Track patient recovery in real-time by processing streaming data

BIOMEDICAL DATA DESIGN

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Content

01

EICU Database

01

Overview of the database

The eICU Collaborative Research Database, a freely available multi-center database for critical care research

Tom J. Pollard, Alistair E. W. Johnson, Jesse D. Raffa, Leo A. Celi, Roger G. Mark & Omar Badawi

Scientific Data **5**, Article number: 180178 (2018) | Cite this article

1.Background of the database

Stream data from ICU → Philips Healthcare → Auxiliary diagnosis

Philips Healthcare → **eICU Collaborative Research Database**

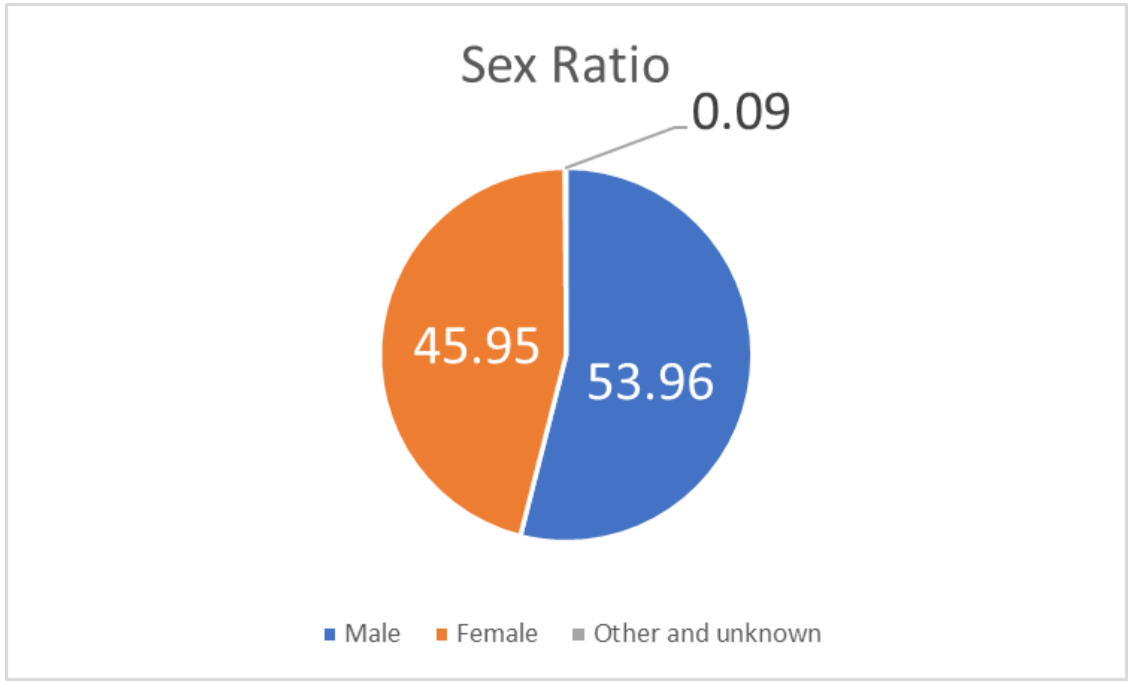
01

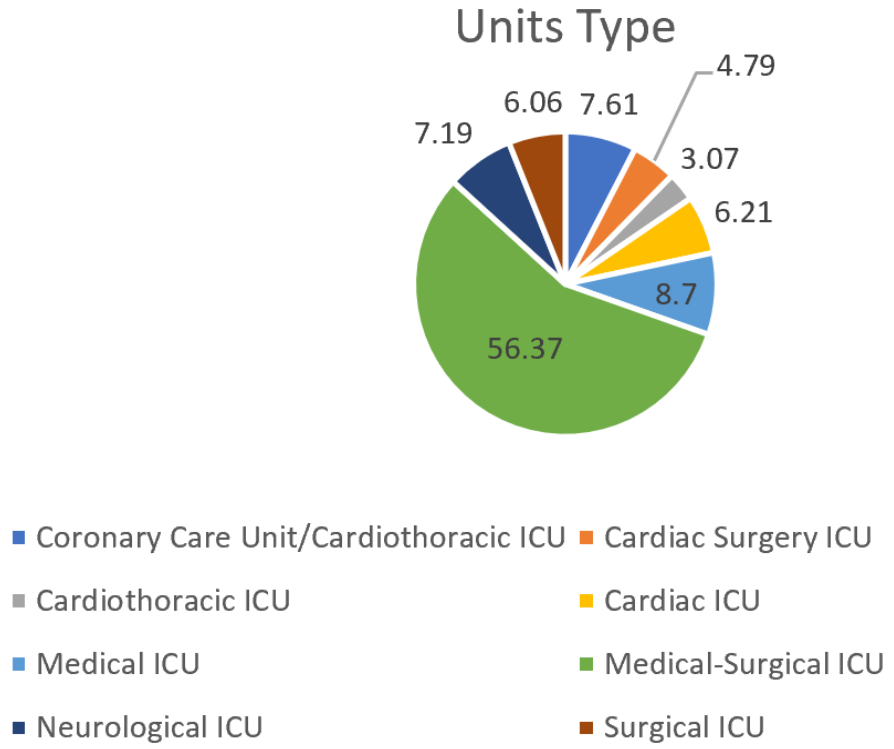
Overview of the database

1.Background of the database

2.Data source of the database

200,859 patient units



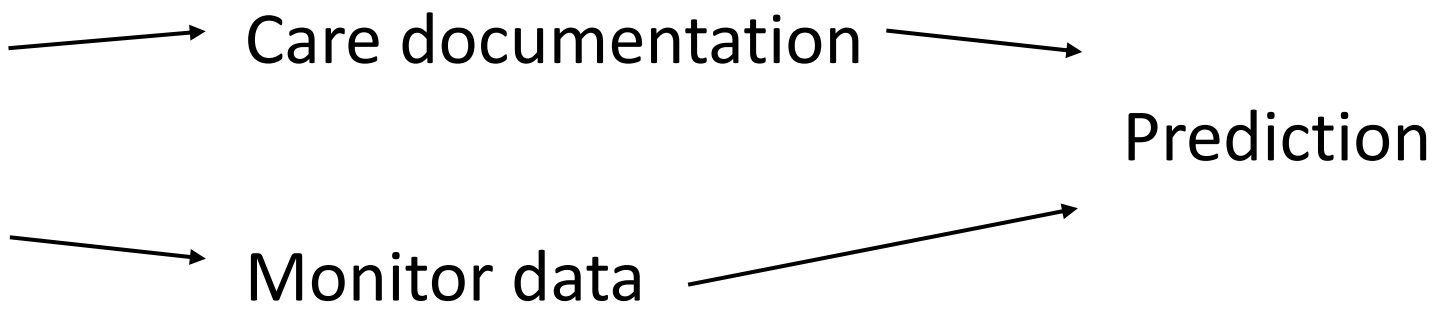


01

Data we need

1. Background of the database
2. Data source of the database
3. Data types and the data we may need to utilize

Care documentation	Monitor data	APACHE	Care plan
admissionDrug	*vitalAperiodic*	*apachePatientResult*	
allergy	*vitalPeriodic*		
customLab			
diagnosis			
infusionDrug			
intakeOutput			
lab			
medication			
microLab			
nurseCare			
nurseCharting			
pastHistory			
physicalExam			
respiratoryCare			



02

APACHE

02 **APACHE**

FEATURE ARTICLES

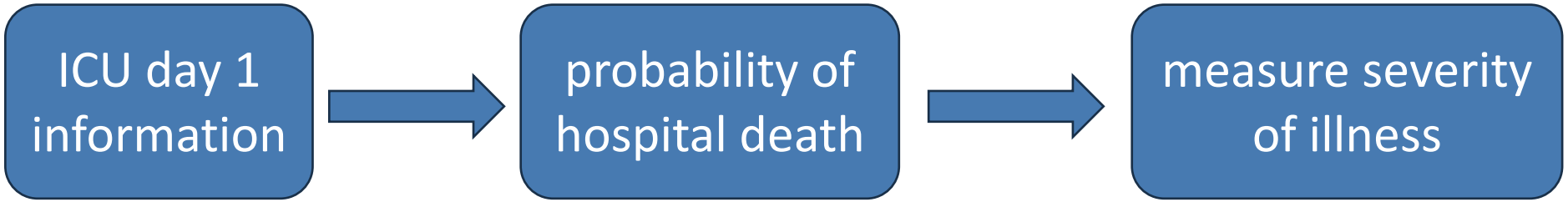
Acute Physiology and Chronic Health Evaluation (APACHE) IV: Hospital mortality assessment for today's critically ill patients*

Zimmerman, Jack E. MD, FCCM; Kramer, Andrew A. PhD; McNair, Douglas S. MD, PhD; Malila, Fern M. RN, MS

Author Information

Critical Care Medicine 34(5):p 1297-1310, May 2006. | ***DOI:*** 10.1097/01.CCM.0000215112.84523.F0

1.Overview of APACHE

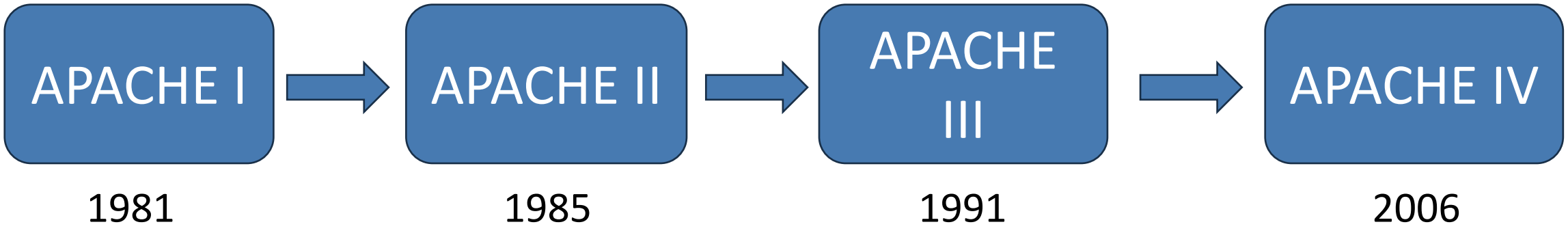


02

APACHE

1.Overview of APACHE

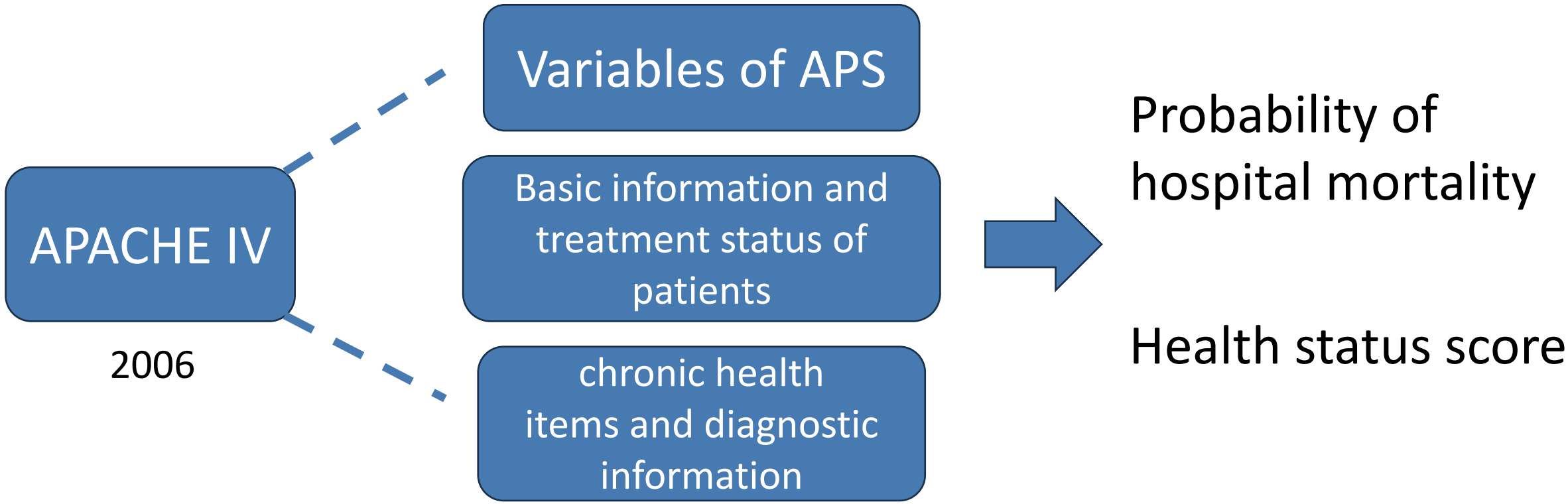
2.APACHE I, APACHE II, III and IV



02 **APACHE**

1.Overview of APACHE

2.APACHE I, APACHE II, III and IV



02 **APACHE**

1. Overview of APACHE
2. APACHE I, APACHE II, III and IV
3. Evaluation criterion

AU-ROC

Hosmer-Lemeshow C statistic for goodness-of-fit test

Cox chi-square test to evaluate the **equivalence of subgroups and in aggregate**

02 **APACHE**

1.Overview of APACHE

2.APACHE I, APACHE II, III and IV

3.Evaluation criterion

4.Advantages and disadvantages

Positive side APACHE IV Negative side

1.Excellent discrimination

2.Excellent calibration

3.Predictions are consistent in most subgroups and the mean

1.Access to the data related to 142 variables

2.The generalization ability

3.Static prediction

03

Our Goal

03

Our Goal

What we hope to predict based on APACHE?

- Healthy status
- Death rate
- Recovery rate
- Expected duration of hospitalization
- Intensive care unit readmission rate
- Complication rate
- Trends in disease progression...

03

Our Goal

The inputs we wish to utilize and the outputs we wish to obtain

(We want streaming input and output.)

Input data:

- **Physiological parameters and monitoring data**
- **Laboratory examination data**
- **Drug information**
- **Treatment information:** Includes information on treatments, surgeries, and rehabilitation received by the patient.
- **Event Data:** Includes event data such as medical records, surgical records, and pain assessments.
- **Other things that may be important...**

03 # Our Goal

The inputs we wish to utilize and the outputs we wish to obtain

(We want streaming input and output.)

Output data:

- **Real-time analysis results:** Includes real-time analysis results of patient status, such as abnormal alerts, disease predictions, and deterioration warnings**.**
- **Patient status prediction:** Predicts possible patient status and disease trends, such as possible patient diagnosis, treatment effects, etc.
- **Decision support information:** Decision support information provided to clinicians, such as recommended treatment plans, drug dose adjustment suggestions, etc.
- **Statistics and analyzing results:** Provides statistical analysis results for a patient group or a specific case, such as average vital signs of the patient group, prevalence of a specific diagnosis, etc.

03

Our Goal

Method/model to be used

- **Better acc?**
- **logistics regression**（reproduced from APACHE）
- **SVM**
- **K-Means**
- **Decision tree**（or a weak learner for AdaBoost?）
- **XGBoost**（Suitable for incremental learning）
- **ANNS** (needs to be followed up with continued research)
- **CNN** (for image)
- **RNN LSTM RL...**

04

Challenges

04 Challenges

- **eICU Database**
  - Accessibility to Database
  - High Dimensional Data
  - Time-Sensitive Data
  - Data Completeness & Quality
- **Evaluating performance / Establishing criteria**
- **Medical interventions / Medicines**

References

1.Pollard, T., Johnson, A., Raffa, J. *et al.* The eICU Collaborative Research Database, a freely available multi-center database for critical care research. *Sci Data* **5**, 180178 (2018). https://doi.org/10.1038/sdata.2018.178

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3.Castella, Xavier MD; Artigas, Antoni MD; Bion, Julian MBBS MRCP, FRCA, MD; Kari, Aarno MD. A comparison of severity of illness scoring systems for intensive care unit patients: Results of a multicenter, multinational study. Critical Care Medicine 23(8):p 1327-1335, August 1995.

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5.Hanley, J. A., & McNeil, B. J. (1982). The meaning and use of the area under a receiver operating characteristic (ROC) curve. Radiology, 143(1), 29-36.

Thank you