HEALTH RESEARCH ABSTRACT SUBMISSIONS #43

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Title of Research *	Terrain of Frontal Crashes
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Introduction & Purpose *

In 2009 an estimated 33,808 people died in motor vehicle traffic crashes. Fifty-five percent of these involved frontal impacts. Based on Kaufman et al's work, a predictive model for determining injury and severity based on shape and level of intrusion, crash terrain, was explored. Crush depth and A-pillar movement are typically used to predict potentially severe injuries. Such injuries currently cannot be estimated because of limitations in current sensor data. Sensors could be used to determine the severity of a crash and map a basic terrain of the crumple and impact. While air bag sensor information gathered is binary, enhanced information of the severity of an impact can be found by the sensor information gathered.

Experimental Design *

To better understand how frontal crashes affect the post-impact terrain of a vehicle we begin with a mid-size car and apply five sensors evenly spaced across the front of the vehicle allowing a 30 degree angle to the sensors, in an inverted "v" shape. In order to understand the shape of a crush pattern, a time series were developed for a set of hypothetical crashes to determine the potential shape of a crash and its intrusion into the occupant compartment. These time series' were then plotted with a trendline to determine the base mathematical structure of the terrain of the impact. To visualize a graphical representation of the crash, a simulated vehicle with sensors was designed. Each sensor was then highlighted as it was affected by the impact sequence.

Results *

We see that a basic mathematical model of the terrain of crashes yields a polynomial equation where x is the time, n power is the number of sensors affected and the y intercept is the time between impact and first sensor affected. To be shown in Figure 5. An increase in the number of sensors increases the information the severity and type of injury by showing which part of the vehicle is affected. When this information is known, then we know through Kaufman et al's work there exists correlations between injury type and crash type. The crush of a frontal impact as seen previously could predict the injury (i.e. if there is movement in the lower portion of the vehicle causing leg impairment, lower extremity injury would be predicted).

Conclusions *	This simplistic representation of the crush terrain provides a visualization of the impact pattern and may be able to better predict injury relative to a single and binary airbag deployment sensor. A future computational model will include: acceleration, velocities of opposing vehicles/objects, mass of opposing vehicles/objects, gravity, coefficient of friction.

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