Pandemic Planning for Critical Care

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Outline – Pandemic planning

- Why plan?
- What do we expect?
- Increasing ICU capacity
- Protecting ICU staff
- ICU management
- Ethical Issues

Why plan?

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What did we learn from SARS?

- Plan ahead!
  - Infection control: equipment, training
  - Increasing ICU capacity
  - Address Staff stress
  - Communication
  - Leadership

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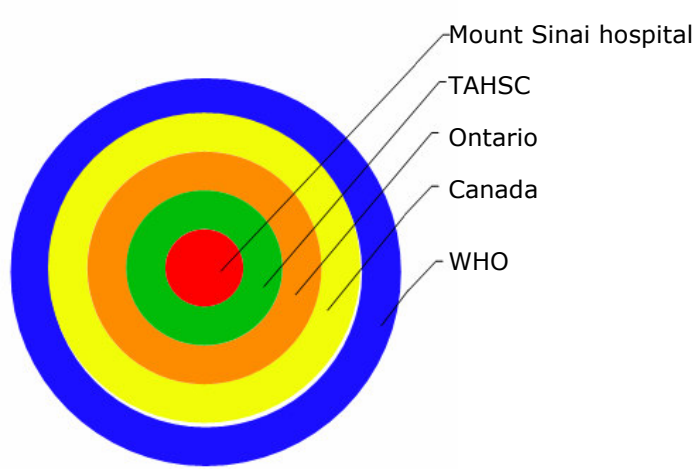
What are we planning for?

- Influenza pandemic

  but also . . .

- Other emerging infection
- Bioterrorist attack
- Other disaster

Critical Care planning – the Big Picture



Critical Care planning – the Big Picture

- Food and Water Sector
- Electricity Sector
- Transportation Sector
- Gas and Oil Sector
- Financial Institutions Sector
- Telecommunication Systems Sector
- Public Safety and Security Sector
- Continuity of Government Sector
- Health Sector

Mount Sinai Hospital Pandemic Influenza Planning Manual

Subject	Item
Patient Management	Emergency Patient Flow Process Out Patient Care Inpatient Care (FLU) Inpatient Care (NON FLU) Inpatient Flow Visitors
Pathology and Lab Medicine	Clinical Testing
Pharmacy	Medication Stockpiles and Location
Supply Management	Stockpile Inventory and Storage Locations • Hospital Wide • Emergency Dept • Inpatient Units ◦ Critical care • Outpatients Critical Lab Tests Distribution Procedures
Nutrition	Staff Menu Patient Menu Contingency Food Supply and Location Delivery Process
Human Resources	Policy for Hiring, Compensation, Reassignment Role of JHSC during Pandemic Labour Pool Volunteers Staffing EAP Childcare Staff Resiliencey
Infection Control	Personal Protective Equipment Department On call/Coverage during Pandemic Patient Surveillance Staff Surveillance Antivirals
Communications	Pandemic Internet Site Pre-pandemic communication Intra-pandemic communication Signage
Education	Education TAHSN Manual
Environmental Management	Ventilation Systems
Administration	Corporate Management Structure for Pandemic

What do we expect?

- What are we planning for?
- What do we expect?
- Increasing ICU capacity
- Protecting ICU staff
- ICU management
- Ethical Issues

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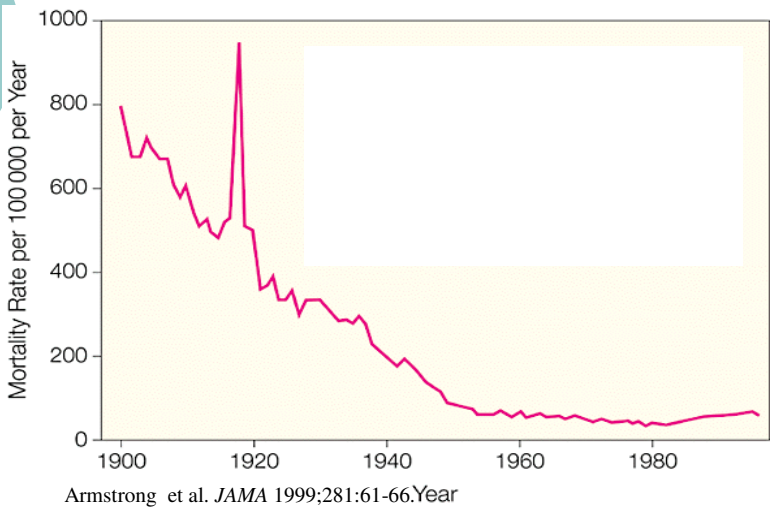
Infectious Disease Mortality, United States



Armstrong et al. *JAMA* 1999;281:61-66.

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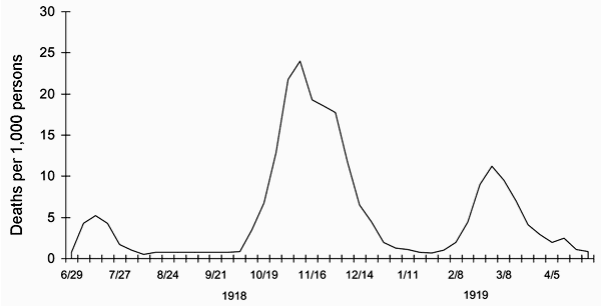
Influenza Pandemic

- Waves, lasting 6 – 15 weeks, over a 1 year period



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Pandemic modeling: Australia

Attack rate	ICU Admissions		
	5%	15%	25%
10%	400-1,700	1,300-1,500	2,100-8,300
30%	1,300-5,000	3,800-15,000	6,300-25,000
45%	1,900-7,500	5,700-22,500	9,500-37,500

ICU LOS	ICU Bed-days		
2 days	2,500-10,000	7,600–30,000	12,600–50,000
6 days	7,600–30,000	22,800–90,000	38,000–150,000

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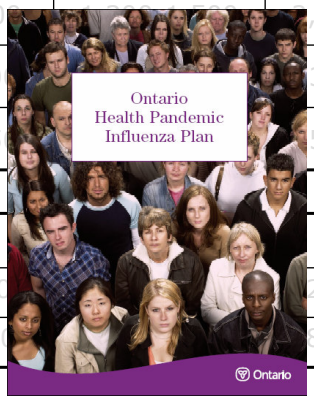
Pandemic modeling: Ontario, Canada

Attack rate	ICU Admissions		
	5%	15%	25%
10%	400-1,700		2,100-8,300
30% / 35%	1,300-5,000		6,300-25,000
45%	1,900-7,500		9,500-37,500

ICU LOS			
2 days	2,500-10,000		12,600–50,000
6 days / 10 days	7,600–30,000		38,000–150,000



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Pandemic modeling: Ontario, Canada

Table 14: Impact of Influenza with 35% Attack Rate on Hospital Capacity

35% Attack Rate 6 Weeks		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
Hospitals	Weekly admissions	7,320	10,370	12,811	12,811	10,370	7,320
	Peak admission/day			1,996	1,996		
Hospitals	# hospitalizations	7,320	10,370	12,811	13,459	12,430	9,895
	% hospital capacity	47%	66%	82%	86%	80%	63%
ICU	# ICU admissions	1,098	2,054	2,628	2,825	2,754	2,236
	% ICU capacity	73%	136%	174%	187%	182%	148%
Ventilator	# on ventilators	549	1,027	1,314	1,413	1,377	1,118
	% ventilator capacity	50%	94%	120%	130%	126%	102%
Deaths	# of influenza deaths			1,442	2,043	2,523	2,523
	70% deaths in hospital			1,009	1,430	1,766	1,766

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Avian 'flu – the Critical care perspective

- Review of 41 patients requiring ICU
- 68% developed multiorgan failure
- 90% mortality
- Time to ICU admission 2d (IQR 0.75 – 3.25 d)
- Complications:
  - Respiratory failure 98%
  - Hemodynamic failure 44%
  - Renal failure 24%
  - Pneumothorax 17%

Gruber PC, et al.Intensive Care Med. 2006;32:823-9

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Increasing ICU Capacity

- What are we planning for?
- What do we expect?
- Increasing ICU capacity
- Protecting ICU staff
- ICU management
- Ethical Issues

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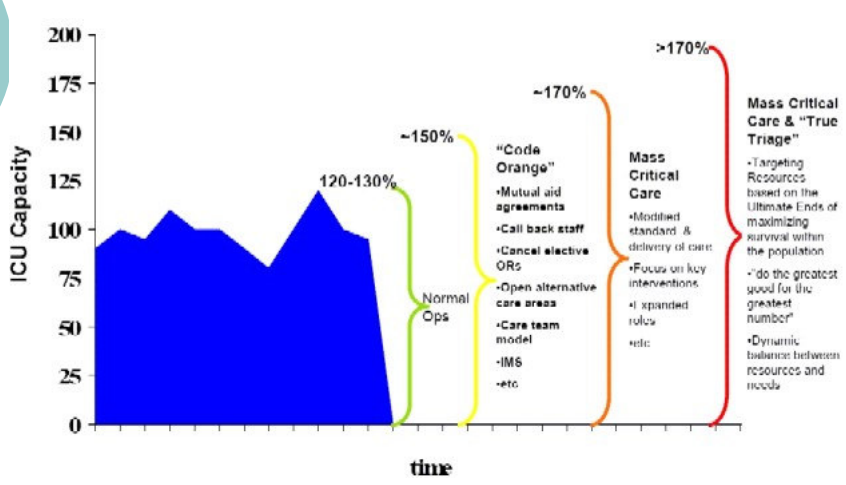
Increasing ICU Capacity



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Limiting Factors

- Nursing Staff
- Space
- Equipment - ventilators
- Medical Staff
- Supplies
- Drugs

Where?

- Step Down units
- Post Anesthetic Units
- Endoscopy
- Operating rooms
- Wards
- Mobile units

Requirements for off-site ICUs

- Patient care
  - Oxygen, suction, electrical outlets
  - Beds, ventilators, monitors
- Staffing
  - Nursing, medical, RT, pharmacy
  - Change area, gowning space, rest areas, call rooms
- Infection control
  - Handwashing facilities
  - Personal protective equipment
  - Negative pressure ability
- Supplies
  - Storage space
  - Pharmaceuticals
  - Refrigerator
  - IV's, lines, ventilator supplies
- Support services
  - Consultation, Social work
  - Radiology, labs
  - Computers, telephones
  - Housekeeping
  - Visitors' facilities

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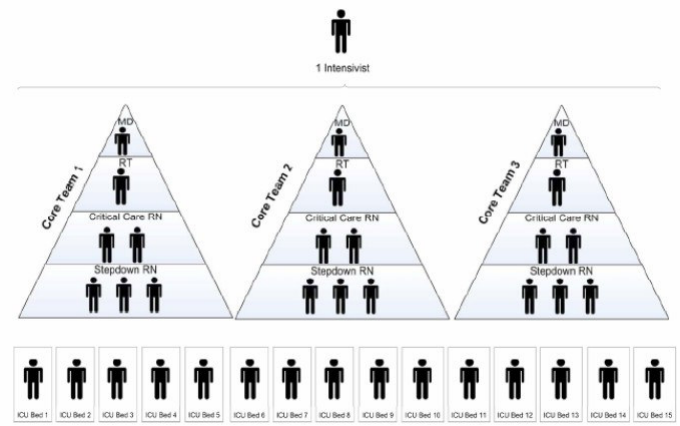
Staffing expanded ICUs



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Staffing expanded ICUs - MD

MD Staffing – 200%

Stage	Location	Patients	Patient type	Housestaff	Support medical staff	Housestaff nights	Attendings
Baseline	ICU	8	Multiorgan	1 ICU resident	Fellow	2 residents and fellow backup	2 ICU staff: one clinical, one administrative/triage
				1 ICU resident			
		8	Multiorgan 'flu	1 Other resident			
150% capacity	CCU	8	non-flu stable	1 ICU resident	Cardiology/GIM with ACES		
200% capacity	PACU	8	single organ "flu	1 ICU resident	Anesthesia staff*		
				1 other resident			
		Evaluation, stabilization, floating		1 anesthesia resident	Fellow*		
				1 Other resident (post call)			
				1 Other resident (post call)			
Source of additional residents:							
ENT							
anesthesia							
surgery							
Med subspecialty							

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Staffing expanded ICUs - RN

RN/RT staffing – 150%

Stage	Location	Patients	Patient type	Leader	ICU	CCRT	PACU	CCU	MSDU	SSDU	TOTAL	RT
-	-		Base Staffing	1	14	1	2	3	2	2		
Baseline	ICU	8	Multiorgan	1	7						8	1
		8	Influenza		6						6	1
150% capacity	CCU	8	non-flu stable		1	1		2	1	2	7	1
	16 SDU/1630	4	cardiac		0			1	1		2	
											0	
TOTAL				1	14	1	0	3	2	2	23	3

Assumptions:

PMH is not a priority or services decreased/discontinued (similar to SARS - what role will UHN play?)
SSDU - closed
MSDU closed, or converted to CCU
Some changes in model of care have occurred
Cardiac arrest service still in place
CCRT staff integrated into staffing patterns
Movement of SSDU monitors to 1630?

NOTE - Triage to start at next level

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Staffing: skills inventory

	ICU	CCU	PACU	SDU	Medicine	Surgery	OR
Airway management	√		√	√	√	√	√
Ventilator management	√						
Cardiac monitoring	√	√	√	√			
ECG interpretation	√	√		√	√		
Hemodynamic monitoring	√	√	√				
ACLS	√	√					
Analgesic and sedation Rx	√		√	√		√	

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Staffing: training

- ICU management
  - For non-ICU nurses and doctors
  - Rotations through the ICU?
- Pandemic roles and response
  - Altered job description and expectations
  - Incident Management System
- Personal protective equipment
- Triage

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Surge Capacity Coaching

Elements	Minor Surge	Moderate Surge	Major Surge
Definition	Acute increase in demand for ICU -15-20% - localized to an individual hospital	A larger increase in demand for critical services that impact on a Region.	A high increase in demand that overwhelms the resources of regions for an extended period of time.
Level of Response	A local Response at the Individual hospital level	An organized response at the Regional level	An Organized response at the provincial or national level is required
Accountability	Individual Hospital Boards	LHINs or Critical Care Network	Provincial or national level is required
Human Resources			
Equipment & Technology			
Physical Plant			
Processes to Address Surge			

Ontario

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Protecting ICU staff

- What are we planning for?
- What do we expect?
- Increasing ICU capacity
- Protecting ICU staff
- ICU management
- Ethical Issues

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Protecting ICU staff

- "maximal" precautions and deescalate
- Training in use of PPE
- Instructions/guidelines posted for correct sequence
- Simulation practice
- Space for donning gowns
- Monitoring
- Management of infection control lapses

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Protecting ICU staff

- WHO & CDC recommend:
  - N95 mask or equivalent
  - Glove, gown, eye-protection
  - Mandatory for most ICU procedures

CDC INFLUENZA (FLU)

Interim Recommendations for Infection Control in Health-Care Facilities Caring for Patients with Known or Suspected Avian Influenza

Avian Influenza, Including Influenza A (H5N1), in Humans: WHO Interim Infection Control Guideline for Health Care Facilities

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Protecting ICU staff

Additional precautions: PAPR

- Consider for high risk procedures, eg
  - Intubation
  - Bronchoscopy
  - Cardiac arrest
- Problems
  - Time consuming to don
  - Communication limited
  - Time limiting
  - May increase risk of transmission if used incorrectly

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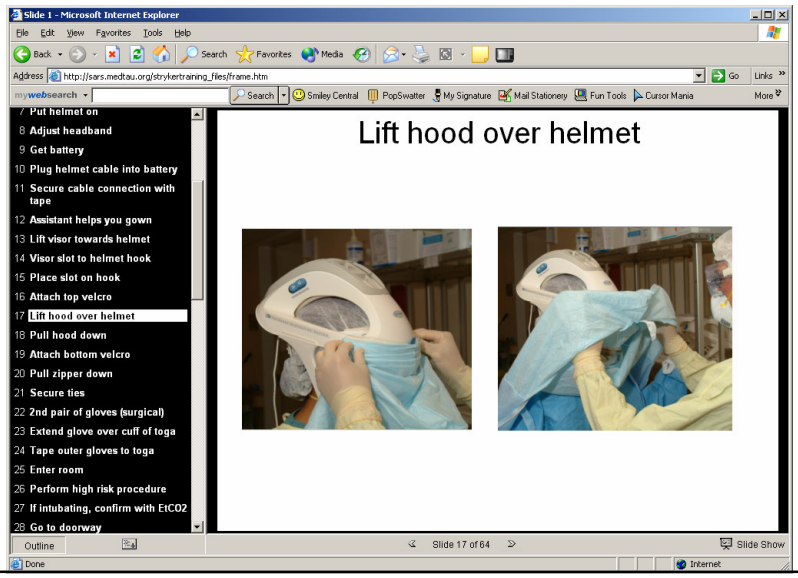
Protecting ICU staff - training



Protecting ICU staff

Infection control: Physical environment

- Various approaches
  - No isolation
  - Cohorting patients
  - Droplet or airborne isolation
- Require:
  - Adequate patient space
  - Space for gowning-up and down
  - Handwashing facilities
  - Negative pressure if indicated

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Protecting ICU staff

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Staffing: psychological effects

- Uncertainty
- Anxiety
- Communication, isolation
- Concern for family
- Stigmatization
- Post traumatic stress disorder

Low morale causes high absenteeism

- Requires:
  - Communication
  - Sensitivity
  - Emotional and other support

Maunder et al, CMAJ 2003;168:1245-51

ICU Management

- What are we planning for?
- What do we expect?
- Increasing ICU capacity
- Staffing expanded ICU's
- ICU management
- Ethical issues

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ICU Management

- Modifying usual standards of care
- Command structure
- Plan:
  - General management
  - Specific management
  - Palliative management

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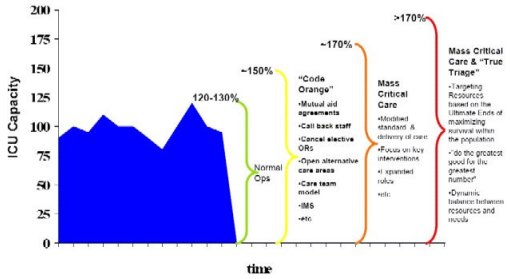
Modifying usual standards of care



- Eliminate high workload interventions with limited benefit
  - HFO, ECMO
  - CRRT?
- Utilize only high-benefit interventions:
  - Basic ventilation, IV fluids, antibiotics, prophylactic measures

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Critical Care triage

- Allocate scarce resources to provide maximum benefit to the population - *the greatest good for the greatest number*
- Based on illness severity and likelihood of survival given limited resources
- Needs to be pre-planned and accepted by the medical and lay community
- Needs to be activated simultaneously across the region

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Critical Care triage

- Stepwise response, e.g.

Tier 1 No ICU treatment for:
- Respiratory failure + shock + organ failure
- ≥ 4 organ failure

Tier 2 No ICU treatment for:
- Tier 1 criteria
- Severe cardiac (EF <25%) or respiratory (home O_2)
- AIDS, active malignancy, severe neurologic compromise

Tier 3
- Disease specific criteria based on epidemiology
- Tracking severity of illness, eg. SOFA score

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Critical Care triage

- Undertriage
  - Not recognizing high priority patients
- Overtriage
  - Unnecessarily assigning a high priority
    - Acceptable in usual practice
    - Associated with worse overall outcome in Mass Critical care situations:

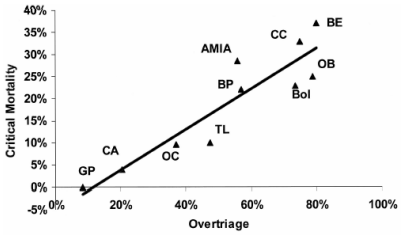

Fig. 1. *Graphic relation of overtriage rate to critical mortality rate, in 10 terrorist bombing incidents from 1969 to 1995*

Frykberg. J Trauma 2002:53:201

Critical Care Triage Tool (Initial Assessment)		
Colour Code	**Criteria**	**Priority/Action**
Blue	• **Exclusion Criteria*** or • **SOFA > 11***	**Medical Mgmt +/- Palliate & d/c from CC**
Red	• **SOFA ≤ 7** or • **Single Organ Failure**	**Highest**
Yellow	• **SOFA 8 – 11**	**Intermediate**
Green	• **No significant organ failure**	**Defer or d/c, reassess as needed**

Ontario Health Plan for an Influenza Pandemic, 2006

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Command Structure

Incident Management System

- Developed to facilitate multi-agency management of wildfires in California
- Common terminology and structure for command and communication

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Incident Management System

- Incident Manager/Commander

- Operations Section Chief
- Planning Section Chief
- Logistics Section Chief
- Finance/Admin Section Chief

- Public Information Officer
- Safety Officer
- Liaison Officer

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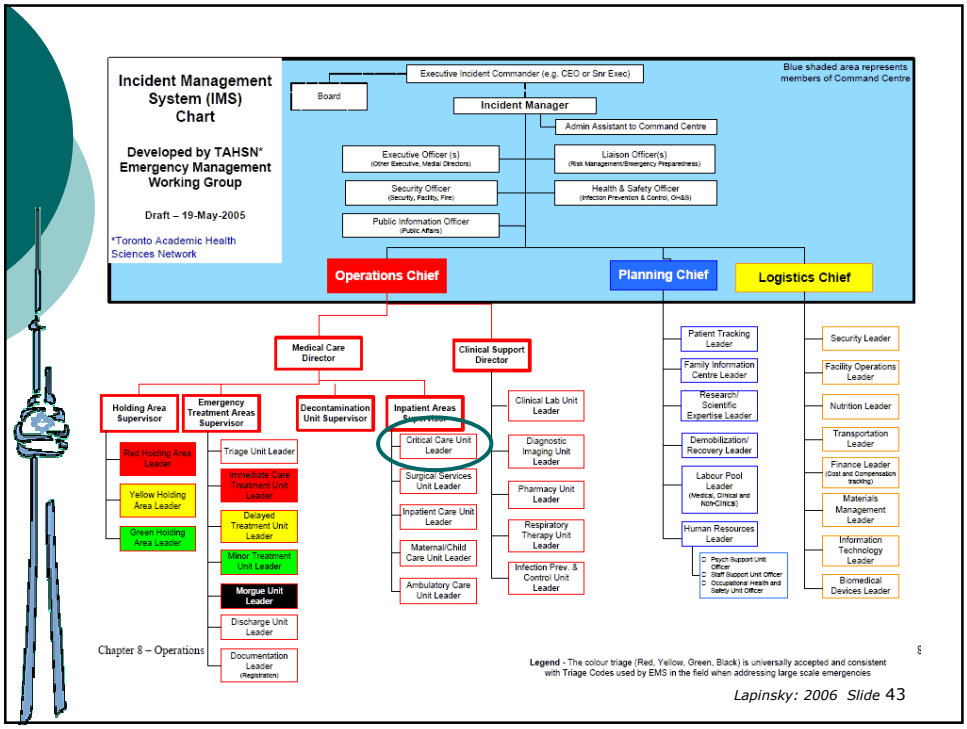

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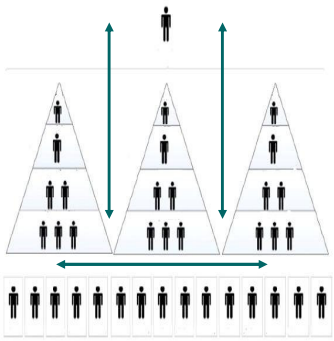
Communication



- IMS
  - Identifies communication channels
- Information technology
  - Email: useful, can be overwhelming and duplicated
  - Websites: to post complex guidelines, position statements
- Teleconferences
  - Multiple groups
  - Dissemination of clinical information
  - Dispel rumors, myths
  - Confirm media reports
  - Clarify complex directives
  - Support those feeling isolated

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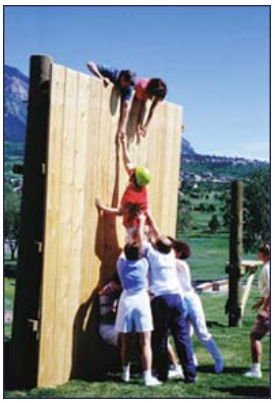
Leadership



Challenges

- Imbalance of Demand and Supply
- Increasing Patients numbers
- Lack of Recognition
- Poor Communication
- Need to Implement Rapid Changes
- Lack of System-wide Coordination
- Lack of Funds for Innovation
- Retention and Recruitment of Staff

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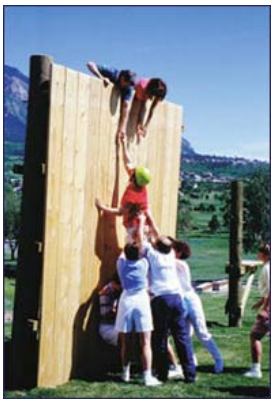
Leadership



Some approaches:

- Align change priorities of the multidisciplinary team
- Start small with early successes
- Build action oriented feedback loops
- Develop needs list and be able to articulate it
- Have data to support your needs
- Know your administration's priorities
- Communicate regularly

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ICU Management

- General ICU management
  - Preprinted orders, protocols
  - Alterations to usual practice/protocols
  - Attention to quality improvement initiatives
- Specific treatment
  - Preplanned: eg. Antibiotic/antiviral protocols
  - May change/develop during the pandemic
- Palliative care
  - Management of those unlikely to survive
  - Sedatives, narcotics for comfort
  - Multidisciplinary palliative care team: physicians, nurses, chaplaincy, social worker

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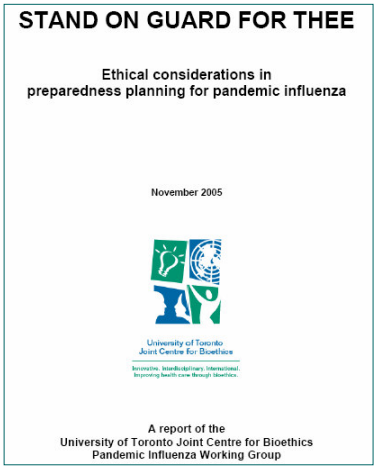
Ethical issues

- What are we planning for?
- What do we expect?
- Increasing ICU capacity
- Staffing expanded ICU's
- ICU management
- Ethical Issues



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Ethical challenges

- Priority setting and allocation of scarce resources:
  - Triage & reduced level of care
  - Prioritization: government, healthcare workers, etc.
- Healthcare workers duty to provide care
- Restricting liberty & quarantine

Ethical approach

- Reasonable
- Open and transparent
- Inclusive
- Responsive
- Accountable

Research

- Essential to gain new knowledge about the pathogen: infection control, treatment, etc
- Infrastructure should be pre-planned
- Need rapid REB turnaround
- May have a number of research staff available where other projects are on hold
- Information technology facilitates multi-center collaboration
- Rapid publication and dissemination

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THE NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Identification of Severe Acute Respiratory Syndrome in Canada

Susan M. Poutanen, M.D., M.P.H., Donald E. Low, M.D., Bonnie Henry, M.D., Sandy Finkelstein, M.D., David Rose, M.D., Karen Green, R.N., Raymond Tellier, M.D., Ryan Draker, B.Sc., Dena Adachi, M.Sc., Melissa Ayers, B.Sc., Adrienne K. Chan, M.D., Danuta M. Skowronski, M.D., M.H.Sc., Irving Salit, M.D., Andrew E. Simor, M.D., Arthur S. Slutsky, M.D., Patrick W. Doyle, M.D., M.H.Sc., Mel Krajden, M.D., Martin Petric, Ph.D., Robert C. Brunham, M.D., and Allison J. McGeer, M.D., for the National Microbiology Laboratory, Canada, and the Canadian Severe Acute Respiratory Syndrome Study Team*

ABSTRACT

BACKGROUND

Severe acute respiratory syndrome (SARS) is a condition of unknown cause that has recently been recognized in patients in Asia, North America, and Europe. This report summarizes the initial epidemiologic findings, clinical description, and diagnostic findings that followed the identification of SARS in Canada.

METHODS

SARS was first identified in Canada in early March 2003. We collected epidemiologic, clinical, and diagnostic data from each of the first 10 cases prospectively as they were identified. Specimens from all cases were sent to local, provincial, national, and international laboratories for studies to identify an etiologic agent.

RESULTS

The patients ranged from 24 to 78 years old; 60 percent were men. Transmission occurred only after close contact. The most common presenting symptoms were fever (in 100 percent of cases) and malaise (in 70 percent), followed by nonproductive cough (in 100 percent) and dyspnea (in 80 percent) associated with infiltrates on chest radiography (in 100 percent). Lymphopenia (in 89 percent of those for whom data were available), elevated lactate dehydrogenase levels (in 80 percent), elevated aspartate aminotransferase levels (in 78 percent), and elevated creatinine kinase levels (in 56 percent) were common. Empirical therapy most commonly included antibiotics, oseltamivir, and intravenous ribavirin. Mechanical ventilation was required in five patients. Three patients died, and five have had clinical improvement. The results of laboratory investigations were negative or not clinically significant except for the amplification of human metapneumovirus from respiratory specimens from five of nine patients and the isolation and amplification of a novel coronavirus from five of nine patients. In four cases both pathogens were isolated.

CONCLUSIONS

SARS is a condition associated with substantial morbidity and mortality. It appears to be of viral origin, with patterns suggesting droplet or contact transmission. The role of human metapneumovirus, a novel coronavirus, or both requires further investigation.

From the Toronto Medical Laboratories and Mount Sinai Hospital Department of Microbiology, Toronto (S.M.P., D.E.L., K.G., A.J.M.); the Department of Laboratory Medicine and Pathobiology (S.M.P., D.E.L., R.T., A.E.S., A.J.M.), Department of Medicine Division of Infectious Diseases (D.E.L., A.K.C., I.S., A.E.S., A.J.M.), and Department of Medicine and Interdepartmental Division of Critical Care (A.S.S.), University of Toronto, Toronto; the City of Toronto Public Health Department (B.H.); Scarborough Hospital, Toronto (S.F., D.R.); the Hospital for Sick Children, Toronto (R.T., R.D., D.A., M.A.); Epidemiology Services (D.M.S.) and Laboratory Services (M.K., M.P.), British Columbia Centre for Disease Control, Vancouver; University Health Network, Toronto (I.S.); Sunnybrook and Women's College Health Sciences Centre, Toronto (A.E.S.); St. Michael's Hospital, Toronto (A.S.S.); the Department of Pathology and Laboratory Medicine, Vancouver Hospital and Health Sciences Centre and University of British Columbia, Vancouver (P.W.D.); and the University of British Columbia Centre for Disease Control, Vancouver (R.C.B.) — all in Canada. Address reprint requests to Dr. McGeer at the Toronto Medical Laboratories and Mount Sinai Hospital, Department of Microbiology, 600 University Ave., Rm. 1460, Toronto, ON M5G 1X5, Canada.

*Members of the National Microbiology Laboratory, Canada, and the Canadian Severe Acute Respiratory Syndrome Study Team groups are listed in the Appendix.

This article was published at www.nejm.org on March 31, 2003.

N Engl J Med 2003;348:1995-2005.

METHODS

SARS was first identified in Canada in early March 2003.

This article was published at www.nejm.org on March 31, 2003.

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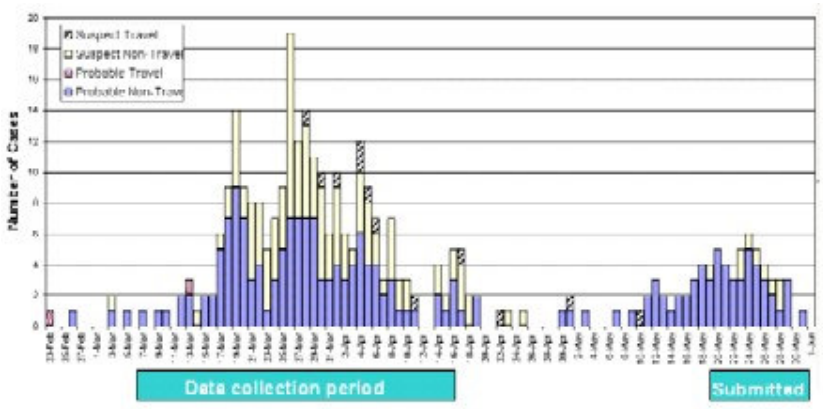
Toronto SARS ICU study



JAMA 2003; 290:367-373.

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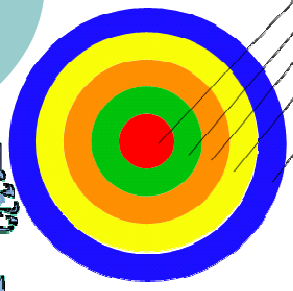
Conclusions



Mount Sinai **info/microbiology/pandemic/** (intranet)

TAHSC **http://portal.sw.ca/tahsn/default.aspx**

Ontario **www.health.gov.on.ca/english/providers/program/emu/pan_flu/pan_flu_plan.html**

Canada **www.phac-aspc.gc.ca/cpip-pclcpi/index.html**

WHO **www.who.int/csr/disease/influenza/ pandemic/en/**

Toronto **www.toronto.ca/health/pandemicflu/index.htm**

Joint Centre for Bioethics
www.utoronto.ca/jcb/home/documents/pandemic.pdf

www.medtau.org/pandemic

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