SARS

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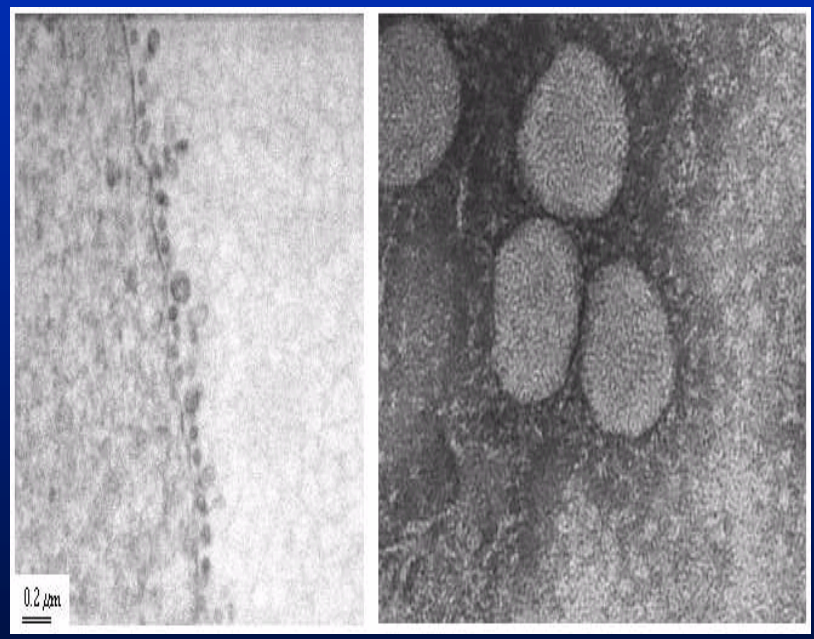
Characteristics of SARS-CoV

- 100nm
- Enveloped
- Ability to survive outside host



Sequential Quantitative PCR SARS Co-V

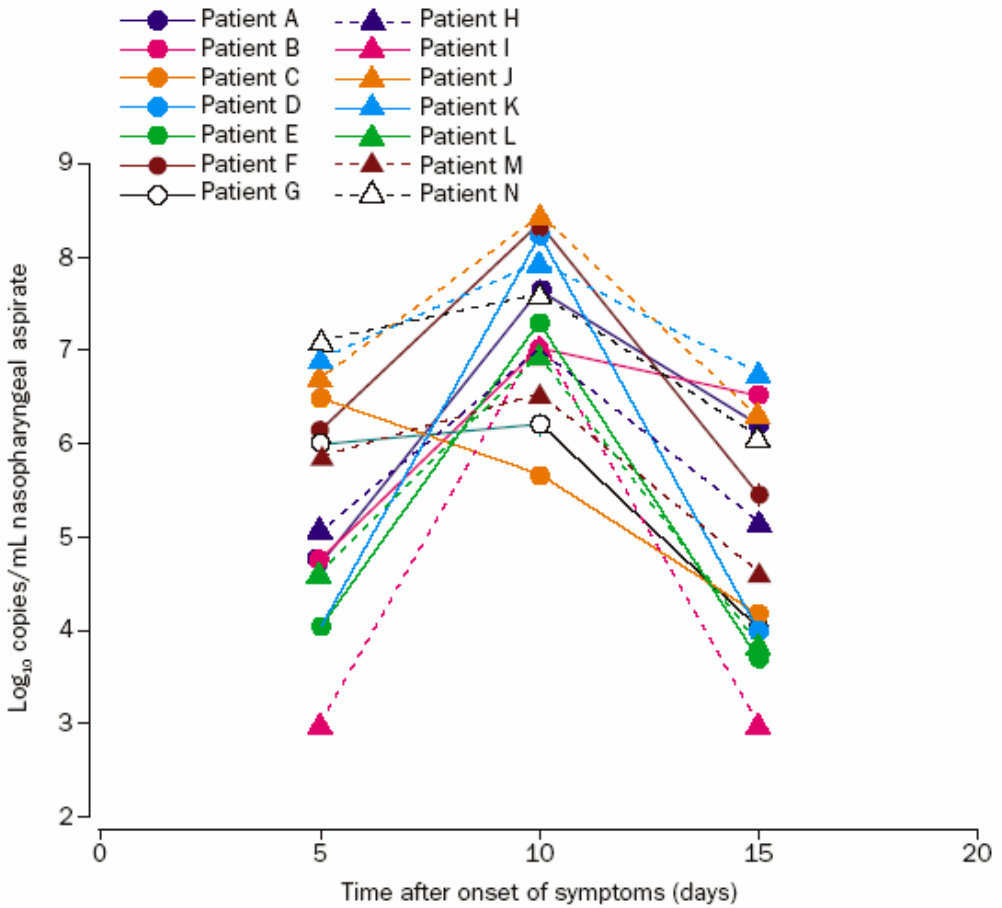
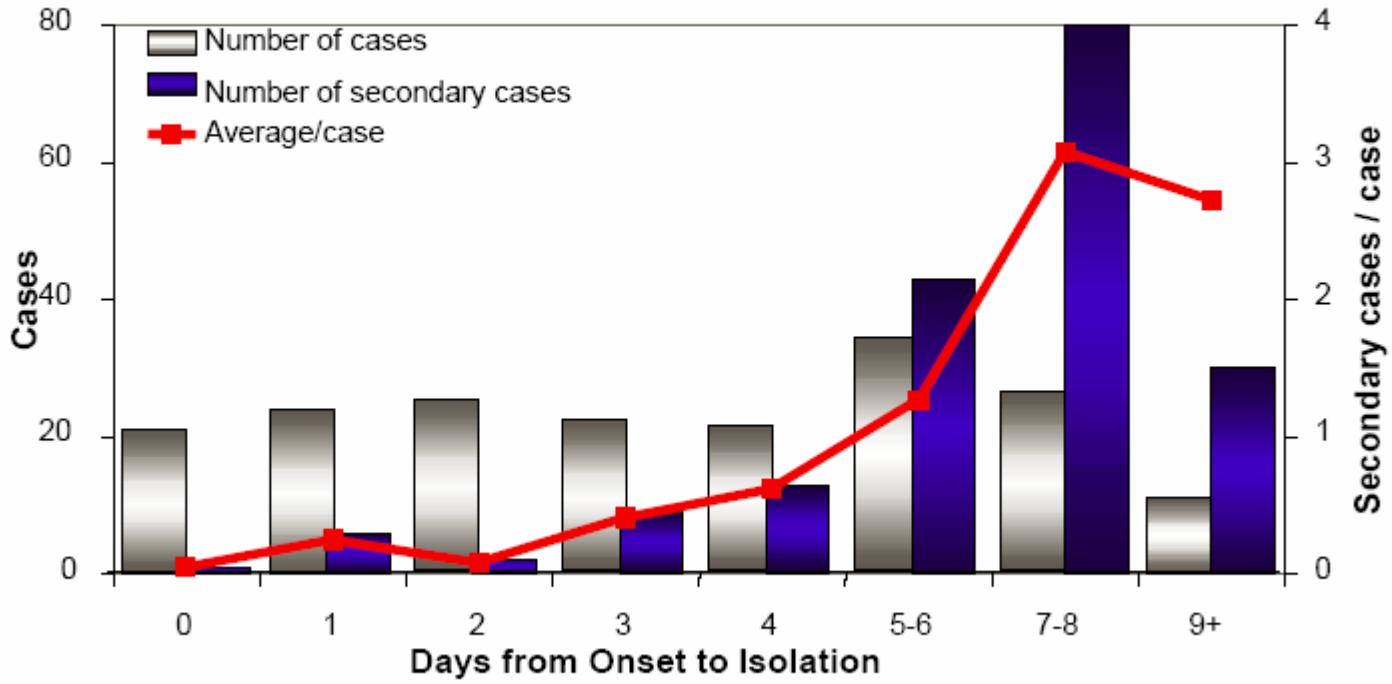


Figure 4: **Sequential quantitative RT-PCR for SARS-associated coronavirus in nasopharyngeal aspirates of 14 SARS patients**

Peiris et al, Lancet 2003

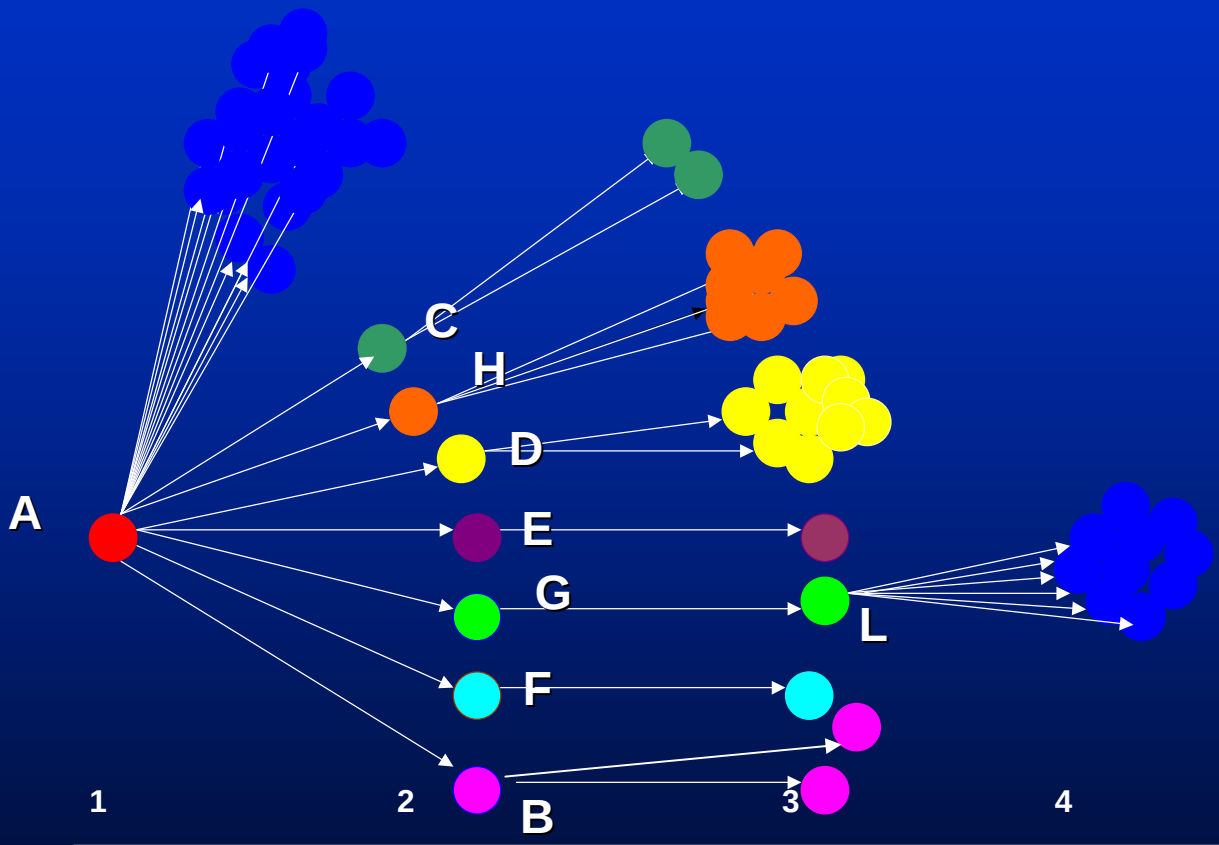
Transmission Efficiency

Figure 1. Secondary cases of SARS by days to isolation of the source case. Singapore, reported to 15 April, 2003



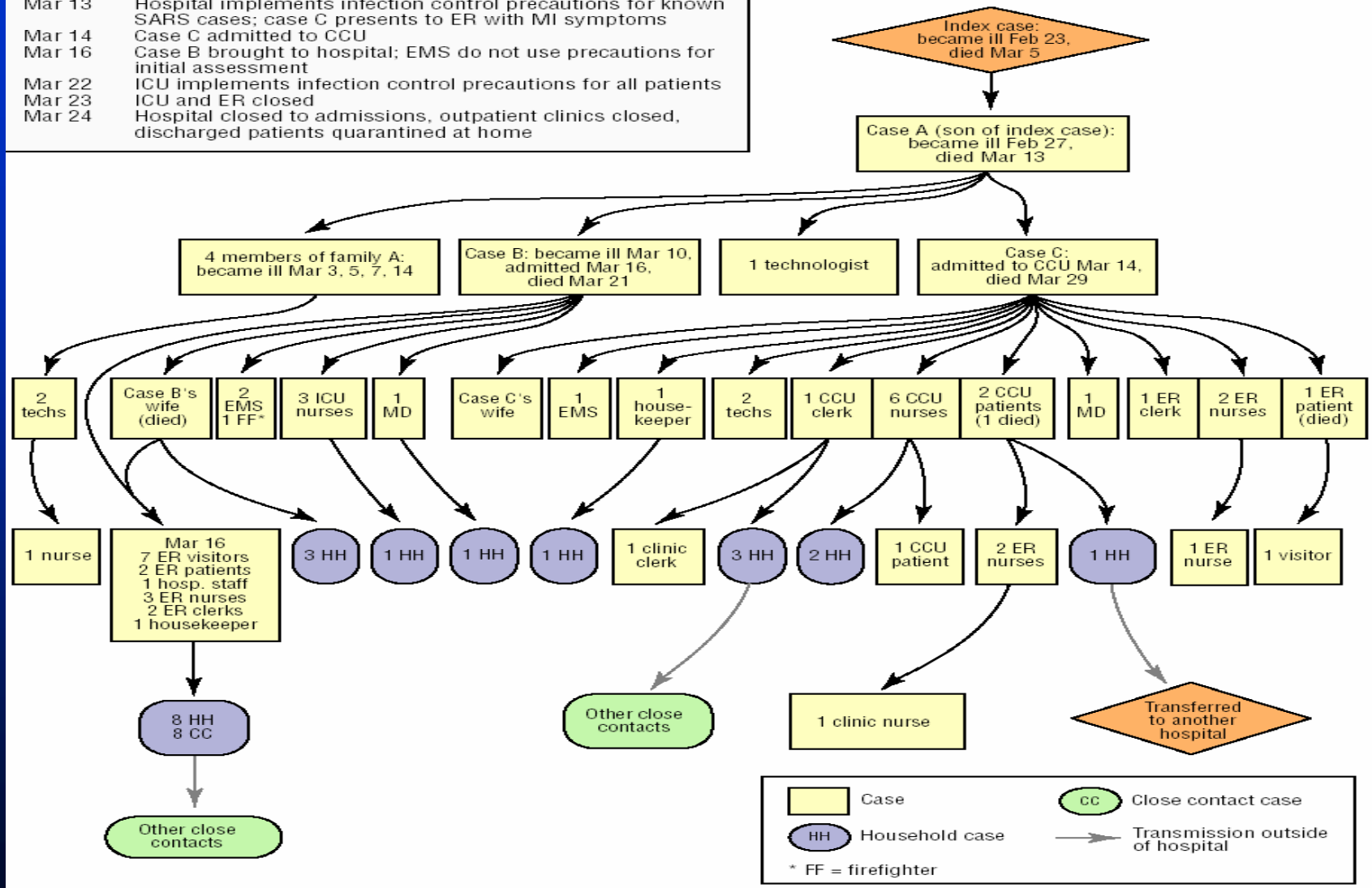
WHO Epidemiology Report

Superspreading SARS Events, Beijing



Shen et al, Emerg Infect Dis 2004

Feb 23	Index case becomes ill
Mar 7	Son of index case (case A) presents to ER, transmits SARS to 2 patients (cases B and C)
Mar 8-10	Case A's family visits him
Mar 10	ICU implements infection control precautions for case A
Mar 12	WHO issues first alert
Mar 13	Hospital implements infection control precautions for known SARS cases; case C presents to ER with MI symptoms
Mar 14	Case C admitted to CCU
Mar 16	Case B brought to hospital; EMS do not use precautions for initial assessment
Mar 22	ICU implements infection control precautions for all patients
Mar 23	ICU and ER closed
Mar 24	Hospital closed to admissions, outpatient clinics closed, discharged patients quarantined at home



Nurses' Relative Risk for SARS by Patient Care Activities

Patient Care Activity	No. (%) nurses exposed		RR (95%CI)	P
	SARS (n=8)	Healthy (n=24)		
Intubation	3(38)	1(4)	4.20 (1.58 – 11.14)	0.04
Suctioning	3(38)	1(4)	4.20 (1.58 – 11.24)	0.04
Nebulizer	3 (38)	2 (8)	3.24 (1.11 – 9.42)	0.09
Manipulation 02 mask	7 (88)	7(29)	9.00 (1.25 – 64.9)	0.01
Insertion of urine catheter	2 (25)	0(0)	5.00 (2.44 – 10.23)	0.06
Manipulation of bedpan	3 (38)	2 (8)	3.24 (1.11-9.42)	0.09
Dressing change	1 (13)	5 (21)	0.62 (0.09 –4.13)	1.00
Bronchoscopy	1 (13)	1 (4)	2.14 (0.46-9.90)	0.44
Chest physiotherapy	2 (25)	5 (21)	1.19 (0.30-4.65)	1.00

Loeb et al, Emerg Infect Dis 2004

Subject exhaling previously inhaled saline aerosol mist while wearing nonrebreathing oxygen mask (top, A) and Venturi-type oxygen mask (bottom, B)

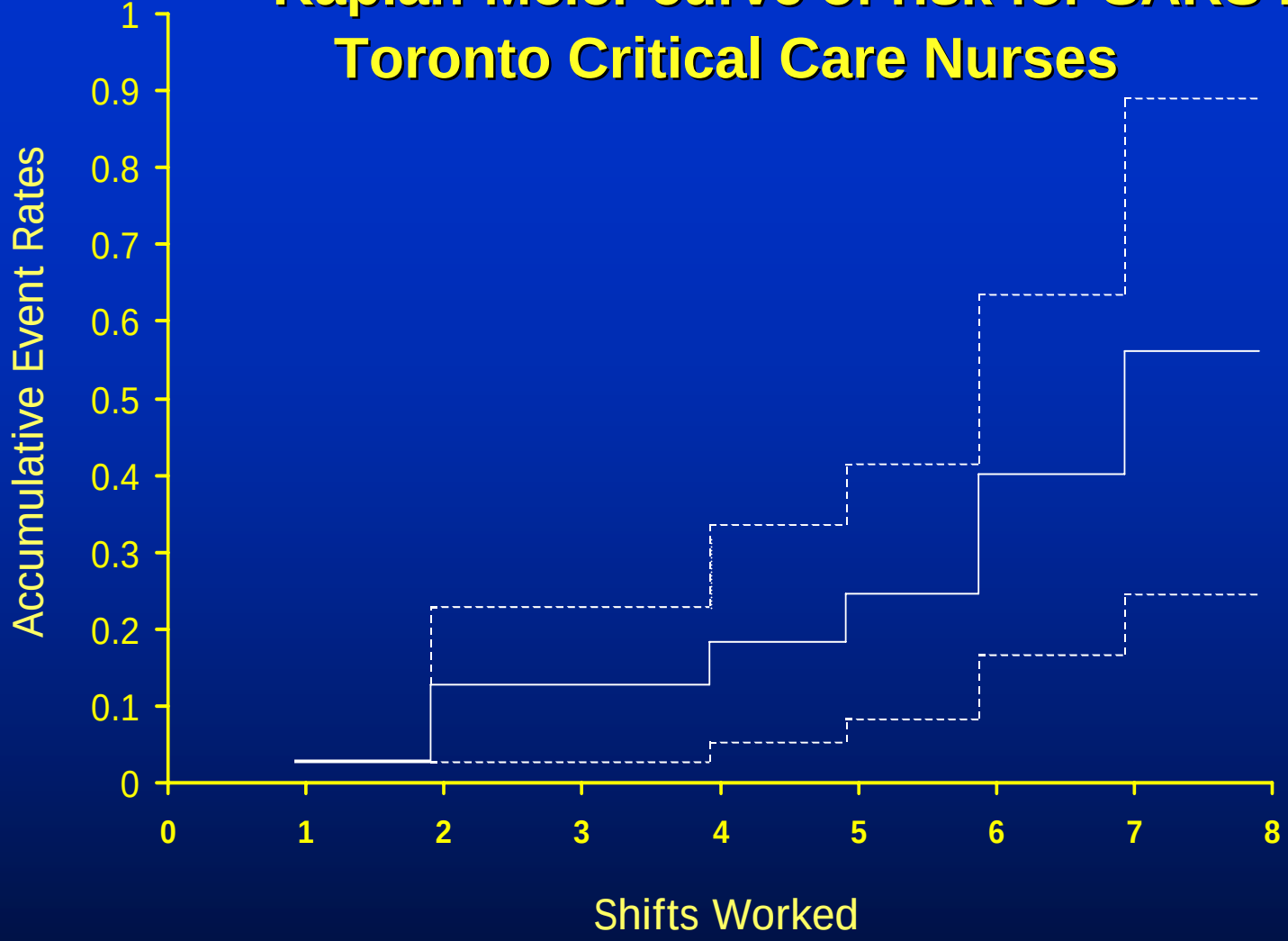
Somogyi, R. et al. Chest 2004;125:1155-1157

Nurses' Relative Risk for SARS by PPE

PPE	No. (%) nurses		RR (95% CI)	P
	Cases (n=8)	Non-cases (n=24)		
Gown	3(38)	17 (71)	0.36 (0.10 – 1.24)	0.12
Gloves	4(50)	18 (75)	0.45 (0.14 –1.46)	0.22
N95 or surgical mask	3 (38)	20 (83)	0.23 (0.07-0.78)	0.02
N95 vs no mask	2 (29)	14(78)	0.22 (0.05-0.93)	0.06
Surg vs no mask	1 (17)	3(43)	0.45 (0.07-2.71)	0.56
N95 vs surg mask	2(67)	14(82)	0.50(0.06-4.23)	0.51

Loeb et al, Emerg Infect Dis 2004

Kaplan-Meier curve of risk for SARS in Toronto Critical Care Nurses



Nurses remaining	**43**	**32**	**23**	**14**	**14**	**10**	**4**	**1**
Events	**0**	**3**	**0**	**1**	**1**	**2**	**1**	**0**

Loeb et al, Emerg Infect Dis 2004

Hong Kong Study

PPE	No. (%) Staff: Infected (n=13)	No. (%) Staff: Non-infected (n=241)	Odds ratio (95% CI)	P
Protective Measures				
Masks	2 (15)	169 (70)	0.07 (0.01-0.30)	0.0001
Paper mask	2	26		0.5
Surgical mask	0	51		0.007
N95	0	92		0.0004
Gloves	4 (31)	117 (48)	0.47 (0.10-1.75)	0.36
Gowns	0 (0)	83 (34)	NC	0.006
Hand-washing	10 (77)	227 (94)	0.21 (0.05-1.31)	0.047
All measures	0 (0)	69 (29)	NC	0.022

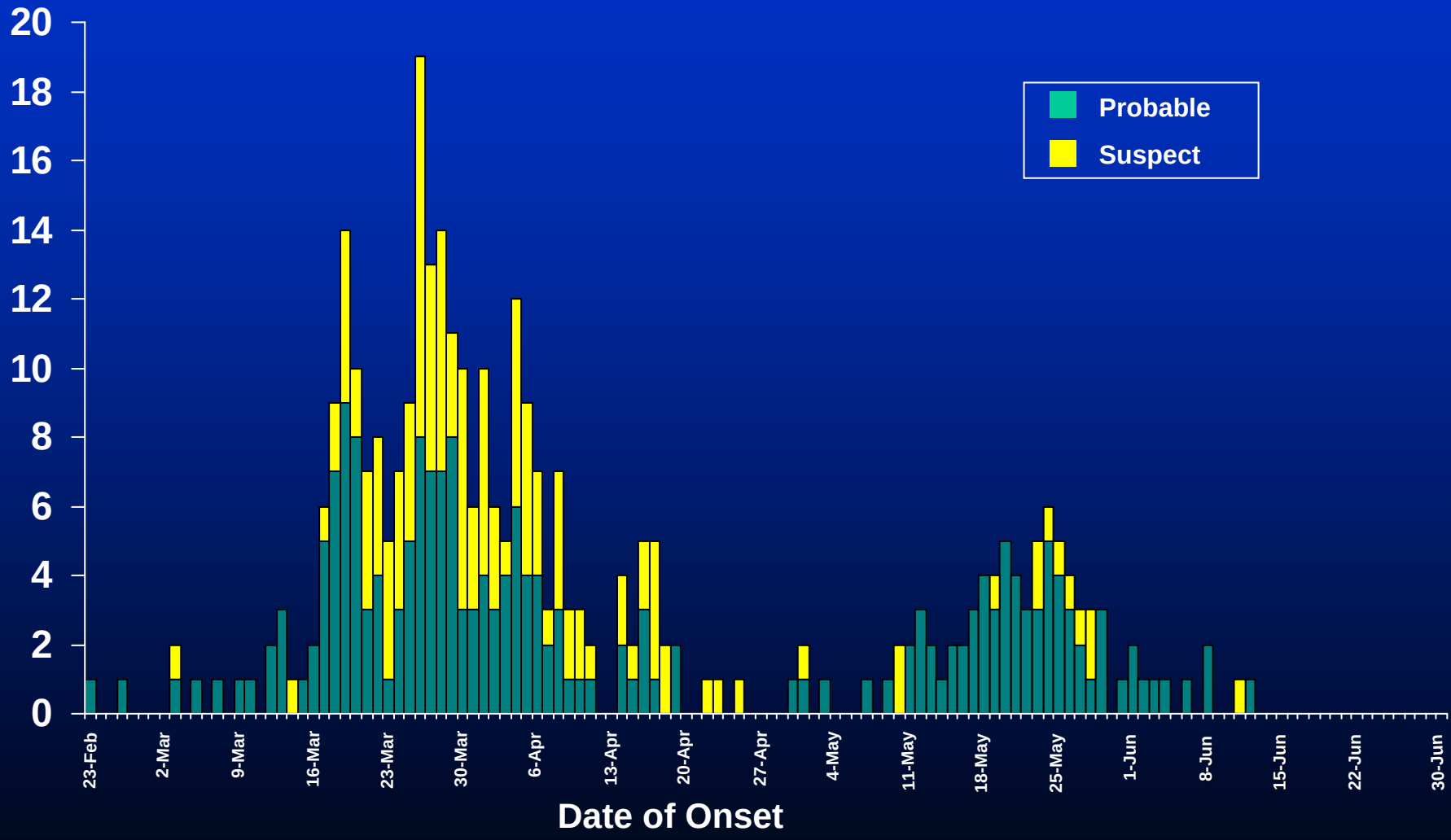
Seto et al, Lancet 2004

Multivariable Analysis of Factors Associated with Transmission of SARS to Health-Care Workers in Singapore

Covariate	Adj. OR	95% CI	P value
Gender			
Male	2.9	0.2-34.0	0.4
Ethnic group			
Chinese	2.0	0.7-6.1	0-2
Non-Chinese			
Wearing of N95 mask	0.1	0.02-0.9	0.04
Wearing of gloves	1.5	0.3-7.2	0.6
Wearing of gowns	0.5	0.4-6.9	0.6
Hand washing after each patient	0.07	0.008-0.7	0.02
Contact with respiratory secretions	21.8	1.7-274.8	0.017

Teleman, Epidemiol Infect 2004

Probable and Suspect Cases of SARS in Ontario by Date of Onset



Characteristics of 11 HCWs who had symptoms of SARS following intubation

HCW	Date	Case	Occupation	Exposure
1	April 15	Suspect	RT	before, during, after intub
2	April 16	Suspect	ICU nurse	before, during, after intub
3	April 16	Suspect	ICU nurse	before, during, after intub
4	April 16	Suspect	RT	before, during, after intub
5	April 16	Probable	Ward MD	on ward
6	April 17	Probable	ICU MD	before, during, after intub
7	April 17	Suspect	ICU nurse	before, during, after intub
8	April 18	Suspect	ICU MD	on ward
9	April 18	Suspect	X-ray tech	on ward
10	April 18	Not a case	ICU nurse	after intubation
11	April 21	Not a case	ICU MD	before intubation

MMWR 2003;52:433-436

Initial Multivariable Analysis of Risk Factors for SARS among HCWs in Toronto Exposed to Patients Prior to Intubation

Variable	Adj. OR	95% CI	P value
Resp. and contact precautions (other than SARS)	4.8	0.97-24.1	0.053
Splash secretions in eyes	17.3	7.5-39.9	0.0001
N95 Fit Test Done	0.38	0.14-1.04	0.06
SARS Infection Control Training	0.27	0.09-0.83	0.02
Fiber optic intubation	7.5	2.7-20.7	0.0001
Suctioning before intubation	0.28	0.19-0.43	0.0001
High frequency ventilation	4.5	1.13-18.6	0.03
Cardiac Compression	12.1	4.8-30.5	0.0001
ECG	3.1	1.7-5.9	0.0003

Shigayeva et al, ICAAC 2004

Case-Control Study Hong Kong

Variable	Odds Ratio (95%CI)	P
Perceived Inadequacy of PPE Supply	4.27 (1.66 to 12.54)	0.003
SARS Infection Control Training < 2 hours	13.6 (1.24 to 27.50)	0.002
Inconsistent Use of > PPE with direct Patient Contact	5.06 (1.91 to 598.9)	0.02

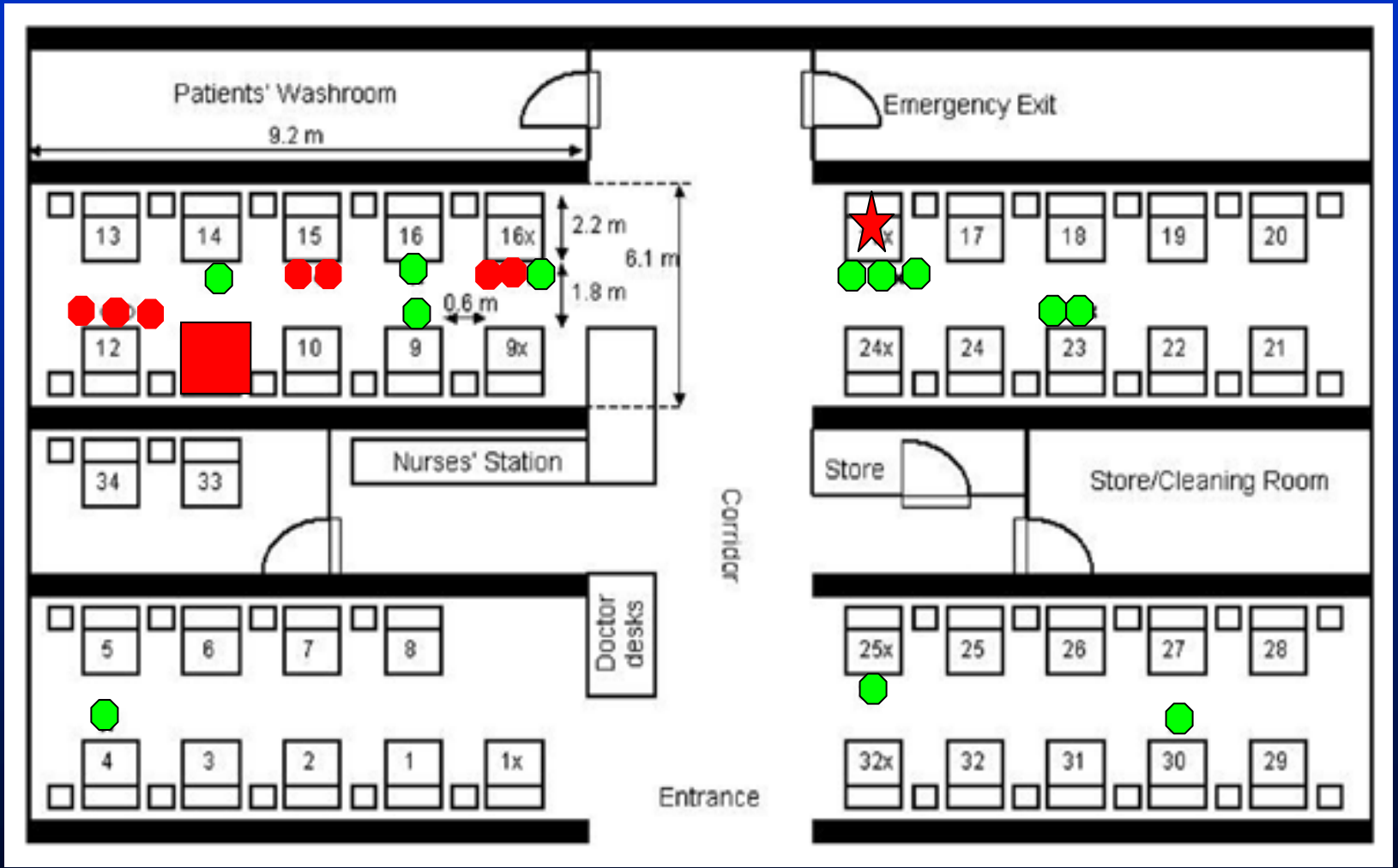
Lau et al, EID 2004;10:280-286

HCWs in US Hospitals Reporting Exposure to SARS

Procedure	No. HCWs	No respirator	No gown, gloves, & eye protection
Coughing	66	27(40)	34 (52)
Diarrhea	11	4(36)	6(55)
Airway manipulation	5	NA	NA
Aerosolized meds	4	1(25)	1(25)
Resuscitation	1	NA	NA
Bronchoscopy	1	0(0)	0(0)

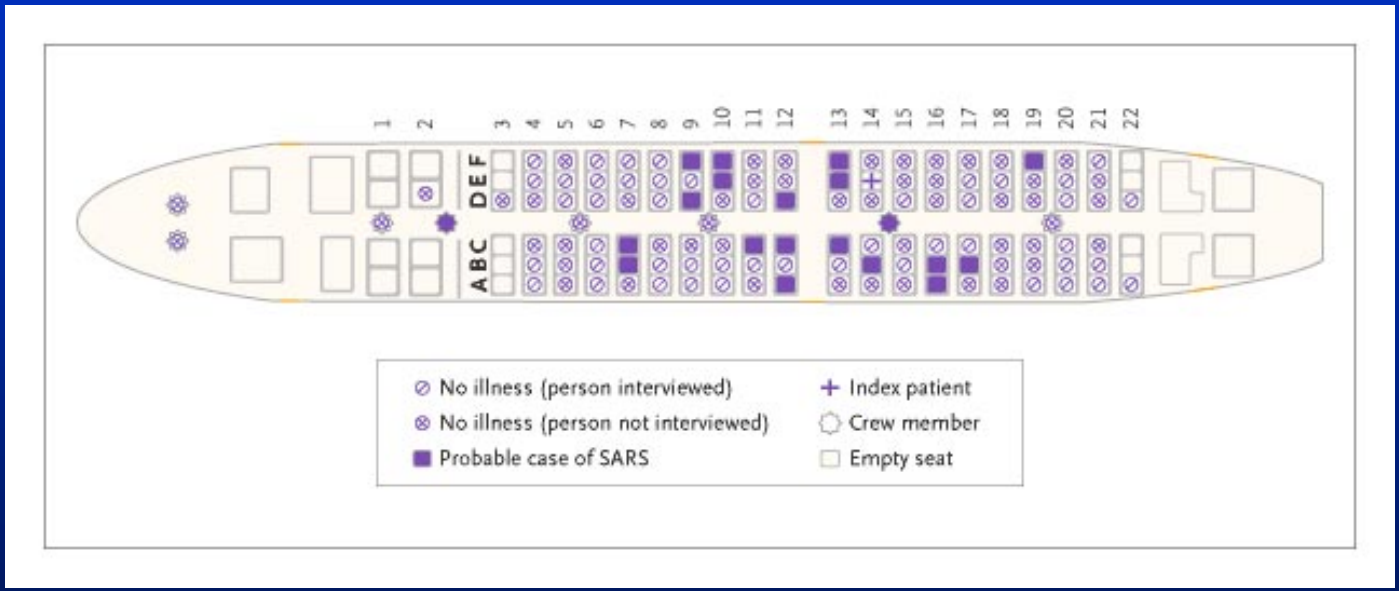
Park et al, Emerg Infect Dis 2004

SARS in medical students exposed to a single unrecognized patient, Hong Kong



Wong, EID Feb2004 http://www.cdc.gov/ncidod/EID/vol10no2/03-0452.htm

Schematic Diagram of the Boeing 737-300 Aircraft on Flight 2 from Hong Kong to Beijing



Olsen, S. J. et al. N Engl J Med 2003;349:2416-2422

Conclusions

- Transmission of SARS in hospitals appears to be mainly due to large droplet
- Droplet nuclei (airborne transmission) does not play a major role in hospital transmission
- The importance of environmental spread (fomite) is unclear
- The patient source plays an important role
- Use of a mask reduces transmission in hospital
- Hand hygiene also reduces risk