Finding the Most Influential Factors which Control the Healing of Chronic Wounds

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Up to $18.7 billion is spent on the treatment of chronic wounds per year, which afflict over 6.5 million people per year. To combat this issue, we set out with the goal of analyzing and refining a mathematical model that describes the interactions within the healing of a specific chronic wound, diabetic foot ulcers, and then find the most influential or factors, or parameters, in the model. Thus, once these factors are found, treatment can be optimized. Using this differential equation model and patient data from a study previously conducted, this work focuses on an approach using a global sensitivity analysis, aiming to find the most influential factors which control the dynamics of the wound. The approach is a variance-based algorithm, which was coded in MATLAB®. Using model output vectors, relative “Sobol” or “sensitivity” indices are computed. These were then ranked and using a cutoff, a subset of factors was found to the most influential. The subset was then tested using model parameter Markov Chains and posterior densities. This serves to demonstrate the validity of our results, however, some of the patients’ chains would not converge. Subsequently, an identifiability analysis was performed, and an explanation was found. This research shows the two most influential parameters and we believe that our results can be generalized to chronic wounds of all cases.

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