Predictive modeling in pharmacy practice, application on hospital readmissions and drug-related problems

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Background Early hospital readmissions are frequent and associated with significant cost. Many of the readmissions are avoidable. Drug-related problems (DRPs) are considered a serious, expensive, and important undesirable complication of health care, as well. Predictive modeling has been identified as superior approach for case finding than other targeting approaches.

Purpose A risk factor model was developed and validated to forecast the likelihood of hospital readmission within 30 days and important DRPs.

Method I. Hospital admission records for adult patients admitted to Antrim Area Hospital in Northern Ireland in 2011 were obtained retrospectively. Patient readmission to the hospital within 30 days was noted together with characteristics that can serve as potential risk factor for readmission. A development, randomly selected, independent, non-overlapping (75%) subsample was used to develop a logistic regression model to identify risk factors for 30-day readmission. A validation sub-sample (25%) was reserved to assess the discriminative ability of the model. II. Patients with diabetes from outpatient clinics from five key hospitals in Jordan were assessed for DRPs (drug without an indication, untreated indication, and drug efficacy problems). Potential risk factors for DRPs were assessed. A logistic regression model was used to identify risk factors using a randomly selected, independent development (75%) subsample from full dataset. The remaining validation subsample (25%) was reserved to assess the discriminative ability of the model.

Findings I. Records for 6610 patients were included in the research, in which 11.0% of those patients had at least one readmission. Independent risk factors for readmission identified (development sub-sample; n=4943) included the Charlson age-adjusted co-morbidity score, respiratory-, genitourinary-, neoplasm- and mental-related primary diagnoses and number of medications prescribed on discharge. Validation results (n=1667) showed an area under the receiver operating characteristic curve of 0.612 (95% confidence interval = 0.583 - 0.640); the model sensitivity and specificity values were 79.7% and 41.8%, respectively. II. A total of 1,494 patients were recruited. Of them, 81.2% had at least one DRP. Using the development subsample (n=1,085), independent risk factors for DRPs identified were male gender, number of medications, prescribed gastrointestinal medication, and nonadherence to self-care and non-pharmacological recommendations. Validation results (n=403) showed an area under the receiver operating characteristic curve of 0.679 (95% confidence interval=0.629-0.720); the model sensitivity and specificity values were 65.4% and 63.0%, respectively.

Conclusion The robust targeting approach utilizing input from the developed risk-factor model in the present study can employed to enhance the case management approaches to decrease avoidable readmissions and DRPs.