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# Financial Effects of an Influenza Pandemic on US Hospitals

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We estimate the financial effects of an influenza pandemic on US hospitals, including the cost of deferring elective admissions and the cost of uncompensated care for uninsured patients. Using US pandemic planning assumptions and national data on health care costs and revenues, a 1918-like pandemic would cause US hospitals to absorb a net loss of \$3.9 billion, or an average \$784,592 per hospital. Policy-makers should consider contingencies to ensure that hospitals do not become insolvent as a result of a severe pandemic. Key words: *influenza pandemic, SARS, elective admissions, hospitalization, bed use, FluSurge.*

**T**HE US Department of Health and Human Services (HHS) estimates that a severe influenza pandemic could cause 90 million Americans to become infected and 9.9 million to be hospitalized.<sup>1</sup> There are only a million hospital beds in the United States, so such an event would quickly overwhelm hospital capacity.

As one strategy to respond to this excess demand, HHS has advised hospitals in a pandemic to “Defer elective admissions and procedures until local epidemic wanes,” freeing capacity for influenza patients.<sup>2</sup> These deferrals are likely to decrease hospitals’ profits, as elective surgical procedures are generally more profitable than treatment for influenza is. The Congressional Research Service reports:

Presuming a surge of patients in the health-care system, non-urgent procedures could be postponed for weeks or months at a time. This has raised questions regarding whether there would be shifts in overall revenue to providers for services rendered during a pandemic, and how such shifts could affect providers and insurers.<sup>3</sup>

The United States has no plan to compensate hospitals for revenues lost during a pandemic.<sup>4</sup> The Stafford Act has no provi-

sion for compensation of lost revenues,<sup>5</sup> and Federal Emergency Management Agency (FEMA) policy specifically excludes it.<sup>6</sup>

Hospitals’ experiences during past surge events suggest these losses could be significant. Following the 2001 terrorist attack on the World Trade Center, public agencies directed area hospitals to cancel elective services. As a result, the hospitals lost an estimated \$200 million in revenues, which were never reimbursed by the government.<sup>7</sup>

During the 2003 SARS outbreak in Toronto, hospitals anticipated a surge of SARS admissions and were directed to defer elective cases. In the first eight weeks of restrictions, the rates of most urgent surgical admissions went unchanged; elective noncardiac surgery rates decreased 22

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percent and elective cardiac surgery rates decreased 66 percent.<sup>8</sup> Limiting entry during these weeks cost Toronto's University Health Network an estimated \$4.7 million in lost revenues,<sup>9</sup> almost twice the direct costs of excess supplies and services provided.<sup>10</sup> Hospitals in Taiwan faced similar losses, and increased their admissions of SARS patients only after the Taiwanese government agreed to reimburse lost revenues.<sup>11</sup>

In contrast to SARS, in an influenza pandemic, elective admissions are expected to decrease whereas overall admissions are expected to increase. Other commentators<sup>12</sup> have noted the possible financial effects of a pandemic on US hospitals, including the cost of deferring elective admissions and the cost of "uncompensated care" for uninsured patients. To our knowledge none has estimated the magnitudes involved. Here we estimate these magnitudes with national data on costs and margins for elective and flu cases.

## Methods

We used FluSurge 2.0, a spreadsheet model developed by the Centers for Disease Control (CDC), to project hospitalizations during a flu pandemic.<sup>13</sup> Model parameters were estimated for an "average hospital," by dividing aggregate national data by the number of US community hospitals (4,936).<sup>14</sup> Two scenarios were considered using HHS Pandemic Influenza Plan assumptions for "moderate" (1958/1968-like) and "severe" (1918-like) pandemics (*see* Exhibit 1).<sup>15</sup>

We assumed ICU flu patients will have a principal diagnosis of acute respiratory failure (ARF) (518.81), whereas non-ICU flu patients will have an equal mix of influenza (487) and pneumonia (480) diagnoses.

**Exhibit 1. FluSurge Parameters for Average Community Hospital**

Parameter	HHS Moderate*	HHS Severe*
Rate of Illness	30%	30%
Hospitalization Rate for Ill Persons	1%	11%
Total Hospital Admissions	175	2006
Percentage of Patients Needing ICU Care	15%	15%
Percentage of Patients Needing Ventilators	7.5%	7.5%
Pandemic Duration (weeks)	8	8
Pandemic Attack Rate	25%	25%
Catchment Population:	16,607	16,607
0–19 yrs**		
Catchment Population:	35,826	35,826
20–64 yrs**		
Catchment Population:	7,434	7,434
65+ yrs**		
Staffed Hospital Beds***	163	163
ICU Beds <sup>+</sup>	18	18
Non-ICU Beds	145	145
Ventilators <sup>++</sup>	20	20

\*U.S. Department of Health and Human Services, 2005.  
 \*\*2006 Statistical Abstract of the United States: Table 12. Resident Population Projections by Sex and Age: US Census Bureau, 2006.  
 \*\*\*American Hospital Association, 2007.  
 +Halpern, et al., 2004.  
 ++Congressional Budget Office, 2006.

Average all-payor case volume, length-of-stay, revenues, costs, and contribution margins (revenues minus variable costs) were obtained from a proprietary database, based on a national sample of Medicare, Medicaid, and private insurance claims from 2005 (The Advisory Board Company, Washington, DC).

## Results

### Bed Use

In 2000, the estimated occupancy rates for non-ICU and ICU licensed hospital beds were 57 percent and 66 percent,

**Exhibit 2. FluSurge Results For Average Community Hospital**

Scenario		1	2	3	4	5	6	7	8
HHS Moderate	Weekly admissions	11	18	26	33	33	26	18	11
	Avg # of flu patients in hospital	8	13	19	24	25	22	17	11
	Avg # of flu patients on ventilators	1	2	3	3	4	4	3	2
HHS Severe	Weekly admissions	120	201	301	381	381	301	201	120
	Avg # of flu patients in hospital	88	147	221	280	290	255	196	128
	Avg # of flu patients on ventilators	9	19	29	39	42	41	32	22

respectively,<sup>16</sup> leaving around 62 non-ICU and six ICU licensed beds unoccupied per hospital. On any given day, 15 of 20 ventilators are being used,<sup>17</sup> leaving five free ventilators per hospital, on average.

During an eight-week period, a hospital admits, on average, 179 elective surgical cases, with an average length-of-stay of 3.9 days. Deferring these cases would free 698 bed-days, or an average 12.5 beds per day. Combining existing free capacity with elective deferrals, a hospital would thus have around 81 free beds, on average.

At the moderate pandemic's peak, 25 flu patients would require beds and four would require ventilators. At the severe pandemic's peak, 290 would require beds and 42 would require ventilators (*see* Exhibit 2).

**Financial Effects of Deferring Elective Surgical Cases**

During a severe pandemic, the shortage of beds would force hospitals to defer elective surgical cases. Elective surgical cases generate \$805,795 in contribution margins per eight-week period (*see* Exhibit 3). Replacing these cases with influenza, pneumonia, and ARF cases generates margins of \$451,810. The net loss from the deferrals is thus \$353,985.

**Costs of Uncompensated Care**

During a pandemic, hospitals would face an increase in uncompensated costs, because of a surge in the number of uninsured patients. If a hospital admits all of the cases projected by FluSurge, these cases will generate

**Exhibit 3. Effect of Replacing Elective Surgical Cases with Flu Cases per Eight Weeks**

	Elective Surgical Cases Deferred	Influenza Cases	Pneumonia Cases	ARF Cases
Number of Cases	179	74	74	13
Bed-Days per Case	3.9	3.7	4.1	9.5
Bed-Days Deferred/Admitted	698	270	304	124
Margin per Case (\$)	4,498	1,738	2,444	11,000
Margin per Bed Day (\$)	1,154	475	593	1,157
Total Margins (\$)	805,795	128,226	180,336	143,248

**Exhibit 4. Costs of Uncompensated Care During Eight-Week Pandemic**

Scenario		Influenza Cases	Pneumonia Cases	ARF Cases	Total
Moderate	Variable costs per case (\$)	2,539	3,072	9,660	
	Number of cases	74	74	26	175
	Total variable costs (\$)	189,113	228,813	253,927	671,853
	Uncompensated costs (\$)	10,590	12,814	14,220	37,624
Severe	Number of cases	852	852	301	2,006
	Total variable costs (\$)	2,164,412	2,618,785	2,906,219	7,689,416
	Uncompensated costs (\$)	121,207	146,652	162,748	430,607

variable costs of \$671,853 during a moderate pandemic, and \$7.7 million during a severe pandemic (*see* Exhibit 4). In 2005, 5.6 percent of hospital costs were uncompensated.<sup>18</sup> At this rate, a hospital will face uncompensated care costs of \$37,624 during a moderate pandemic, and \$430,607 during a severe pandemic.

### Limitations

Because our analysis was limited to average data from a national sample, these results have stronger implications for national policymakers than for individual hospitals, whose margins may significantly differ from national averages. If a pandemic disproportionately affected Medicare and Medicaid populations, then contribution margins on flu cases would be lower than those we used. (For instance, the average margin per Medicare ARF case is \$154 lower than the all-payor average, per bed-day.) If a pandemic disproportionately affected uninsured populations, then uncompensated care costs would be higher than those we estimated.

As our analysis focuses on margins during a pandemic, we did not estimate regained income from rescheduled elective cases. After a pandemic, hospitals may admit some de-

ferred elective cases; some deferred patients will recover or die before receiving hospital care, whereas others will be lost to competing facilities.

We did not estimate the effects of a pandemic on overhead or non-influenza margins. Non-influenza costs could increase, because of overtime costs, supply shortages, and increased lengths of stay; the costs may decrease, as hospitals might discharge non-flu patients early or increase patient-to-staff ratios. We ignored hospitals' other revenue-generating activities, such as outpatient services and retail sales.

### Discussion

During a moderate pandemic, an average hospital could absorb HHS' projected flu patients without deferring elective cases, and would accrue only \$37,624 in uncompensated care costs. With broad variation among hospitals in the percentage of uncompensated care, the financial burden would be higher for some hospitals than for others.

The financial effects of a severe pandemic would be more significant. Bed shortages would require deferring elective surgeries and replacing them with flu cases, causing an average cash flow loss of \$353,985 per hospital. The costs of uncompensated care

would average \$430,607 per hospital. The combined cash flow loss would average \$784,592 per hospital, or \$3.9 billion for all US hospitals. Some hospitals may not have sufficient cash on hand to cover these losses.<sup>19</sup>

Combined with preexisting unoccupied beds, deferring elective surgical admissions will free only 81 of the 290 beds a hospital needs, on average, during a severe pandemic's peak—and will free at most 20 of the 42 ventilators needed. Deferring elective surgical admissions by itself is insufficient; other surge strategies to expand capacity in and outside the walls of the hospital are needed.

Although hospitals are expected to increase admissions during a flu pandemic, our analysis suggests that these admissions will decrease hospital profits. This study looks at only two components of hospital

finances that may be affected by a pandemic. Actual losses may be higher than this study suggests. The severity and duration of a pandemic could be greater than HHS assumes. H5N1 now has an inpatient mortality rate greater than 50 percent; HHS assumes rates of 19 percent and 24 percent. A severe pandemic could cause staff absences and medical supply interruptions that severely compromise the ability of hospitals to deliver care.<sup>20</sup>

The expected negative financial impact on hospitals of a severe pandemic is significant. Under the existing disaster assistance system, much of hospitals' financial loss is not reimbursable. As such, hospitals should include their financial personnel in pandemic planning. Federal policymakers should consider contingencies to ensure that hospitals do not become insolvent as a result of a pandemic.<sup>21</sup>

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