Predicting Patients at Risk for Preventable Adverse Events Upon Discharge From the Hospital With an Acute Exacerbation of Congestive Heart Failure

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Congestive Heart Failure (CHF) is a chronic, progressive condition that limits the heart's ability to pump adequate volumes of blood to the vital organs, accounting for 1 in 4 deaths in the US. Using a preexisting CHF patient database (n=88), which was developed based on a directed acyclic graph, descriptive and predictive statistical analyses were run through R software to identify the factors associated with elevated rates of CHF-related hospital readmissions. Descriptive statistical analysis classified patients who are African American, ages 80-95, and/or have a LACE readmission score of 60-80, as individuals who frequently utilize hospital resources. Unsupervised machine learning analyses validated LACE score, length of stay, and total prior visits as influential features in the health status of CHF patients and hospital readmissions. Then, 3 analytical models were developed and compared to discover the algorithm (K Nearest Neighbor, Regression Tree, or Random Forest) that produced the most accurate predictive model. The accuracy of the 3 predictive algorithms was measured by the correct number of predictions, a confusion matrix, and a root mean square (RMS) value. The Random Forest model had the lowest RMS (0.96), and accurately predicted the disposition of 21/22 patients, identifying Random Forest as the most accurate in predictive ability. Monitoring patients using predictive analytics can prevent readmission by initiating timely interventions for patients at-risk of readmission. With these developments, healthcare systems can bridge the gaps in patient care created by social determinants of health and focus on allocating resources towards the most vulnerable patient populations.

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