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Paper Poster Session IV

Management of staphylococcal infections

How should we risk-adjust hospital outcomes for bloodstream infections? A nationwide cohort study of *Staphylococcus aureus* bacteraemia

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Objective: Increasingly, administrative databases include microbiology results extracted from electronic health records. This will increase pressure to publically report hospital performance rankings on outcomes for patients with infections such as *Staphylococcus aureus* bacteraemia (SAB). However, there is little known about how to risk-adjust for hospital infection outcomes. While public reporting of other conditions (e.g., acute myocardial infarction) is based on patient characteristics identifiable in administrative data, it is unclear whether these data are sufficient for assessing hospital infection outcomes. Inadequate risk-adjustment may misclassify hospitals as having unacceptable mortality rates. We used data from the national U.S. Veterans Health Administration (VHA) hospitals to calculate hospital-level 30-day mortality rates for patients with SAB, using two risk-adjustment models: (1) a "standard" model comprised mostly of variables found in administrative data; and (2) an "augmented" model that added patients' admission vital signs and laboratory values to the standard model.
Methods: Using a retrospective cohort design, all patients with community-onset SAB (first positive culture <48 hours of admission) from 2003-2010 were included. The primary outcome was all-cause 30-day mortality. The standard model included patient demographics, comorbid conditions (as defined by ICD-9CM codes) and MRSA vs MSSA. The augmented model further incorporated variables extracted from electronic health records, including admission vital signs (temperature, pulse, blood pressure) and laboratory values (bilirubin, sodium, creatinine, glucose, hematocrit, and white blood cell count) within 24 hours of admission. For each set of variables, hospital-level risk-standardized mortality rates (RSMRs) were calculated using hierarchical multivariable logistic regression models, and hospitals were ranked by RSMRs. We used the c-statistic to assess discrimination of the two risk adjustment models, and the Kendall's tau-b rank-order correlation coefficient to compare rankings generated using the two models. Smaller values of Kendall's tau-b indicate greater changes in rankings.
Results: 27,380 patients admitted to 122 VHA were included. The overall 30-day mortality was 16.0%, and ranged from 6.8% to 30.2% across hospitals. The "augmented model" that included patient vital signs and laboratory values had better discrimination than the "standard model" [c =0.811 (0.805–0.819) vs. 0.733 (0.726–0.742), p<0.01]. Addition of vital signs and labs to the standard adjustment model substantively influenced overall hospital mortality rankings (Kendall's tau-b = 0.58, indicating reordered rankings for 21% of hospital pairs).
Conclusion: Inclusion of patient vital signs and laboratory values improved the discrimination of risk adjustment models and changed hospital rankings for SAB mortality. Pay-for-performance and public reporting programs that evaluate outcomes for SAB patients– and potentially for other serious infections – should include data on patient vital signs and laboratory values in risk-adjustment models. If these data are not available or not included, errors in classification could result in unintended consequences for affected hospitals.