Smartphones and the Sixth Vital Sign

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Background

- Walking speed has been shown to be an important vital sign, which is an indicator of general physical health
- Uptake of walk tests in healthcare is slow, and there is not an easy way for the general population to measure their own walking speed
- The 6th Vital Sign Study is a population-based U.S. cohort study that aims to establish walking speed as a new standard for measuring physical health for adults with iPhones anywhere

How the App Works

- Download the app
- Consent - with 18+ age restriction*
  - Make an account and enter basic information
- Take a walking test*
  - Answer questions related to the test
- Complete the health information survey*

* : Levels with which participants could have stopped with valid data

Data Sources & Methods

- Translated zip codes from the app data to zip code tabulation areas (ZCTAs), which are census blocks aggregated by the most frequently occurring zip codes
- Downloaded sociodemographic data by ZCTA from the American Community Survey (ACS)
- Only considered the first valid value for walking test data and the first response for health demographics data
  - Walking test data was deemed invalid if the distance traveled was 0 and the iPhone version was a 5 or older
- Narrowed app data down to only include North Carolina participants
- Chose neighborhood characteristics from ACS such as percent insured and median income that we believed could affect walking speed and linked ACS data to app data by ZCTA

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Downloaded App          Consented                Walking Test              Health Demographics      Specific ZCTA
n = 6459        →       n = 1072 (NC = 349)  →   n = 671 (NC = 221)   →    n = 433 (NC = 144)   →   n = 404 (NC = 131)

                                                 Multiple Walking Tests
                                                 n = 138 (NC = 70)
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Data Visualizations of Study Participation

App Data Comparison
- Separated app participants into the different levels of participation (consent, walking test, and health demographics survey) and created maps of these groups

Health Data Comparison
- Grouped app participants into three categories based on their walking speeds: unhealthy (<=1.0 m/s), at risk (>1.0 to 1.2 m/s), and healthy (>1.2 m/s)
  - Created maps of these groups and compared the average walking speeds of the ZCTAs with different ACS variables

- Broke up all groups into subcategories by gender and age group and created maps of these subgroups, as well as maps of the median ages and gender ratios of the ZCTAs
- Utilized R Shiny and Leaflet to create interactive maps and graphs
  - Embedded R Shiny app into Google sites found at https://sites.google.com/view/thesixthvitalsign/
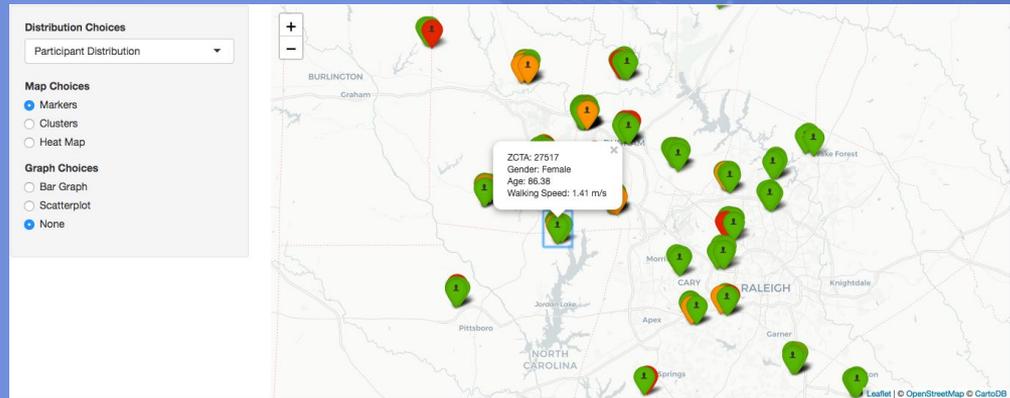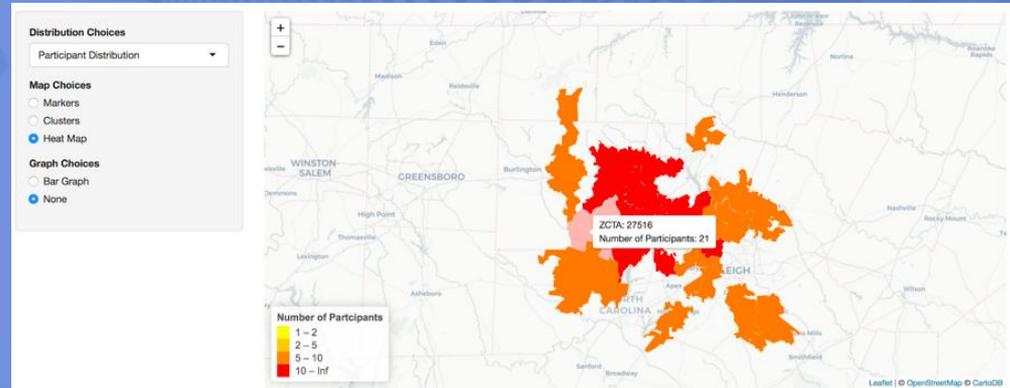
Results & Conclusions
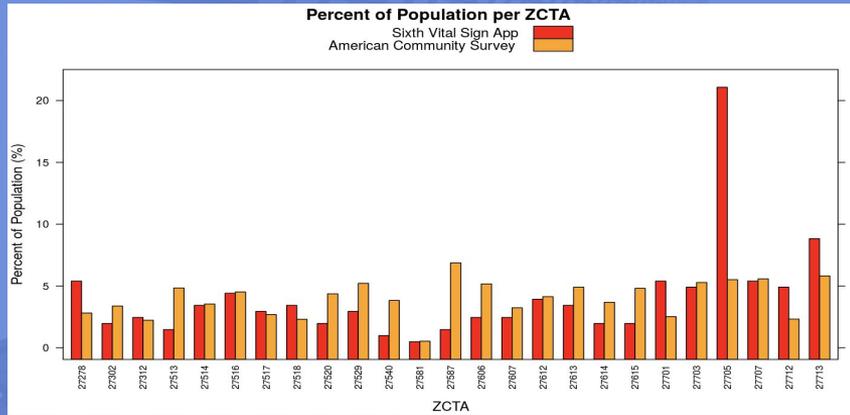
- Based on the comparison of the demographics of our app participants to census data (ACS), future goals should include targeting more males, minorities, and the less educated in areas other than the east coast. It is important to note that the 6VS app is currently only available on iPhones. Apple products are an indication of affluence from research by the National Bureau of Economic Research. "Across all years in our data, no individual brand is as predictive of being high-income as owning an Apple iPhone in 2016." [2]
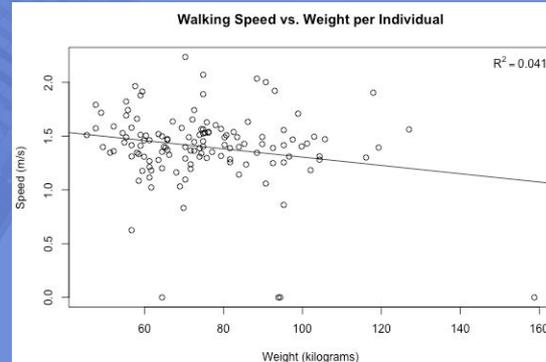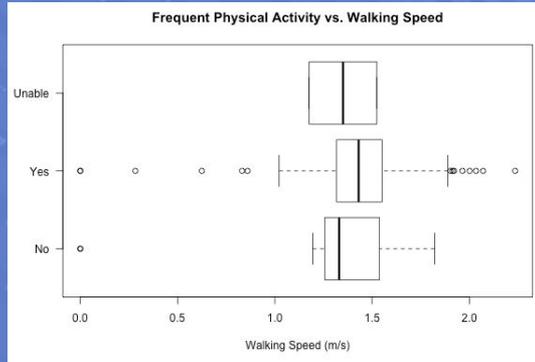
- There is little variation in walking speed based on the neighborhood characteristics from the ACS data across all North Carolina ZCTAs
- Data visualizations (heat maps, bar charts, and more) can be found at https://sites.google.com/view/thesixthvitalsign/