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A Hypothesis-Driven Parametric Study of a Computational Dermal Replacement Model

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ABSTRACT IMPACT: This work will be used to improve the design of engineered dermal replacements that can be used to treat difficult-to-heal wounds such as burns or ulcers. OBJECTIVES/GOALS: Wounds of the skin are among the most common and costly medical problems experienced. Engineered dermal replacements have been developed to improve outcomes, but the optimal design features are unknown. Here we describe a hypothesis-driven study of scaffold parameters using a computational model of wound healing to simulate a variety of treatments. METHODS/STUDY POPULATION: The computational model, which was informed by animal data, was used to simulate cell, cytokine, and collagen density fields. There are reciprocal mechanobiological interactions between the cells and collagen that guide the wound healing process. We analyzed initial wound properties such as scaffold stiffness, microstructure, degradation, and wound geometry by running a one-at-a-time order-of-magnitude parameter change. We then conducted a derivative-based local sensitivity analysis for simulated experimental conditions and constructed a surrogate model of wound contraction using Gaussian process regression. RESULTS/ANTICIPATED RESULTS: We conducted finite element model simulations of scaffolds that varied in physical properties. A sensitivity analysis demonstrated that wound contraction was highly sensitive to collagen fiber stiffness and density. Wound contraction rate was also dependent on initial wound size and surface area. Collagen fiber orientation in the scaffolds affected contraction directionality and the orientation of the final wound area. A Gaussian process regression model was fit to the simulation results for use in rapid prototyping of scaffolds for design optimization. The Gaussian process model was able to reproduce the wound contracture for training and test cases. DISCUSSION/SIGNIFICANCE OF FINDINGS: This work further analyzes a computational model of wounds treated with collagen scaffold dermal replacements. The hypothesis driven analysis of the model suggested several key design features of scaffolds. The model surrogate will further be used for the purposes of prediction and optimization of tissue regeneration outcomes.

Commercialization/Entrepreneurship

26600

HiTech and Health Interest Trends in Rural Neighborhoods are Associated with COVID-19

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ABSTRACT IMPACT: Current, complete, unbiased, and accurate information, which includes patient social and environmental context, is necessary to understand health outcomes. OBJECTIVES/GOALS: Literacy in technology empowers patients in improving their health. We hypothesize that by integrating this information into clinical information, obfuscated relationships may become apparent. To test this, we have combined technological literacy elements with clinical data and test results from patients at risk for severe COVID-19 reactions. METHODS/STUDY POPULATION: Zip level data was appended to approximately 55,000 clinical records of COVID-19 positive and negative patients with comorbidities linked to high illness severity (e.g., diabetes, heart disease). The patient zip code was matched to zip code level health and technology interest indicators. Health interest indicates the level of interest in health such as research, exercising, better dieting, preventive care, etc., and is ranked from 0 to 9. The technology interest indicator is a binary flag indicating technology adopters. These lifestyle factor data points were obtained from survey data and purchasing patterns using transactional and response information from self-reported sources. For each zip code, the index values were represented by a percentage of that population. RESULTS/ANTICIPATED RESULTS: There is a pronounced difference between urban and rural areas with respect to interest in health and technology. In neighborhoods where most residents are interested in both health and technology, the percentage of COVID-19 cases was smaller. A Wilcoxon signed-rank test indicated that the distributions were statistically different (p-value = 4.606e-06) when evaluating the low interest values for health and technology, and (p-value = 1.069e-09) when there was high interest in health and technology against COVID-19 results. In addition, the health and technology indicator variables are not correlated with income at the zip code level. At the low index values, interest in health and technology, the correlation was -0.0856, and at the high end, the correlation was -0.0436. DISCUSSION/SIGNIFICANCE OF FINDINGS: This result is significant for COVID-19 research because it describes a methodology for identifying patients who may be at higher risk for contracting the disease. This relationship was reflected in electronic health record data only after zip-level information was added. Moreover, this was true at across income levels.

Dissemination and Implementation

90552

Evidence synthesis with reconstructed survival data

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ABSTRACT IMPACT: A one-stage Bayesian multilevel model for meta-analysis integrating different survival data is introduced to complete the information synthesis without assuming proportional hazard. OBJECTIVES/GOALS: To develop a general modeling approach to perform efficient and robust meta-analyses using aggregated data (AD) for survival type endpoint and apply to a meta-analysis to examine the association between measurable residual disease (MRD) and disease-free survival (DFS) and overall survival (OS) in patients with acute myeloid leukemia (AML). METHODS/STUDY POPULATION: A Bayesian semi-parametric hierarchical model with a time-varying HR effect was presented. Three common types of survival information, including reconstructed survival data, the hazard ratio (HR) estimates with corresponding CIs and survival rates at specific time points, are synthesized such that all literature from the systematic review can contribute properly to the estimation and uncertainty quantification of the model parameters. The

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