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IMPACT OF THALASSEMIA ON POPULATION DYNAMICS

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Thalassemia is an inherited blood disorder that causes the human body to have less haemoglobin than normal. Haemoglobin is essential because it lets human red blood cells carry oxygen to all parts of the body. The impact of thalassemia can range from mild to severe anaemia and be life-threatening. Thalassemia affects approximately 4.4 out of every 10,000 live births throughout the world. To develop thalassemia major, both parents must be carriers of the disease. As a result, an individual will have two mutated genes. On the other hand, an individual can become a thalassemia carrier by having only one mutated gene. The objective of this study is to develop a mathematical model using the basics of Lotka's model, which describes the pattern of inheritance of thalassemia disease from parents to offspring and the long-term impact of thalassemia disease by the Markov chain process. The developed model can be used to predict the propagation of thalassemia within a given population. After formulating the model, some fundamental properties of the model are analyzed. Further, it is proved that carrier screening prior to marriage or mating will contribute to the reduction in the population of those suffering from thalassemia disease. The Markov process reflects that the carrier class has greater potential to dominate the population in the long run. It is estimated that the population will stabilize at 25, 50, and 25% for a normal, carrier, and patient genotypic groups, respectively. Therefore, these findings should alert the authorities to take serious preventive measures to address the issue.

Keywords: Blood disorder, Markov process, Mathematical model, Thalassemia