

Developing a Novel Model for Predicting Patient Susceptibility to Contracting a Hospital Acquired Infection Utilizing Machine Learning in the Evaluation of Electronic Patient Health Records

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Hospital Acquired Infections (HAI) are of growing concern in the healthcare market because they lead to a 6% mortality rate, increase the average length of stay for a patient from five to twenty-two days, and cost the healthcare industry a projected \$88 billion per year. In the analysis of hospital acquired infections, identification of specific risk factor families, combinations of variables in patient care such as length of stay and age that lead to the contraction of a hospital acquired infection have not been clearly defined. This study focuses on eight hospital acquired infections of interest: Ventilator Associated Pneumonia, MRSA Septicemia, MSSA Septicemia, Pseudomonas aeruginosa Septicemia, Clostridium difficile Infection, Escherichia coli Septicemia, Legionnaires' Disease, and Gastroenteritis and, utilizes k-means clustering, which identifies specific risk factor families (variable combinations that increase risk) for each of the hospital acquired infections of interest, a gradient boosting model, which gives the percent importance of each of the variables of interest, and a regression, a predictive model, to evaluate and create a model using the data. The identification of risk factor families for the data set of 174,804 encounter patients with 126 associated variables accounts for the complex influence of variables in the development of a hospital acquired infection in a patient. In addition, the predictive model will serve in the continual effort to decrease and eventually eradicate hospital acquired infections from patient care by predicting the probability of a patient's susceptibility to acquiring a hospital acquired infection.

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