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# Measuring the Accuracy of Predictions from Patient-Specific Models of Intracranial Pressure Dynamics

Wayne W. Wakeland Portland State University, wakeland@pdx.edu

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#### Measuring the Accuracy of Predictions from Patient-Specific Models of **Intracranial Pressure Dynamics** Portland State Systems Science

### Objective

Determine the prediction capability of a computer model of ICP dynamics

### Background

 Outcomes for elevated ICP following traumatic brain injury (TBI) remain mixed

- TBI remains leading cause of death and disability in children
- Sophisticated computer models calibrated to fit patientspecific clinical data No studies have
- reported the prediction capability of these models

## **Discussion/Conclusion**

- Despite small error in model fit to data. model prediction error is too large to be clinically useful
- Caution warranted: prediction is hard!!

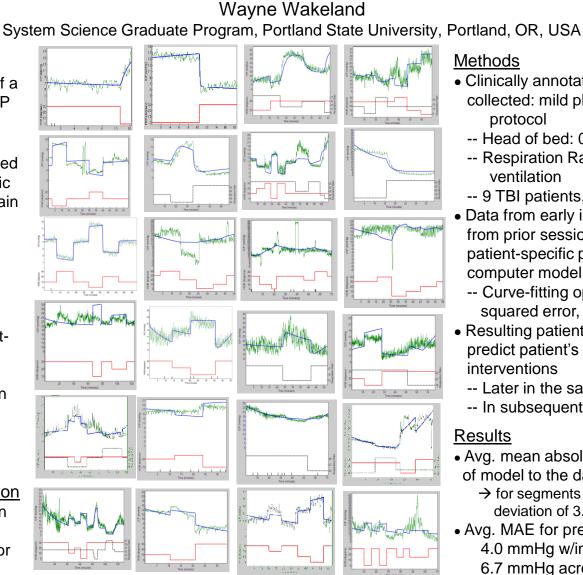


Figure 1: Model ICP (blue) vs. Actual ICP (green), w/HOB (red) and Respiration Rate (dotted black)

 $\rightarrow$ A good fit between model and historical data may not yield good predictions!

# Methods

- Clinically annotated prospective data collected: mild physiologic challenge protocol
  - -- Head of bed: 0 to 30 degrees
  - -- Respiration Rate: mild hyper- to hypoventilation

Graduate Program

- -- 9 TBI patients, 24 sessions
- Data from early in single long session or from prior sessions used to estimate patient-specific parameter values for computer model of ICP dynamics
  - -- Curve-fitting optimization minimized squared error, modeled ICP vs. data
- Resulting patient-specific models used to predict patient's ICP response to interventions
  - -- Later in the same session
  - -- In subsequent sessions

# Results

- Avg. mean absolute error (MAE) for fitness of model to the data: 1.9 mmHg
  - $\rightarrow$  for segments with avg. mean absolute deviation of 3.1 mmHg
- Avg. MAE for predictions:
  - 4.0 mmHg w/in same session;
  - 6.7 mmHg across sessions

#### **ICCAI 2007** Long Beach, CA