Predictive Model for the Development and Spread of Bacterial Resistance in Relation to Antibiotic Consumption in Hospital Settings

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Antibiotic resistance poses a global threat, leading to millions of infections annually and thousands of deaths and the chance of the world entering a post-antibiotic era where common infections and minor injuries are life-threatening. In the efforts put in place towards containing antibiotic misuse through the use of international policies, challenges still lie since the policies are too generalized and do not address problems at specific hospitals. The model proposed in this research relies on the correlation between antibiotic consumption and bacterial susceptibility collected over two years from one hospital to track and predict future resistance. The 800 correlation and significance values calculated are then inputted into the model created to successfully determine the best antibiotics to administer when another antibiotic is facing resistance. The program was then validated against existing literature, microbiologist recommendations and existing policies. For example, when the model was given the case of e.coli showing resistance towards Cefotaxime, the model recommended the use of penicillins or aminoglycosides which had a high correlation between consumption and susceptibility. This is significant because the model suggested the use of antibiotics that belong to different classes of antibiotics, meaning ones that kill bacteria in a different way (bacteria not resistant to). The model also gave the 5 worst antibiotics to use and most of them were cephalosporins (same class as cefotaxime), meaning they kill the bacteria in a similar way and would eventually lead to more resistance. The model can be applied in hospitals to track the antibiotic resistance growth in an area and enhance infection prevention efforts in hospitals and communities.

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