

A General Microsimulation Toolkit for Patient Specific Predictions, Treatment Efficiency and Life Expectancy

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The use of microsimulation is a widely accepted and useful strategy to help clinicians decide on treatment of patients with aortic valve replacement (AVR). Microsimulation simulates the probability of operative mortality and AVR related events for an individual patient based on his clinical characteristics and the type of AVR. Specifically, it creates a virtual population of patients with identical baseline characteristics to predict the event free period after surgery, reoperations and life expectancy for each type of AVR. We hypothesize that the microsimulation technique can be applied to other clinical patient populations. We rewrote the specific tailored microsimulation software for AVR patients (that was developed in our center) into a general microsimulation toolkit. This toolkit can process an array of patient / disease specific baseline parameters, event prediction / survival functions, treatment efficiency / treatment related events. We developed a webbased toolkit in C# .NET and the mathematical toolkit JEP.NET. The system can handle a variety of statistical methods such as: (logistic) regression models, (log) normal, 2-period, Weibull, Pareto, and Gompertz. It has a user-friendly interface to incorporate these statistical methods into a patient-event-treatment microsimulation model. It calculates the time-to-event, event-free period, life expectancy, treatment efficiency and treatment related events. It facilitates the comparison of the outcomes of each simulation (statistical and graphical in a survival curve) for different treatment choices. We have evaluated the AVR model in this newly developed toolkit and compared the results of both programs. We ran 100000 simulations for 4 types AVR operations and we found excellent similarity in the results that were obtained with the two microsimulation tools. We found < 0.08 risk difference for operative mortality and < 0.44 years for life expectancy. In near future we will develop microsimulation models for a range of cardiac patients with this new toolkit.