Predicting Influenza Attributable Rehospitalization

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Research Objective: Persons who are hospitalized prior to the influenza season represent a substantial proportion of persons in the community who are at increased risk for serious complications caused by influenza. In this research, we report a method to identify hospital patients at high risk of being rehospitalized during the influenza season.

Study Design: We used California hospital discharge data to determine which specific diagnoses, procedures, and patient demographic characteristics are the most important predictors of rehospitalization caused by influenza attributable conditions during the flu season. Influenza attributable rehospitalizations were identified as any hospitalization after the index hospitalization and during the influenza season (December 1996 – April 1997) for which the primary reason for admission was either pneumonia, influenza, acute bronchitis, chronic obstructive pulmonary disease, or asthma. Demographic characteristics measured for each patient included age group, sex, race, insurer, and admission or discharge to a long term care setting. Multivariable logistic regression analysis was used to assess the statistical significance and relative risk of influenza attributable rehospitalization associated with each patient characteristic included in the model. We assessed the validity of the model by applying the estimation equation (fixed intercept and parameter coefficients) to a validation population (persons over 6 months old discharged alive from a California hospital during October or December 1996) not used in the development of the model and constructing a calibration chart. We simulated the cost and benefits of mounting a minimally successful vaccination campaign on patients at high risk.

Population Studied: Persons over 6 months old discharged alive from any California hospitals during November 1996.

Principal Findings: The developed model demonstrated good discrimination (ROC area = 0.865) with very little shrinkage when applied to the validation population (ROC area = 0.842). The model demonstrated good but not perfect calibration for patients with the highest predicted risks of rehospitalization. Important risk factors include age over 50, and diagnoses of asthma, chronic obstructive pulmonary disease and bronchiectasis, cystic fibrosis, multiple myeloma, and diabetes mellitus without complications. Our simulation assumptions were as follows: (1) it would cost $10 per patient to vaccinate identified individuals, (2) only 23% of influenza attributable hospitalizations were truly due to influenza, and (3) the vaccination would be only 50% successful in reducing the occurrence of influenza attributable rehospitalization. The simulation results indicate that it would be cost effective to vaccinate the half of the hospitalized population at highest risk, because the estimated cost of hospitalization is 80 to 100 times as expensive as the vaccination program.

Conclusions: The developed method provides a valid technique for predicting occurrences of influenza attributable rehospitalization for California patients hospitalized during the influenza season.

Implications for Policy, Delivery, or Practice: The most significant risk factors and/or the complete model can be used as part of hospital based influenza control programs to identify high risk patients who should be actively encouraged to receive the vaccine. The model could also be used to focus vaccination efforts during periods when the vaccine supply is limited.