

Epidemiology of Influenza in the Hospital Setting

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Nosocomial Influenza - Definitions

- Disease definitions
 - CDC: “Influenza-like Illness” (ILI)
 - Temp $\geq 37.8^{\circ}\text{C}$
 - Cough or sore throat (or both)
 - No other documented cause of illness
 - Other clinical definitions
 - Laboratory confirmed cases
 - Culture
 - Serologic tests
 - Others: DFA, rapid antigen tests, PCR
- Timing definitions
 - ≥ 72 hours after admission
 - ≥ 48 hours after admission

Not All ILI Patients Have Influenza

- Blumenfeld: 22/30 nosocomial ILI with positive convalescent titers
- Weingarten: 2/4 nosocomial ILI with positive cultures
- Pachucki: 15/38 submitted specimens (patients and HCW) with positive cultures
- Rivera: 16/21 nosocomial ILI patients with positive convalescent titers
- Van Voris: 18/29 nosocomial ILI patients with either positive culture or positive convalescent titers (1/11 non-positive with confirmed RSV)
- Glezen: 6/17 nosocomial ILI patients with positive culture

Blumenfeld HL. J Clin Invest. 1959;38:199-212

Rivera M. Am J Nursing. 1982;82:1836-1838

Voris LP. Ann Intern Med. 1982;96:153-158

Weingarten S. Arch Intern Med. 1988;148:113-116

Pachucki CT. Arch Intern Med. 1989;149:77-80

Van Glezen WP. Can J Infect Control. 1991;6:65-67

Not All Influenza Patients Have an ILI

TABLE 4. Frequency of Influenza-Like Illness (ILI) Among Patients Found To Have Influenza Virus Infection

ILI Symptom	No. (%) of Patients
Temperature $\geq 37.8^{\circ}\text{C}$	124 (60)
Temperature $\geq 37.8^{\circ}\text{C}$ and cough	106 (51)
Temperature $\geq 37.8^{\circ}\text{C}$ and sore throat	25 (12)
Temperature $\geq 37.8^{\circ}\text{C}$ and either cough or sore throat ^a	106 (51)

^a Centers for Disease Control and Prevention definition of ILI.

Estimates of Nosocomial Influenza

- Weingarten: 0.3 cases / 100 hospital admissions (2/663)
- Glezen: 0.6 cases / 100 hospital admissions
- Weinstock: 0.73 - 2.62 / 10,000 patient days (cancer center)
- Adal: 0.01 – 0.14 / 100 admissions (overall 0.08)
- Babcock: 0 / 335 participating patients

Weingarten S. Arch Intern Med. 1988;148:113-116

Glezen WP. Can J Infect Control. 1991;6:65-67

Adal KA. Infect Control Hosp Epidemiol. 1996;17:641-648

Weinstock DM. Infect Control Hosp Epidemiol. 2000;21:730-732

Babcock HM. personal communication

Outbreak - 1957 Pandemic

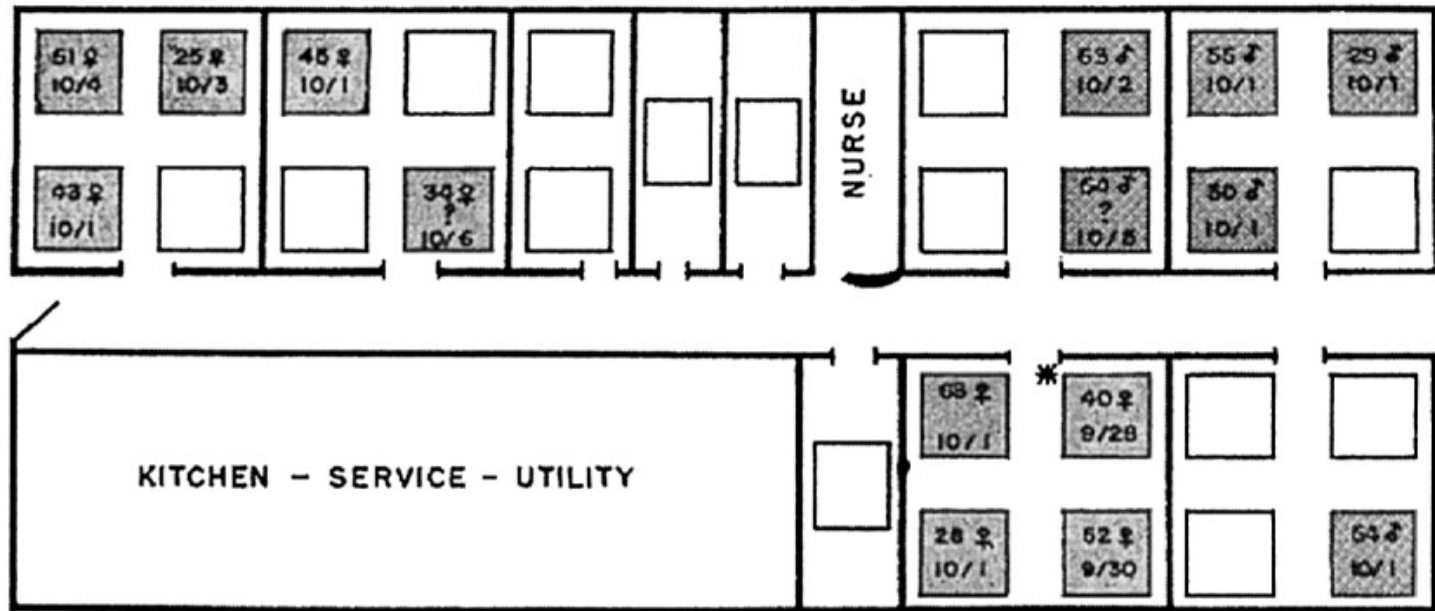
- 1957 “Asian Flu” H2N2
 - SW China February
 - US cases starting in May, slow during summer, epidemics Sept-Dec
- Ward H5 at New York Hospital - Cornell Medical Center
 - 29 patients, 33 healthcare workers
 - 22 HCW vaccinated with monovalent vaccine

patient attack rate 15/29 (52%)

INFLUENZA EPIDEMIC

HCW attack rate 15/33 (45%)

WARD H-5 29 PATIENTS



PERSONNEL (33)

	DOCTORS	NURSES	STUDENTS (MEDICAL)	STUDENTS (NURSING)	NURSES AIDES	OTHER
VACCINE	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> 10/4 <input checked="" type="checkbox"/> 10/10 <input checked="" type="checkbox"/> 9/29 <input type="checkbox"/>			<input checked="" type="checkbox"/> 10/5 <input checked="" type="checkbox"/> 10/10 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input checked="" type="checkbox"/> 10/3 <input checked="" type="checkbox"/> 10/4 <input type="checkbox"/>
NO VACCINE	<input checked="" type="checkbox"/> 9/30	<input type="checkbox"/>	<input checked="" type="checkbox"/> 10/1 <input checked="" type="checkbox"/> 10/2 <input type="checkbox"/>	<input checked="" type="checkbox"/> 9/30 <input checked="" type="checkbox"/> 10/1 <input checked="" type="checkbox"/> 10/3 <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> 10/4 <input checked="" type="checkbox"/> 10/1	<input type="checkbox"/>	

Epidemiology of 12 Nosocomial Acute-Care Influenza Outbreaks

- Strains: A (11; mostly H3N2), B (2)
- Years: 1960s (1), 1970s (4), 1980s (2), 1990s (3), 2000s (2)
- Outbreak durations: 2-69 days (median 7)
- Attack rates: Patients – 3-50% (affected wards)
– 0.7-20% (hospital-wide)
HCWs – 11-59% (flu caregivers)
- Patient mortality: 0% (5); 10-67% (7)

Review of 17 Reports of Nosocomial Influenza

- 5 reports also in Salgado et al.
- Years: 1950s (1), 1960s (1), 1970s (3), 1980s (6), 1990s (1)
- Strains: A (10), B (1), A & B (1)
- Patient mortality: 0% (6), 6-33% (6)
- In most reports fewer than 1/3 of HCW vaccinated

Special Populations - HIV

- Outbreak at residential AIDS facility in NYC 1996
 - 34/65 (52%) residents with ILI
 - 19/68 (28%) employees with ILI
 - 20/31 (65%) ILI patients had laboratory confirmed influenza
 - 2/41 (5%) of participants w/o ILI who were tested had (+) serologies (both were residents)

Special Populations - HIV

Influenza Attack Rates

Characteristic	All persons (n = 133)			Residents (n = 65)			Employees (n = 68)		
	No. (%)	RR	P	No. (%)	RR	P	No. (%)	RR	P
AIDS	37 (52.9)	2.1	.001	34 (100)	NA	—	3 (60.0)	2.4	.129
No AIDS	16 (25.4)			0			16 (25.4)		
HIV infection	38 (52.1)	2.1	.002	34 (100)	NA	—	4 (50.0)	2.0	.145
No HIV infection	15 (25.0)			0			15 (25.0)		
Vaccinated ^a	26 (32.5)	0.7	.063	16 (43.2)	0.7	.086	10 (23.3)	0.8	.528
Unvaccinated	24 (49.0)			17 (65.4)			7 (30.4)		
Other chronic illness ^b	16 (50.0)	1.4	.177	13 (68.4)	1.5	.097	5 (23.8)	0.8	.705
No other chronic illness	35 (36.5)			21 (45.7)			13 (28.3)		
Current smoker	39 (54.2)	2.4	.001	33 (57.9)	4.6	.019	6 (40.0)	1.6	.195
Nonsmoker	14 (23.0)			1 (12.5)			13 (24.5)		

On multivariate analysis, current smoking status was strongest predictor of influenza, followed by vaccination status. HIV/AIDS status was not strongly predictive.

Special Populations - Transplant

- BMT unit, 1998
 - Source: BMT patient admitted with ILI but not isolated
 - Patient attack rate: 7/27 (26%)
 - 5 staff with ILI
- Solid organ transplant unit, 2000
 - Patient attack rate: 4/12 (33%)
 - Source: nurse with ILI. 2/26 (8%) other HCW developed ILI

Control of Influenza in the Hospital Setting

Influenza - Routes of Spread



Measures Used to Control Outbreaks

- Isolating or cohorting patients with ILI
 - Restricting group activities
- Having staff wear masks
- Closing ward to new admissions
- Limiting or prohibiting visitors
- Having ill HCW stay home
- Antiviral prophylaxis

- Vaccinating patients/HCW

Key Unanswered Questions

- What is the true incidence of nosocomial influenza, and how do we prevent it?
 - How common is clustering, really?
 - Which patients and HCW had what levels of exposure?
 - What factors are associated with transmission?
 - patient factors
 - hospital factors
 - HCW factors
 - process factors
 - visitor factors
 - How can influenza patients best be identified early?
 - What interventions prevent nosocomial influenza?

Key Unanswered Questions

- Healthcare worker beliefs, knowledge and behaviors
 - How do we motivate HCW to stay home if ill?
 - How do we motivate them to come to work if well?
 - How do we influence adherence to infection control measures?
 - administrative controls (e.g., initiating isolation)
 - personal protective equipment
 - vaccine acceptance