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IMPLEMENTING ACG SYSTEM IN ITALY: VALIDATION OF PREDICTED PROBABILITY OF HOSPITAL ADMISSION

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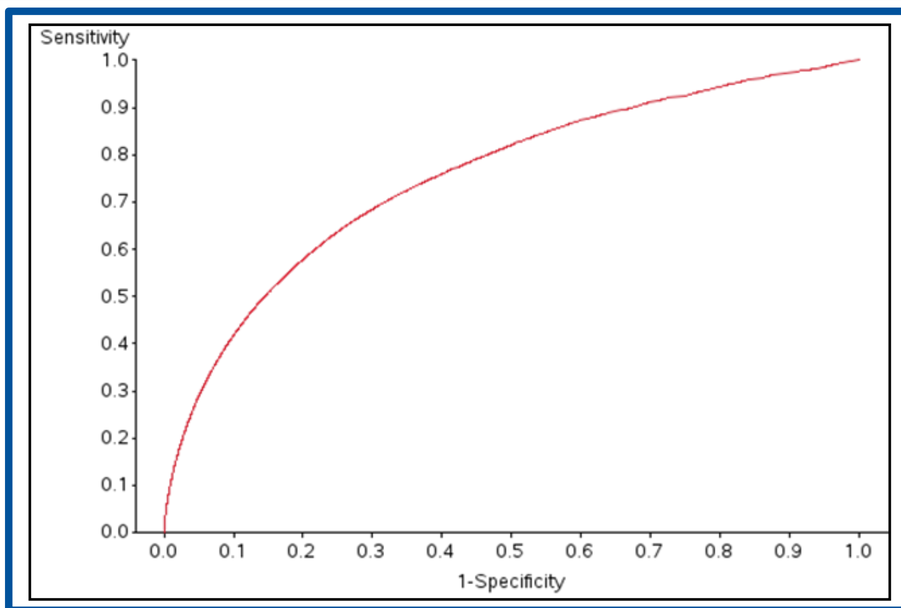
Introduction

Understanding the health care needs of a population is fundamental to improve the cost-effectiveness and sustainability of public health systems as a guide to appropriately distribute resources.
In 2012 the Veneto Region, first in Italy, started a pilot project for implementing ACG system using available claims data.
This study analyzes the prospective application of case-mix measures and statistical forecasting to predict health resource needs. The purpose of the present study is to compare the predicted probability of hospitalization calculated in 2013 with the observed events in 2014, in order to validate the ACG System predictive models in the Italian context.

Results

An increasingly important use of the ACG Suite of Predictive Models has been for high risk case identification. In this study models are used like a diagnostic test and performance is measured at how well true cases are identified and false positives ignored. The table presents three key indicators, sensitivity, specificity and positive predictive value for three cut-off of risk score. The first cut-off selected is the optimal probability where the Youden Index (Sensitivity-(1-Specificity)) is maximum (~20% of Risk Scores). In addition to sensitivity and specificity in assessing the value of a predictive model the Receiver Operating Characteristics Curve (ROC) was constructed and the C-Statistic resulted 0.75.



Methods

This study analyzes the total Veneto Region population (4.856.471 inhabitants) in 2013 and 2014.
For each individual, data on diagnoses, drugs, procedures and costs experienced during 2013 were analyzed using the Johns Hopkins University ACG System v.10.0.1. Sources of data were all the routinely available administrative databases (Hospital Discharge Abstracts, ER visits, copayment exemptions, Ambulatory visits, Medications) and the disease registries (Rare diseases, Psychiatry). The type of predictive models used is the DxRx-PM, a combined model that includes all available data streams, diagnosis and pharmacy codes.
For each person the ACG System generates a probability score indicating the likelihood of a future hospitalization event, intended as an acute care inpatient hospital admission within the 12 months subsequent to the observation period. The probability predicted on data 2013 was compared with the observed hospitalization events 2014.

The model performance is measured by how well true cases are identified and false positives are avoided. The sensitivity, the positive predictive value and the C-Statistic were used as measures of model fit. To find the optimal cut-off value, sensitivity, specifity, Positive Predictive Value (PPV) and Youden Index were assessed.

Risk Group	Evaluation Metric* *outcome is inpatient hospitalization next year	ACG Hospitalization Predictive Model (C=0.75)
Youden TOP ~20% of Risk Scores	**Sensitivity**	**65%**
	Specificity	**74%**
	PPV	**16%**
TOP 10% of Risk Scores	Sensitivity	37%
	Specificity	92%
	PPV	26%
TOP 5% of Risk Scores	Sensitivity	24%
	Specificity	96%
	PPV	34%

Conclusions

ACG Predictive Modeling provides information at the individual patient level to help identify persons who potentially would be well served by special attention from the organization's care management infrastructure.
Using data from almost 5 millions lives, that represents the whole Veneto Region population, we compared the predicted probability of hospitalization calculated in 2013 with the observed events in 2014. In this way we were able to validate the ACG System predictive models in the Italian context and to provide the health professionals with a screening tool that can be set based on the intervention goals and on the health programming priorities. Once identified by the screening procedure, only subjects at higher risk of hospitalization can be enrolled in risk-reducing programs therefore minimizing the occurrence of adverse events (hospitalization) while maximizing the cost-efficiency of the interventions.
The ACG System hospitalization predictive model showed a fair accuracy once applied to Italian data. Such a performance could be improved after a calibration of the model using the variables included in the ACG predictive models and local data: as done in other countries a new set of scores could be developed customized for the local population.