Assessing and Augmenting Mechanical Ventilatory Capacity in New York City Hospitals for Pandemic Influenza Planning

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Background & Objectives

Pandemic Preparedness Goals

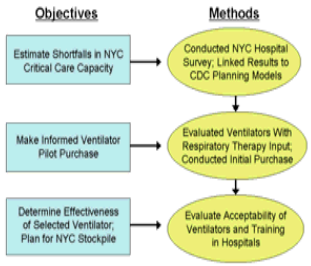
- Limit morbidity and mortality
- Augment the capability and capacity of the health care system to provide patient care (particularly in absence of antivirals or vaccine)
- Staff, space, and ventilators are limiting factors
- Ventilator purchase = one strategy to ↑ patient care capacity
- 11/2005 DHHS Pandemic Influenza Plan, along with CDC 2006 pandemic influenza funding, provided framework and unique opportunity

Objectives

- Estimate shortfalls in New York City hospital critical care/ventilatory capacity
- Make informed ventilator purchase decision
- Create closer emergency planning relationships with hospital respiratory care departments
- Determine effectiveness of selected ventilator in hospital setting prior to larger stockpile purchase

Methods

Assessing and Augmenting New York City (NYC) Ventilatory Capacity, 12/2005 – 8/2007



- NYC DOHMH conducted a 12/2005 survey of 65 NYC acute care hospitals to determine mechanical ventilatory/critical care capacity
- CDC FluSurge 2.0 pandemic influenza planning models were used to estimate ventilator needs in varied pandemic scenarios
- NYC DOHMH consulted with representatives from NYC hospital respiratory therapy departments to evaluate and select ventilator for the NYC DOHMH Respiratory Care Surge Capacity Pilot Project
- From 2/2007-8/2007, three Versamed iVent 201 ventilators will be distributed to each of 24 NYC hospitals to evaluate ventilators and training materials in hospital settings as part of pilot project

Influenza Pandemics: 20th Century

Credit: US National Museum of Health and Medicine

1918: "Spanish Flu"	1957: "Asian Flu"	1968: "Hong Kong Flu"
A(H1N1)	A(H2N2)	A(H3N2)
50 - 100 M deaths	1-4 M deaths	1-4 M deaths
>600K US deaths	~70,000 US deaths	~34,000 US deaths

The NYC Health Care System

- NYC Population: 8.1 million
- 65 acute care hospitals
- 22,000 licensed hospital beds
  - –16,000 staffed beds (high occupancy)
  - –1,700 intensive care unit beds
- 163,000 full-time hospital employees
- 27,000 licensed physicians
- 68,000 licensed nurses (RN, LPN)

Sources: 2000 U.S. Census; NYC DOHMH 11/2001 Hospital Survey; Greater New York Hospital Association; NYS Department of Education

Peak Impact of Pandemic Flu Patients on NYC Hospitals (1957/68 Scenario)

Variable	# Related to Flu Patients	% of Existing Capacity Required by Flu Patients
Daily Hospital Admissions	1,129	23%
Hospital Beds (n = 26,177)	5,512	21%
Intensive Care Unit Beds (n = 1,713)	2,662	155%
Mechanical Ventilators (with 40% of 2,688 vents available, n = 1,075)	1,331 Gap: 256	50%

Note: Impact estimated at Week 5 of 8-week pandemic; 35% attack rate; 10-day vent use; 25% of flu patients require ICU care; 50% of ICU patients require ventilation

Sources: CDC FluSurge 2.0; NYC Vital Statistics 2003; NYC DOHMH 2005 Critical Care Capacity Survey

Peak Impact of Pandemic Flu Patients on NYC Hospitals (1918 Scenario)

Variable	# Related to Flu Patients	% of Existing Capacity Required by Flu Patients
Daily Hospital Admissions	8,016	31%
Hospital Beds (n = 26,177)	39,155	160%
Intensive Care Unit Beds (n = 1,713)	18,907	1,104%
Mechanical Ventilators (with 40% of 2,688 vents available, n = 1,075)	9,454 Gap: 8,379	352%

Note: Impact estimated at Week 5 of 8-week pandemic; 35% attack rate; 10-day vent use; 25% of flu patients require ICU care; 50% of ICU patients require ventilation

Sources: CDC FluSurge 2.0; NYC Vital Statistics 2003; NYC DOHMH 2005 Critical Care Capacity Survey

NYC DOHMH Critical Care Capacity Survey Results, December 2005 (N=65 Hospitals)

Result	Implication
2,688 full-featured mechanical ventilators	Shortage of ventilators expected during influenza pandemic
1,385 full-time equivalent respiratory therapists	Citywide shortage in respiratory therapists; need to cross-train staff
3 (5%) hospitals familiar with ventilators in the U.S. Strategic National Stockpile (SNS)	No clear advantage to use or stockpile vents in the SNS
49 (76%) hospitals willing to store, maintain & train staff on new vents	Most hospitals willing to build hospital-based cache
60% of ventilators in average daily use during 2004-2005 flu season	Maintaining essential medical services will require vents for non-pandemic illnesses

Source: NYC DOHMH 2005 Critical Care Capacity Survey

NYC Ventilator Need Estimates and Cost Model Based on Severity of Pandemic

	1957/68 Scenario	1918 Scenario
# of NYC hospital-based full-featured ventilators (12/2005)	2,688	2,688
# of available ventilators for pandemic patients; 60% already in use for non-pandemic patients	1,075	1,075
# of ventilators needed for pandemic influenza patients	1,331	9,454
Estimated Shortfall	-256	-8,379
Estimated Costs to Address Shortfall (vent+durable med. equip. = $8,400)	$2.2 million	$70.4 million

Assumptions: 8-week pandemic; 10-day vent use; 35% attack rate; 25% of flu patients require ICU care; 50% of ICU patients require ventilation

Ventilator Evaluation Tool

- Evaluation of ventilators based on (pandemic focus*):
  - Ease of use/set-up/storage
  - Oxygen-sparing
  - Sufficient oxygen flow
  - Ability to provide adequate positive-end expiratory pressure (PEEP)
  - Designed for long-term/chronic care use
  - Service/maintenance/product recall history
- Ventilator Selected: Versamed iVent 201

(*Pandemic focus implies that the ventilator has been FDA-approved to treat patients with pneumonia and respiratory failure for several days)

Next Steps: Ventilator Implementation February 2007 – August 2007

- 24 hospitals will evaluate ventilators and are eligible to receive up to $15K in HRSA funds
- Hospitals will receive 3 vents and provide feedback on equipment/training over 6 months
  - Transport; ICU; chronic care settings
  - Pediatric; adult; chronic care populations
  - 850-2,000 patient-hours of ventilator use
- Advisory Committee assisting NYC DOHMH with development of reporting tools and evaluation of training materials for non-respiratory therapists
- Determine oxygen supply needs

Summary / Recommendations

- **Pandemic influenza modeling highlighted need for critical care beds and ventilators**
- **Surveying hospitals allowed for: 1) accurate baseline assessment of ventilators, 2) gap analysis, and 3) creation of cost estimates**
- **Working with hospital partners optimized creation of ventilator evaluation tool, ventilator selection, and project buy-in**
- **Training and ventilator use are next steps to purchasing hospital-based ventilator caches**