3 A- Supervisor who assessed index in airport lounge
- Marsden. Med J Aust 2003;179:172-3.



# Influenza Outbreak- Airline

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Front	G					F			F		I		F		F
	F	M			M				M	M	F		F	F	
	E				M						F			F	
	Aisle														
	B									F	F	F			F
	A			F							F				
		Rear													

- I = index patient.
- F = passenger developed influenza-like illness.
- M = passenger developed mild upper respiratory tract illness.
- [http://www.mja.com.au/public/issues/179\\_03\\_040803/letters\\_040803\\_fm-3.html](http://www.mja.com.au/public/issues/179_03_040803/letters_040803_fm-3.html)

- **Teen on AirTran flights has meningitis**
  - [http://www.usatoday.com/news/health/2007-07-23-plane-meningitis\\_N.htm?csp=34](http://www.usatoday.com/news/health/2007-07-23-plane-meningitis_N.htm?csp=34)
- **AirTran seeks passengers on flight with meningitis-afflicted teen**
  - [http://www.usatoday.com/travel/flights/2007-07-23-meningitis-passenger\\_N.htm?csp=34](http://www.usatoday.com/travel/flights/2007-07-23-meningitis-passenger_N.htm?csp=34)

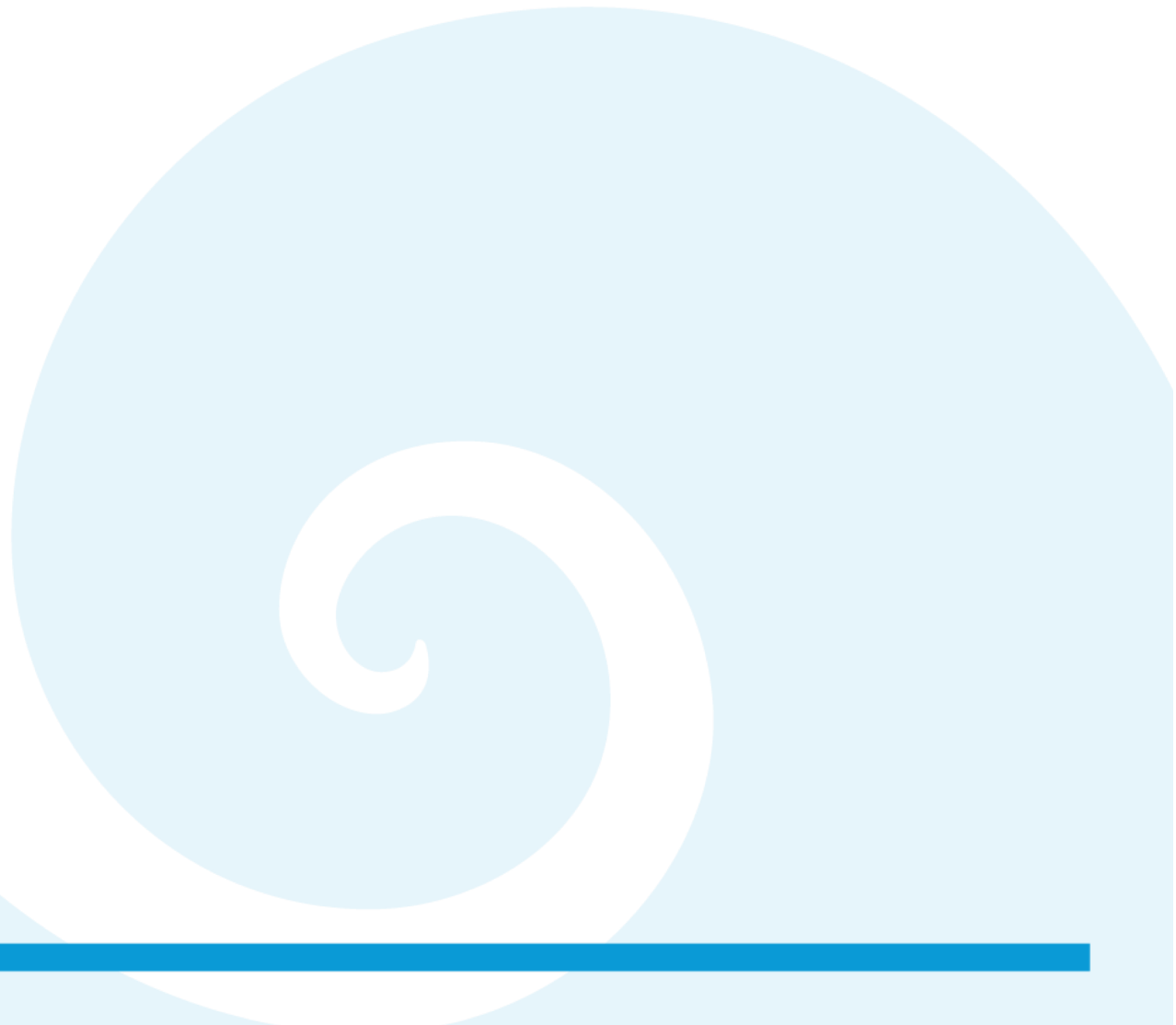
- No cases of secondary disease among passengers
- In-flight transmission can occur with TB, SARS, influenza
- Passengers seated next to index patient may be at increased risk
- MMWR. 2001;50:485-9



- CDC and Council of State and Territorial Epidemiologists (CSTE)
- Contacts- Chemoprophylaxis recommended
  - Household members traveling with index
  - Other close contacts traveling (roommates)
  - Direct contact with patient's secretions
- MMWR. 2001;50:485-9

- Risk to passengers and aircrew
- Based on flight duration and proximity
- Chemoprophylaxis recommended
  - Flight >8 hours including ground time
  - Passengers seated next to index patient
- MMWR. 2001;50:485-9

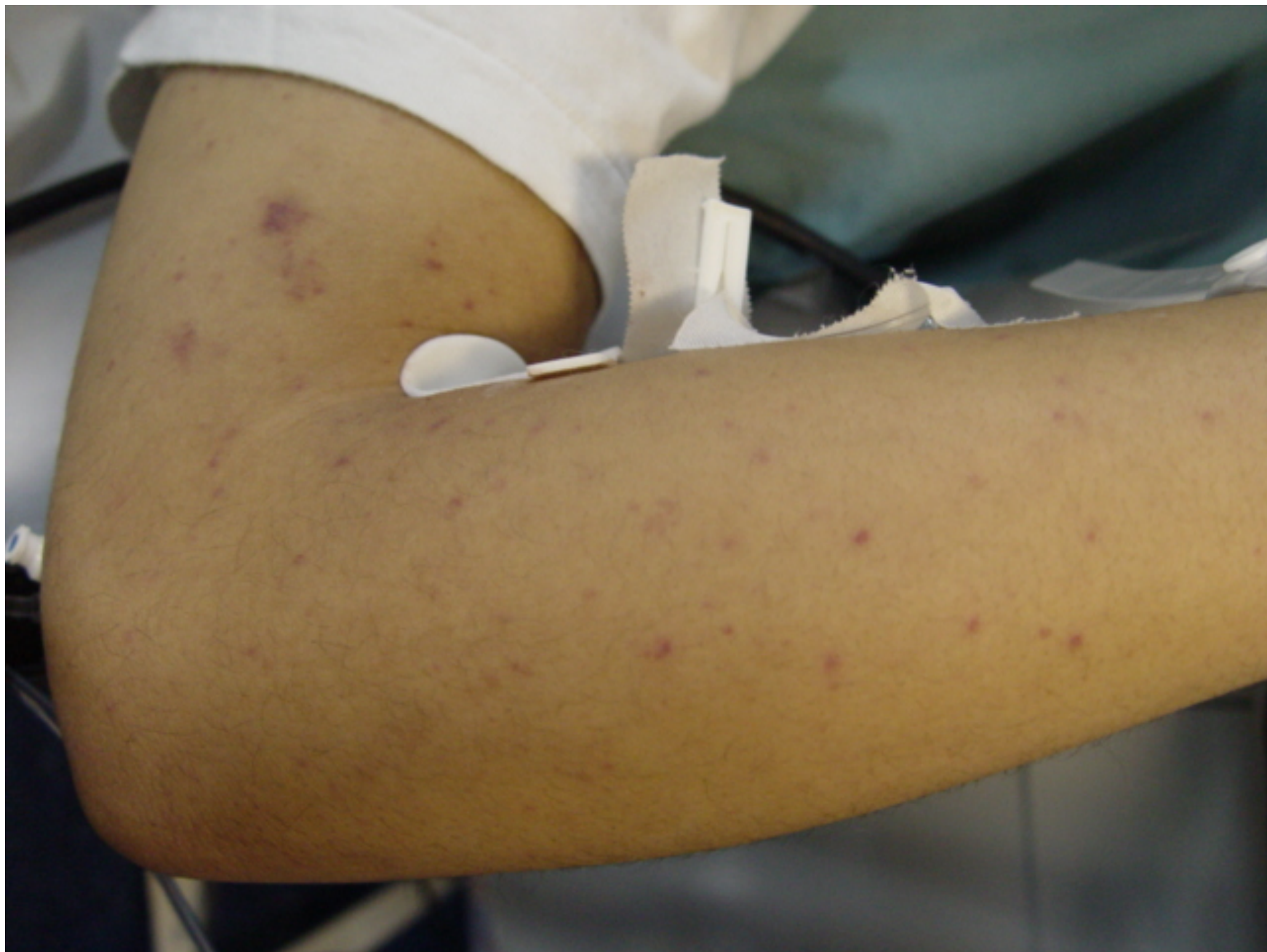
- Notify health departments
  - Where patient has been living
  - Where patient has been visiting
  - Destination of passenger contacts
- Notify federal health authorities
  - CDC quarantine station notifies airlines
- MMWR. 2001;50:485-9



- 24-y-o Hispanic male
- Ordnanceman (AO3) on HST returning to Norfolk from Mediterranean Sea and Operation Iraqi Freedom DEC 2002-May 2003
- Unable to get out of bed on Saturday, 17 May
- 2-day history of fever, arthralgias, and myalgias
- Stayed in bed day prior to admission

- T 101 F; HR 130; BP 86/52
- Pulse oximetry O2 Sat'n 100%
- Alert and partially oriented
  - "In Medical on HST"
  - "Friday, May 14"
- Lungs- clear to A
- Heart- regular tachycardia without murmur, rub, gallop

- Neck
  - Unable to actively flex
  - Positive Kernig's and Brudzinski's signs
- Skin
  - Fixed petechial rash with  $< 1$  cm purpuric lesions
  - Trunk, arms, palms
  - No splinter hemorrhages











- WBC- 31,500 (63 PMN; 8 Band; 2 Meta; 4 Myelo; 19 Lct; 4 Mono
- Platelets- 146,000
- Creat 1.8; BUN 35
- Na 141; k 3.4; CO2 26; CL 95
- Tbil 1.9/Dbil 0.8; AST 42; ALT 30

- RPR- negative
- ECG- sinus tachycardia
- CSF- cloudy
  - 28,500 WBC
  - Gram stain- several PMNs; no organisms seen

- 0619- Medical response team
- 0650- IVF with NS and droplet isolation
- 0658- ceftriaxone 2 grams IV
- 0730- Lumbar puncture completed; transported to ICU
- 0930- CSF results -many neutrophils but no organisms; Vancomycin 1 g IV

- Marseille, France 22-26 DEC
- Souda Bay, Crete 29 DEC-2 JAN
- Koper, Slovenia 31 JAN-6 FEB
- Portsmouth, England 6-12 MAY
  - 6-8, 10-11 May- slept on ship
  - 9 May- hotel in London
  - 7 May- intimate contact with women at Club Walkabout in Portsmouth

- Close contacts
  - Household
  - Military sharing same berthing
  - Close enough to share eating utensils
  - Close friends at school but not entire class
- Health care workers not at increased risk unless contact with secretions

- > 4 hours in a day during previous 7 days
- Same berthing area
- Same work center
- Stood watches together
- Close friends- Portsmouth or ship



- Rifampin 600 mg po q12h for 2 days
  - Children <1 month 5 mg/kg q12h
  - Children >1 month 10 mg/kg q12h
- Ciprofloxacin 500 mg po x 1 dose
- Ceftriaxone 250 mg IM x 1 dose
  - Children <15 years 125 mg IM x 1 dose
- MMWR. 2001;50:485-9



