EE241

ECONOMIC BURDEN OF INFLUENZA HOSPITALIZATION IN HIGH-RISK PATIENT GROUPS IN THE US

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OBJECTIVES

Understanding the influenza-related clinical and economic burden is important for the development of novel prevention and treatment strategies, as well as for policy making by payors. Costs associated with influenza-related hospitalizations in the United States (US) were evaluated using claims-based analytics and machine learning to understand:

- the unmet medical need;
- the overall economic burden;
- cost differences by patient risk groups.

METHODS

IQVIA datasets for influenza-related US claims (2015-2019):

Clinical Database Management (CDM) claims[1]
- Hospital (in- and outpatients)
- Claims: 834K
- Patients: 690K

Longitudinal prescription (LRx) claims[2]
- Non-hospital
- Claims: 20M
- Patients: 13M

Artificial intelligence (AI) approach:

Filter and clean → Exploratory analyses → Data and feature engineering → Machine learning modelling → Cost of care analysis / Predictive risk model

[1] Collected from 400 non-federal hospitals and including information on procedure or diagnosis codes, deidentified patient demographics, location of care, length of stay, and related hospital or care information.

[2] Covering >90% of retail channel, 60%–85% of mail service, and 75%-80% of long-term care and including longitudinal data received from pharmacies, payers, software providers, and transactional clearinghouses.

RESULTS - Dataset key characteristics

	CDM dataset	
Number of patients with influenza-related visits/claims	**690K**	
Number of influenza-related hospital visits/claims	**834K**	
Outpatient visits	726K	(87%)
Inpatient visits (hospitalizations)	108K	(13%)
ICU admissions	17K	(16% of inpatient visits)
Age		
Inpatient visits		
45-64 years	23%	
≥65 years	56%	
ICU admissions		
45-64 years	29%	
≥65 years	47%	
Medical history		
Inpatients with ≥1 CDC risk factor[1]	59%	

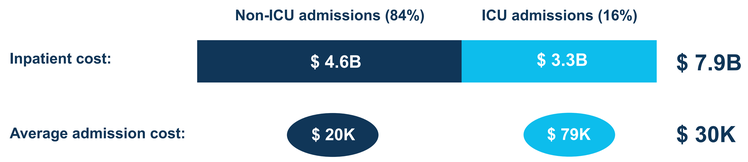
CDC=Centers for Disease Control and Prevention; COPD=chronic obstructive pulmonary disease; HIV=human immunodeficiency virus; ICU=intensive care unit.

[1] CDC risk factors: asthma/COPD, heart disease, chronic kidney disease, HIV, neoplasms, diabetes, stroke, pregnancy, transplant.

RESULTS - Cost of care analysis

Hospital admission costs per year[1]:

- Annual costs of influenza-related hospitalizations in the US were estimated at **$ 7.9B**.
- The average length of stay for influenza-related hospitalizations was 4.5 days, with 20% of hospitalizations lasting longer than a week.



[1] Absolute numbers extrapolated to full US population, charges converted to cost by cost-to-charge ratio of 0.47.

Antiviral use:

- Antivirals were prescribed (2017-2019) to 42.5% of patients presenting at the hospital (in- and outpatients): 24.4% were prescribed antivirals prior to hospital presentation and 21.2% at the hospital (3.1% at both instances).
- Overall, 75% of influenza inpatients and 13.5% of outpatients were prescribed antivirals at some point during their influenza illness.

RESULTS - Predictive risk model

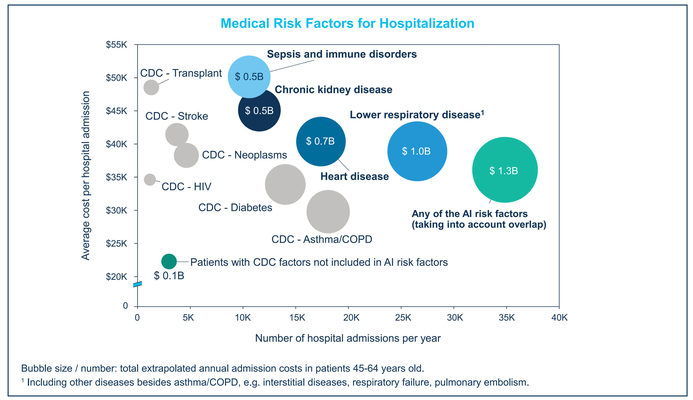
Risk factors for influenza-related hospitalization identified from predictive model:

- Approximately 300 factors were taken into account, e.g. seasonal/annual, regional, and inter-hospital differences, medical history on International Classification of Diseases (ICD) subchapter level, and pre-hospital antiviral use.
- **Age** was identified as the strongest single risk factor:
  - >75% of influenza-related hospital and ICU admissions occurred in patients aged ≥45 years.
  - Patients aged ≥65 years accounted for **~$ 4.0B** or ~50% of the annual influenza-related hospitalization costs (**average $ 27K per admission**).
- Four disease areas in medical history (i.e. occurring within 1 year to 2 weeks prior to hospital visit) were identified as being most predictive of hospitalization risk and high costs, independent of age:
  - **Lower respiratory disease** (ICD10: J40-59, J80-84, J90-99, I26-I29)
    - Chronic lower respiratory diseases
    - Pulmonary interstitial diseases (acute respiratory distress syndrome, edema, fibrosis)
    - Respiratory failure, atelectasis, bronchospasm
    - Pulmonary embolism and pulmonary hypertension
  - **Heart disease** (excluding hypertensive diseases) (ICD10: I05-09, I20-25, I30-I59)
  - **Chronic kidney disease** (ICD10: N00-N19)
  - **Sepsis and immune disorders** (not on CDC list) (ICD10: A40-41, D80-89)
- Other CDC risk factors (i.e. HIV, neoplasms, diabetes, stroke, pregnancy, transplant) were found to be less independently related to admission when correcting for all other variables.

RESULTS - Predictive risk model

Impact of medical risk factors on influenza-related hospitalization risk and total costs:

- Patients aged 45-64 years with at least 1 of the 4 AI-identified medical risk factors in the past account for **$ 1.3B** or 56% of the $ 2.3B of annual influenza-related hospitalization costs within that age group (**average $ 36K per admission**).
  - Of note, this average cost per admission is ~30% more than that of patients aged ≥65 years.
- Patients with a CDC risk factor not included in the AI-identified medical risk factors account for limited costs (**$ 0.1B**) (**average $ 22K per admission**).

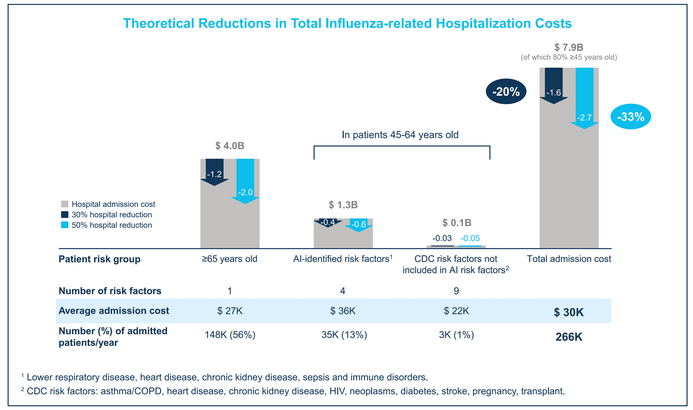


Bubble size / number: total extrapolated annual admission costs in patients 45-64 years old.

[1] Including other diseases besides asthma/COPD, e.g. interstitial diseases, respiratory failure, pulmonary embolism.

Sensitivity analyses on the total influenza-related hospitalization costs:

- Assuming a reduction in hospitalization of **30%** in key risk groups, total influenza-related hospitalization costs could be reduced by **20%**.
- At a **50%** reduction in hospitalization in these groups, costs could be reduced by **33%**.



[1] Lower respiratory disease, heart disease, chronic kidney disease, sepsis and immune disorders.

[2] CDC risk factors: asthma/COPD, heart disease, chronic kidney disease, HIV, neoplasms, diabetes, stroke, pregnancy, transplant.

CONCLUSIONS

Cost of care analysis

- Despite widespread recommendations for and access to influenza vaccines and antivirals in the US, the total influenza-related burden of disease as measured by hospitalization costs remains substantial: $ 7.9B annually in the US with an average cost of $ 30K per admission.

Predictive risk model

- As expected, age is the strongest single risk factor for influenza-related hospitalization.
- Novel AI approaches identified medical risk factors associated with influenza-related hospitalization risk and cost of care that were only partially consistent with the risk factors previously identified by the CDC:
  - Sepsis and immune disorders were uniquely identified as medical risk factors.
  - HIV, neoplasms, diabetes, stroke, pregnancy, and transplant were not identified as medical risk factors.

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