Teaching Bioinformatics Students about Clinical Data

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Introduction: Ted Laderas

- Assistant Professor
  - Division of Bioinformatics and Computational Biomedicine
  - Department of Medical Informatics and Clinical Epidemiology
  - Oregon Health & Science University
- Research Interests
  - Education (active learning)
  - Interactive Visualization
  - Immunoinformatics
  - Drug Sensitivity/Resistance in Cancer

Overview

- Why teach bioinformatics students about clinical data?
  - Encourage translational research
- How do we teach them?
  - Clinical Data Wrangling
  - Data Analytics
  - BioData Club
- Who are examples of our success?
  - Gabby Choonoo
  - Connor Smith

Motivation: Why?

- Research is multi-disciplinary
- Need for Translational Research Workforce
- Bridge gaps between computational biology and clinical realms

Bioinformatics Students: Clinical Data Opportunities

- Clinical Data Wrangling Workshop
- BMI569 Data Analytics
- BioData Club

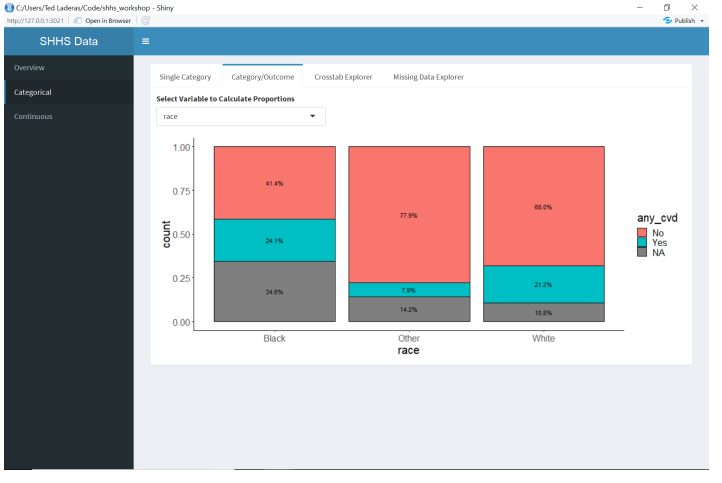
Clinical Data Wrangling

- Designed for both clinical and bioinformatics students
- Introduce students to data quality issues with clinical data
- Use Sleep Heart Health Study data
  - Partnership with http://sleepdata.org
- http://laderast.github.io/clinical_data_wrangling/

Eilis Boudreau, Ted Laderas, Nicole Weiskopf

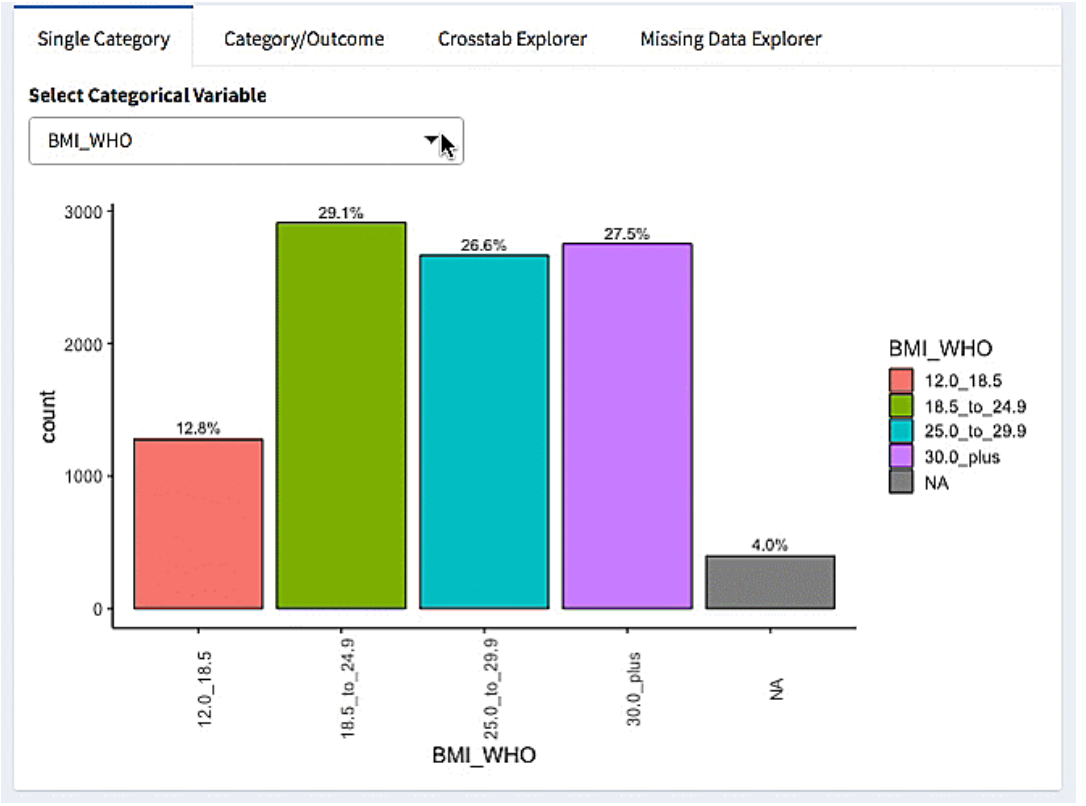
The Goal: build a predictive model of Cardiovascular Disease

- Biology of Sleep
- Data Quality Issues
- Exploring the Dataset
- Building a predictive model
- Reporting your predictive model



Making Decisions by Exploring Data

- Shiny app (burro) that lets students explore dataset
- Code-less, assumes no coding expertise



Building Predictive Models by Making Decisions

Step 1: Initial Model

Choose your initial model from the following. You don't need to show any figures here.

- `any_cvd` (your outcome)
- `age_s1`
- `gender`
- `bmi_s1`
- `neck20`

Hide

```
#show your code for the basic model here
```

Step 2: Do you add `race` to your model?

Put a short definition of `race` from your model. If you think it is important to add race and you are satisfied with the quality in the dataset, show a figure here. If you don't think it's important or you aren't satisfied with the quality of the `race` variable, show a figure here.

Hide

```
#put model code here
```

Outcomes

- Currently assessing impact on students

BMI569: Data Analytics

- Summer Hybrid Course taught jointly with Kaiser Permanente
- Focus on helping make decisions in a Health Care Setting
- Sociotechnical challenges in implementing a predictive model
  - Implementing a predictive model (R-based)
  - Organizational Lectures and Challenges from Kaiser

David Dorr, Tracy Edinger, *Ted Laderas*, Shannon McWeeney, *Delilah Moore*, and *Brian Sikora*

BMI569: Practical Coursework

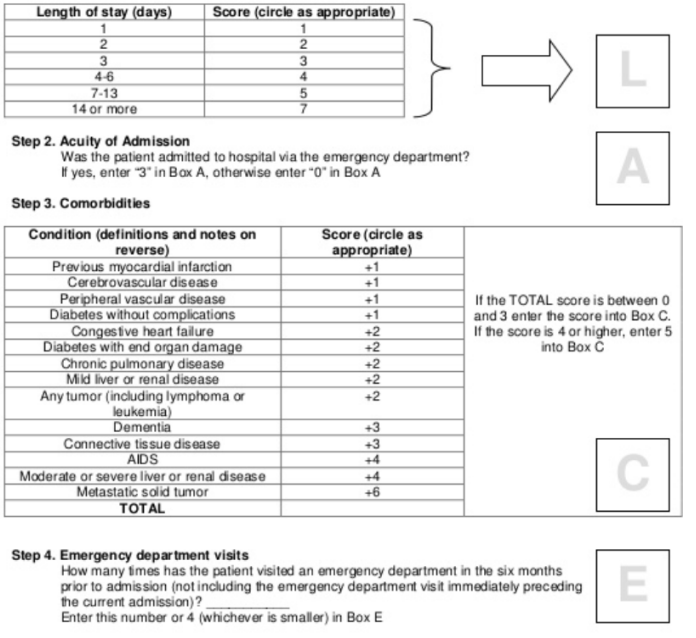
- 8 weeks online coursework in R/SQL and 1 week in person
- Patients assess and query a simulated data warehouse
- Rmarkdown document based assignments
  - provide guidance
- http://laderast.github.io/AnalyticsCourse

Mixing Clinical and Bioinformatics

- Roughly 50% Clinical/50% Bioinformatics
- Opportunity! Pair them up for joint learning
- Learn skills and challenges from each other

Goals

- Predict 30-day hospital readmissions
- Joining/Querying/Data
- Implementing the LACE metric and assessing it
- Kaiser Experience in Implementation and Impact
- Communicating your results to an executive team



Length of stay (days)	Score (circle as appropriate)
1	1
2	2
3	3
4-6	4
7-13	5
14 or more	7

L

Step 2. Acuity of Admission
Was the patient admitted to hospital via the emergency department?
If yes, enter "3" in Box A, otherwise enter "0" in Box A

A

Step 3. Comorbidities

Condition (definitions and notes on reverse)	Score (circle as appropriate)
Previous myocardial infarction	+1
Cerebrovascular disease	+1
Peripheral vascular disease	+1
Diabetes without complications	+1
Congestive heart failure	+2
Diabetes with end organ damage	+2
Chronic pulmonary disease	+2
Mild liver or renal disease	+2
Any tumor (including lymphoma or leukemia)	+2
Dementia	+3
Connective tissue disease	+3
AIDS	+4
Moderate or severe liver or renal disease	+4
Metastatic solid tumor	+6
TOTAL	

If the TOTAL score is between 0 and 3 enter the score into Box C. If the score is 4 or higher, enter 5 into Box C

C

Step 4. Emergency department visits
How many times has the patient visited an emergency department in the six months prior to admission (not including the emergency department visit immediately preceding the current admission)? _____
Enter this number or 4 (whichever is smaller) in Box E

E

https://greatplainsqin.org/wp-content/uploads/2015/01/Lace-Index-Scoring-Tool.pdf

Analytics Course: Successes

- Nominated for a course award by our students
- Students have gone on to work for Kaiser

BioData Club

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- Lifelong Learning Group about Data Science
- Cross Disciplinary / Hierarchy Flattening
- Psychologically safe space to learn
- Teaching Opportunity
- Lots of workshops/social activities!

http://biodataclub.github.io

BioData Club Kit

- Start a BioData Club at your Institution!
- Part of CD2H (Center for Data to Health)
- Contact me if interested!

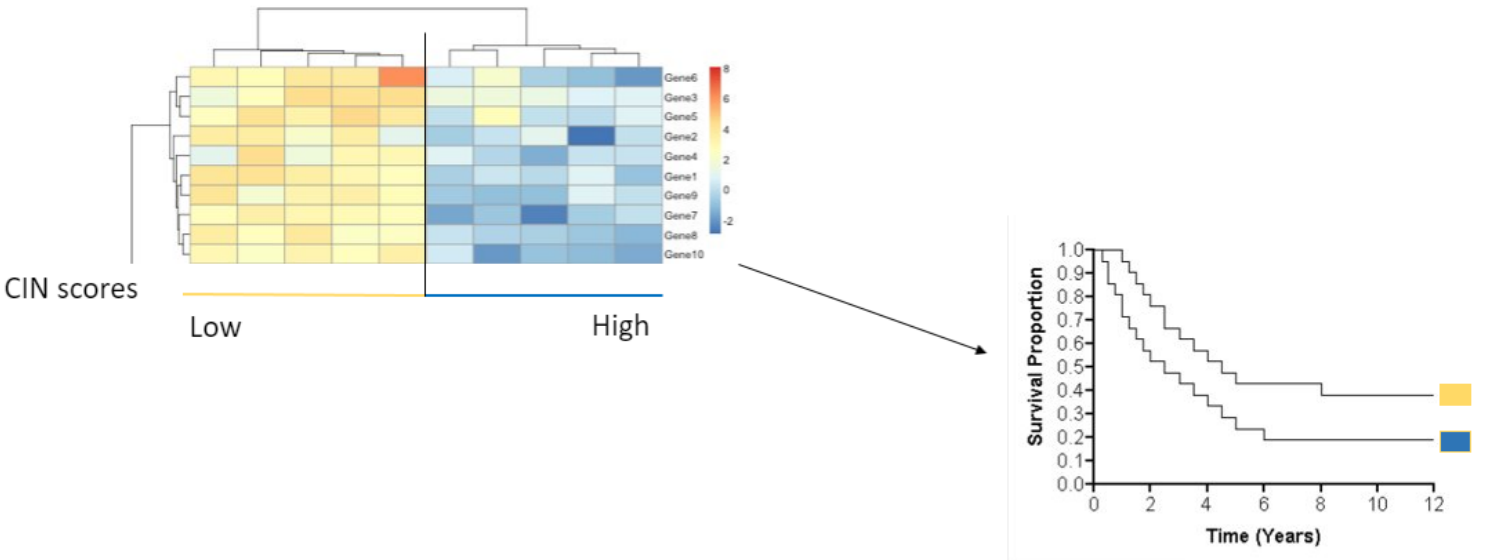
Student Successes

- Gabrielle Choonoo
- Connor Smith

Gabrielle Choonoo

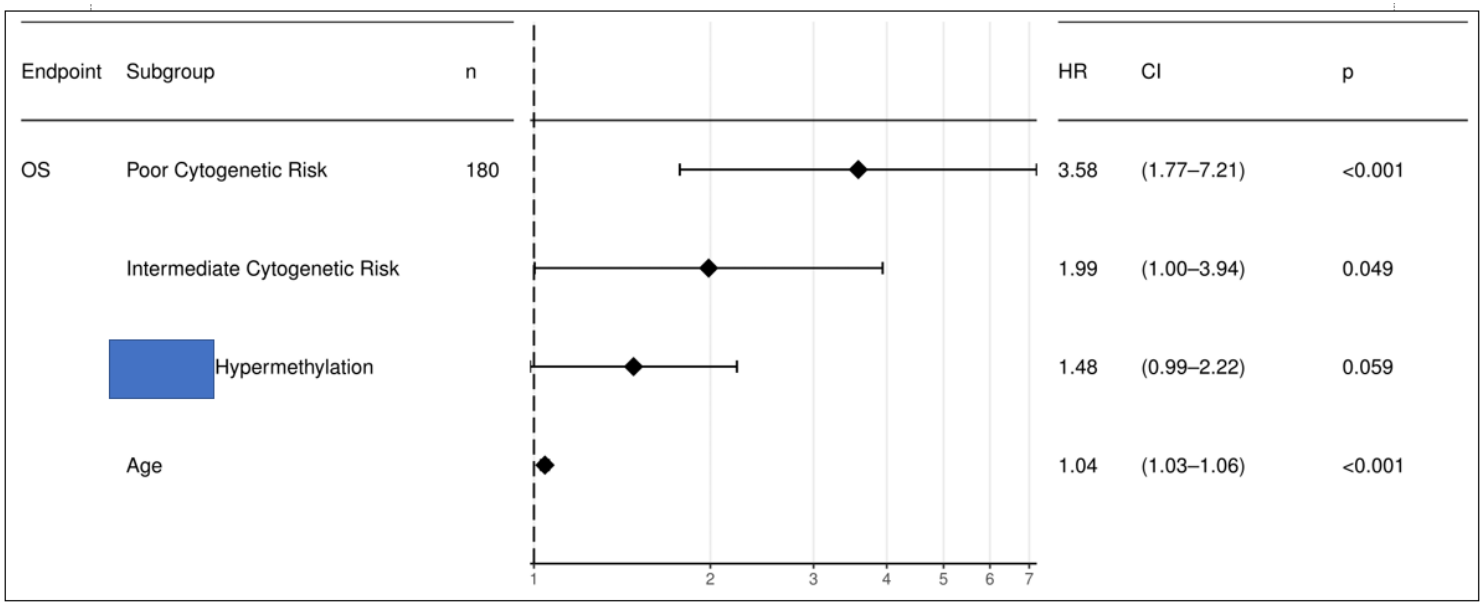
"Genomic Stability of Solid Tumors and Clinical Applications"

Investigate the predictive ability of the genomic instability annotations across a variety of cancer types



Connor Smith

- OSU Graduate in Biology
- Thesis: Methylation Effects in AML
- Now working in a clincal setting!



Principles and Values

- Reduce barriers between clinical and computational cultures
- Pair clinical/bioinformatics students for co-learning
- Flatten hierarchies for co-learning
- Value lifelong learning as an attitude

Keep in Touch!

laderast@ohsu.edu | @tladeras | http://laderast.github.io

- http://laderast.github.io/AnalyticsCourse
- http://laderast.github.io/burro
- http://laderast.github.io/clinical_data_wrangling/
- BioData-Club Kit: http://biodataclubkit.github.io

Learn more about our graduate program!

- 4/23, 10 AM - 2 PM @ OSU PreHealth Fair (Memorial Union Ballroom)
- Webinars about
  - Clinical and Bioinformatics Majors
  - email Lauren Ludwig: ludwigl@ohsu.edu