The Impact of Indirect Contact with C. Diff Patients on C. Diff Infection Occurrence: Risk Factor Analysis and Predictive Modeling

R Shabbar[1], B Azoulai[2], S Poranki[1, 2], and M Khasawneh[1]

[1]Department of Systems Science and Industrial Engineering,
State University of New York at Binghamton,
NY 13902, USA

[2]United Health Services Hospitals,
Binghamton, NY 13903, USA

Corresponding author's Email: rshabba1@binghamton.edu

Abstract: Clostridium difficile (C. Diff) infection is a bacterium infection caused by a spore-forming bacterium, Clostridium difficile. C. Diff bacterium can cause symptoms ranging from diarrhea to life-threatening inflammation of the colon. The infection can spread by bacterial spores found within feces. Surfaces may become contaminated with the spores with further spread occurring via the hands of healthcare staff and/or other C. Diff infected patients. This becomes crucial in a healthcare utility such as hospitals and clinics. For this reason, the indirect contact between patients in a healthcare facility such as sharing room, bed, and/or bathroom need to be investigated. In this paper, an extensive analysis is done to address the impact of C. Diff patients' contacts on spreading the infection. A collected data during the year 2016 from a community hospital for all patients (those who had C. Diff and those who did not) is used. The data includes information about patients' contacts via sharing rooms, beds, or bathrooms, admitting physicians, and length of stay duration (LOS). In addition, four prediction models: Logistic Regression (LR), Gaussian Naïve Bayes (GNB), Decision Tree (DT), and Support Vector Machine (SVM) are developed and compared according to their accuracy in predicting the infection occurrence if the patient have had shared a room, bed, and/or bathroom with a C. Diff patient. Results have shown that sharing the same bathroom prior to departure with C. Diff patients increases the risk of having the infection 6.1 times. This is followed by sharing the same room which has a risk factor of 3.12. Also, physicians and LOS in hospital play an important role in increasing the risk of C. Diff infection occurrence. The mutual information between C-Diff occurrence and LOS and the admitting physician are 28.82%, 24.50%, respectively.

Keywords: C. Diff, Risk Factors, Prediction Models, Data Mining.