

# Lean Analytics for a Leaner Person





# Hello!

***We are Group #8***

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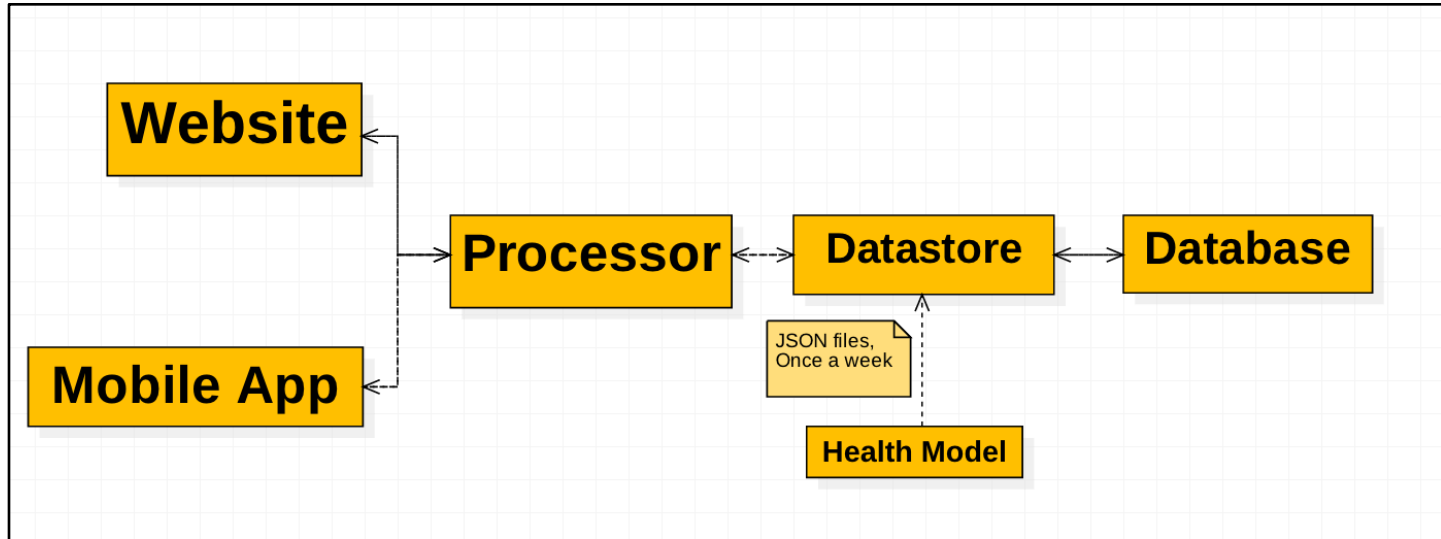
# System Architecture

How is our system architected?

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# System Architecture



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## Data and Model Improvements

Generated state level samples & developed state level models for health statistics, increasing model precision

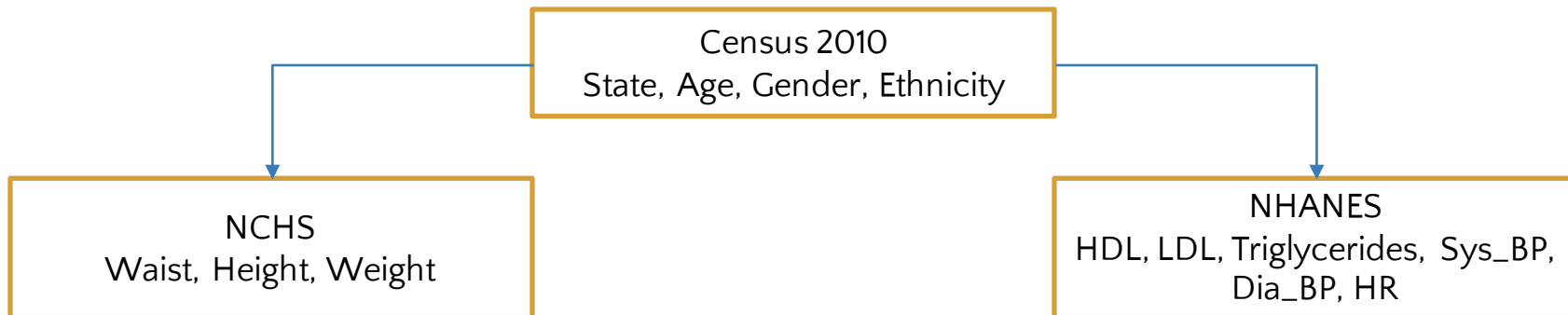


## Sample Generation

- ◉ Technical Challenge: Lack of State Level Data
- ◉ Solution: Stratified Monte Carlo Sampling
  - Used sample statistics from NHANES, NCHS and Census as marginal distributions about state populations
  - Assign Health Statistic using National Level CDC Data to person
- ◉ Two methods were used:
  - Random Sampling – Mersenne Twister
  - Partially Correlated Sampling
    - Linear Relationship between Systolic and Diastolic Blood Pressures <sup>[1]</sup>
    - Inverse Relationship between HDL and Triglycerides Levels <sup>[2]</sup>



## Sampling Methodology



- ◉ Sample generated for each state is 1% of the state's population
- ◉ **Note:** The Census oversampled when due overlap of Whites, White Hispanic/Latinos, and Hispanic/Latinos. To minimize over counting, we considered only Hispanic/Latinos and Non-Hispanic Whites.



## Simulation Validation

(%)	Random*	Correlated*	National* [3,4,5]	State Stat* [6,7,8]
Obesity	63.25	65.76	68.80	64.10**
Hypertension	14.18	27.18	29.10	32.49***
High Cholesterol	11.39	11.42	13.00	38.54***

\* The percentages have been adjusted for population

\*\* State Level Obesity level reports the percentage of people overweight or obese

\*\*\* State Level Hypertension and Cholesterol stats report the percentage of people **who have ever been told** by their doctor to have the condition.





## Model Prediction

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- ◉ **Technical Challenge**: Improving the precision of the model
- ◉ **Solution**: Use Correlated Sample to generate model
- ◉ Prediction range shrank from [Min, Max] to [Mean – STD, Mean + STD] with little change in accuracy
- ◉ The models are similar to before, with minor tweaks to the static threshold



## Model Validation

(%)	State (Mean, STD)	National (Min, Max)
HR	73.69	77.57
Systolic	74.77	76.35
Diastolic	69.54	77.86
LDL	73.48	59.51
HDL	75.06	63.02
Triglycerides	73.97	58.31

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# API Server: Processor & Datastore

The central link between the Health Model, Database, Mobile Application and Website



## API Server: Processor & Datastore

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The API server is written in PHP and composed of two sub systems: Processor and the Datastore.

The processor accepts requests from the mobile app and the website.

The processor passes this request onto the datastore.

The datastore performs all interactions with the database.

The datastore is made up of the the driver and data operations.

The driver makes the connection to the database via the PDO abstraction layer.

Data Operations contains all queries executing all CRUD operations.

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# Website & Mobile Application

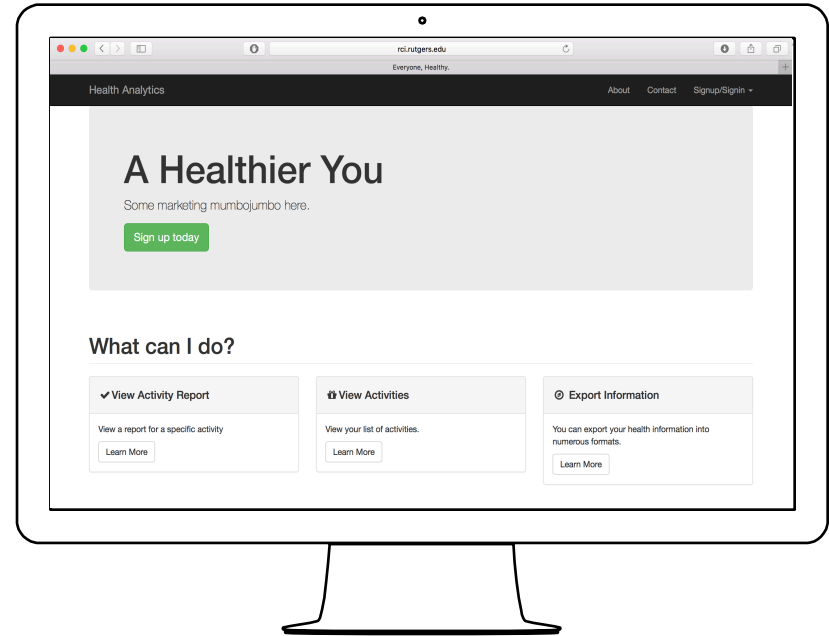
How our users will interact with the system



## Website project

Created using  
Bootstrap, AngularJS,  
the Google Maps API &  
Packaged using Grunt  
and Gulp.

These tools allow for  
efficient MVC design,  
specifically AngularJS.

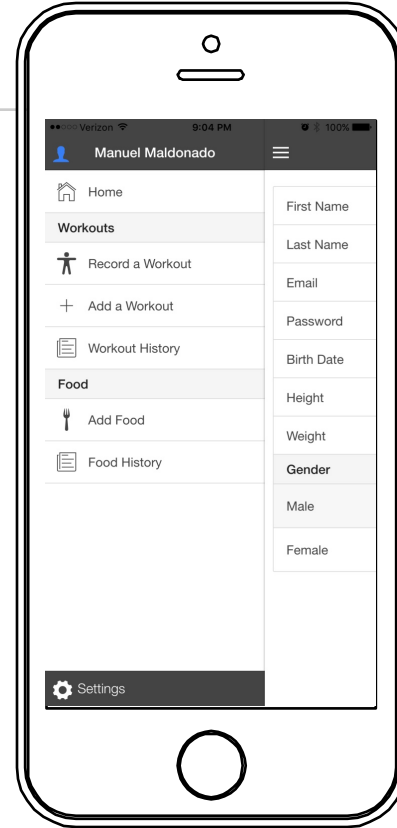




## Mobile project

Created using Ionic Framework, AngularJS and Apache Cordova, tested with Karma.

These allow for great MVC design, ease of test and cross-platform support.





# Thanks!

**Any *questions* ?**

You can find our project information at:

- **Website:** <http://willkara.com/projects/HealthAnalytics/about.html>
- **Blog:** <http://blog.willkara.com/tag/software-engineering-class-project/>
- Full source code will be publically available shortly.





## References

- + [1] Linear relationship between systolic and diastolic blood pressure monitored over 24 h: assessment and correlates. <http://www.ncbi.nlm.nih.gov/pubmed/18192832>
- + [2] Relationship between high-density lipoprotein-cholesterol and malondialdehyde-modified low-density lipoprotein concentrations. <http://www.ncbi.nlm.nih.gov/pubmed/12740480>
- + [3] Overweight and Obesity Statistics <http://www.niddk.nih.gov/health-information/health-statistics/Pages/overweight-obesity-statistics.aspx>
- + [4] Hypertension Among Adults in the United States: National Health and Nutrition Examination Survey, 2011–2012 <http://www.cdc.gov/nchs/data/databriefs/db133.pdf>
- + [5] Total and High-density Lipoprotein Cholesterol in Adults: National Health and Nutrition Examination Survey, 2009–2010 <http://www.cdc.gov/nchs/data/databriefs/db92.pdf>
- + [6] Percent of Adults Who are Overweight or Obese <http://kff.org/other/state-indicator/adult-overweightobesity-rate/>
- + [7] Percent of Adults Who Have Ever Been Told by a Doctor that They Have Hypertension <http://kff.org/other/state-indicator/percent-of-adults-who-have-ever-been-told-by-a-doctor-that-they-have-hypertension/>
- + [8] Percent of Adults Who Have Ever Been Told by a Doctor that They Have High Cholesterol <http://kff.org/other/state-indicator/percent-of-adults-who-have-ever-been-told-by-a-doctor-that-they-have-high-cholesterol/>
- + [9] Relation of High TG–Low HDL Cholesterol and LDL Cholesterol to the Incidence of Ischemic Heart Disease <http://atvb.ahajournals.org/content/17/6/1114.full>