CENTER FOR WIRELESS & POPULATION HEALTH SYSTEMS

The Promise of Mobile & Social Technologies to Improve Individual and Population Health

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Co-Founder, Santech, Inc.

International Society for Research on Internet Interventions
April 6, 2011

UCSD Institute of Engineering in Medicine

AMERICAN JOURNAL OF
Preventive Medicine

A Journal of the
American College of Preventive Medicine &
Association for Prevention Teaching and Research

Journal Ranking

Impact Factor: 4.235
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Ranking 16 out of 132
Medicine, General and Internal category

Ranking 11 out of 122
Public, Environmental and Occupational Health category

AJPM's 5-Year impact factor is 5.006 and it ranks 13th in Medicine, General and Internal and 8th in Public, Environmental, and Occupational Health.

Calit2

California Institute for Telecommunications and Information Technology

Center for Wireless and Population Health Systems

CENTER FOR WIRELESS & POPULATION HEALTH SYSTEMS

Research on systems of wireless, clinical, and home technologies to measure and improve lifestyle and other health-related behaviors in:

- -- Healthy adolescents
- -- Overweight and obese children and adults
- -- HIV infected adults with substance abuse
- -- Adolescents risk for type 2 diabetes
- -- Adolescents with chronic disease
- -- Older adults to promote successful aging
- -- Adolescents recovering from leukemia and other chronic disease
- -- Young adults to prevent weight gain
- -- Adults with schizophrenia
- -- Exposure biology research
- -- Cancer comparative effectiveness research

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Collaborating Investigators & Partners

CW PHS
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UCSD School of Medicine
Kevin Patrick, MD, MS, Greg Norman, PhD, Fred Raab,
Jacqueline Kerr, PhD, Jeannie Huang, MD, MPH, Cheryl Rock, PhD

UCSD Jacobs School of Engineering
Bill Griswold, PhD, Ingolf Krueger, PhD, Tajana Simunic Rosing, PhD

San Diego Supercomputer Center
Chaitan Baru, PhD

UCSD School of Medicine, Division of Genetics & Department of Political Science
James Fowler, PhD

SDSU Departments of Psychology, Exercise/Nutrition Science & School of Public Health
James Sallis, PhD, Simon Marshall, PhD, Elva Arredondo, PhD

PhD students and Post-doctoral Fellows (current)
Jordan Carlson, Barry Demchak, Laura Pina, Ernesto Ramirez, Celal Zifti

Santech, Inc.
Jennifer Shapiro, PhD, Ram Seshan, MS, MBA

Guiding principles for our research

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Clinical needs -

Measuring and improving health behaviors as a means of preventing and/or managing illness such as diabetes, CVD, cancer, and obesity

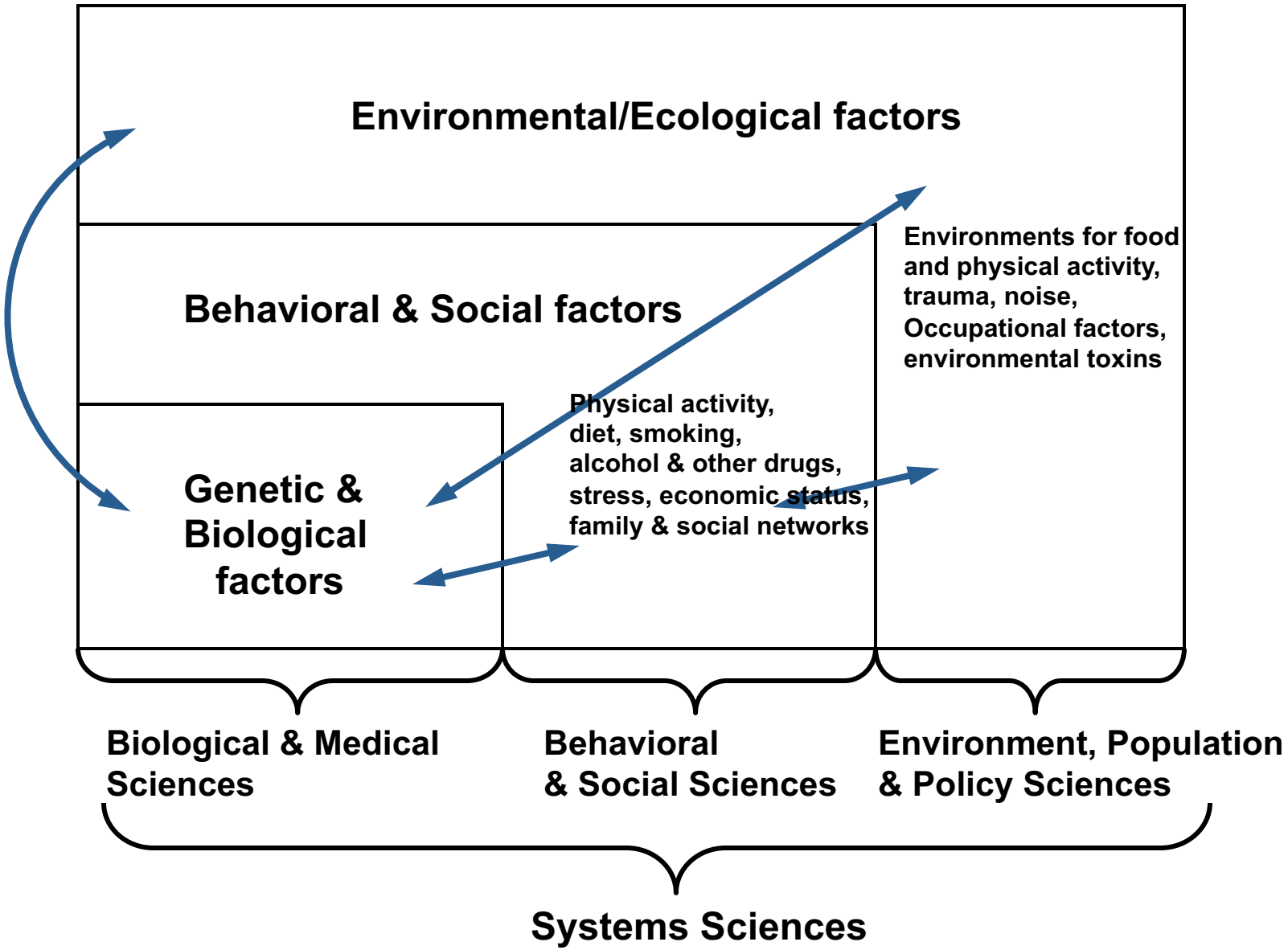
Population-level needs -

Measuring and promoting health behavior change at a population level to leverage investments and policies in the areas of public health, transportation, urban planning, education and other areas important to human health and sustainability

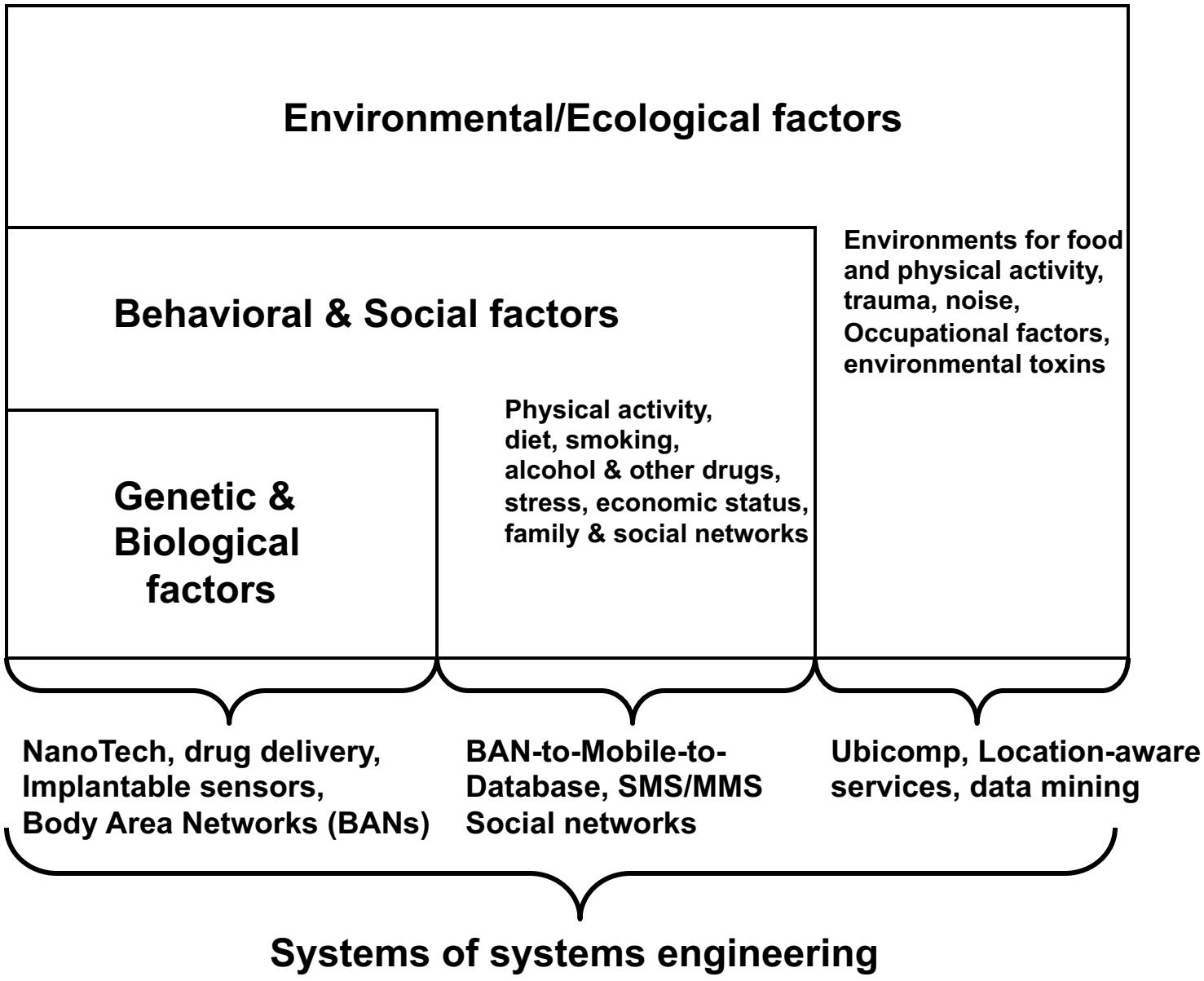
Theory -

That helps us understand what is happening, why, and how we might change it for the better

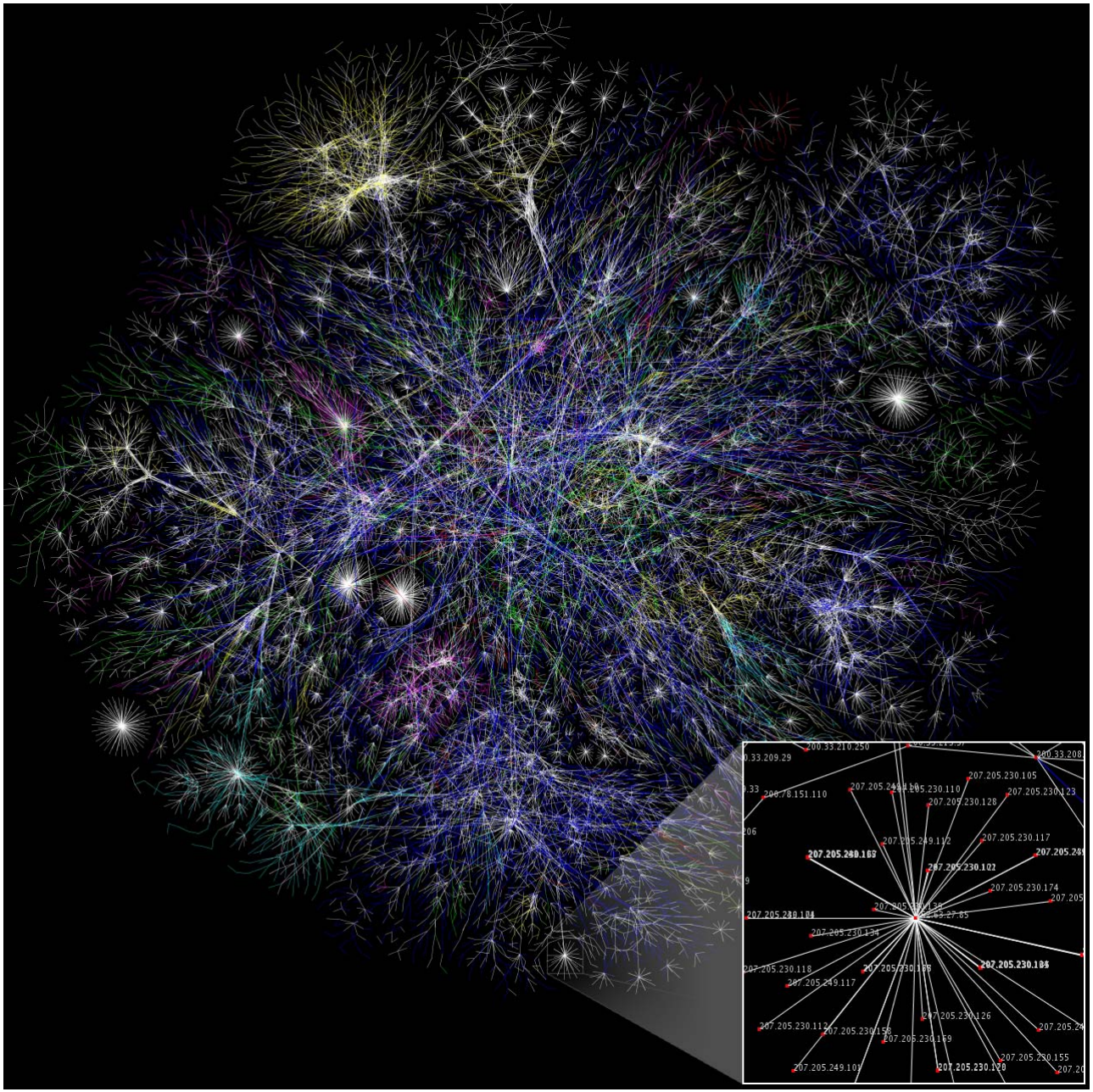
Our point of view is an ecological one: Many factors continuously interact with one another to create health outcomes



We work hand-in-hand with engineers who are developing technologies to influence these factors to shape better health outcomes



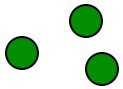
The beauty of the Internet is that it ties all of these things together in ways useful to those of us who work in health…



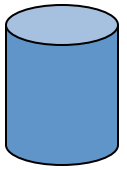
Source: Wikipedia

In part, it's about collecting data from Sensors…

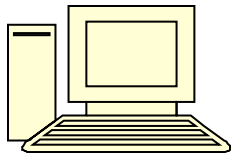
Sensors embedded in the environment



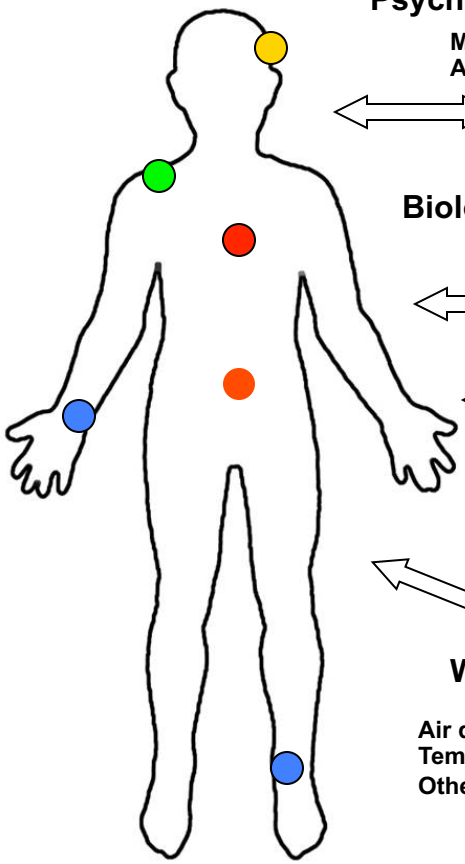
Geocoded data on safety, location of recreation, food, hazards, etc



Sensor data



+ Genetic, Clinical & Personal Health Data



Psychological & Social sensors

Mood, Social network (peers/family)
Attention, voice analysis

Biological sensors

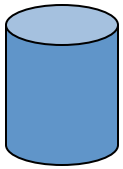
BP, Resp, HR, Blood (e.g. glucose, electrolytes, pharmacological, hormone), Transdermal, Implants

Diet & Physical Activity sensors

Physical activity (PAEE, type), sedentary
Posture/orientation, diet intake (photo/bar code)

Wearable Environmental sensors

Air quality (particulate, ozone, etc)
Temperature, GPS, Sound, Video,
Other devices & embedded sensors



+
Data on environmental determinants of health
+
Analysis & comparison of parameters in near-real time (normative and ipsative)
+
Sufficient population-level data to comprehend trends, model them and predict health outcomes
+
Feedback in near or real-time via SMS, audio, haptic or other cues for behavior or change in Rx device

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= True Preventive Medicine!

In part, it's about collecting data from Sensors…

It's also about data-driven interventions via Mobile and Social Media…

Rapidly growing base of mobile information devices…

5+ Billion Mobile Phone users

- UN International Telecomm Union (2011)

14.2 Million iPads sold, 2010; 75% of market

- Wikipedia (2011)

Total Text Messages sent July, 2009 - June, 2010:

1.8 Trillion –

- 260 messages/person on earth

~ 80% of all mobile users worldwide

Source: CTIA

Social Media

- Almost 600 Million active users
- 50% of active users log on once/day
- About 70% of Facebook users are outside the US

- Over 100 million registered users
- 180 million unique users each month

twitter

Login Join Twitter!

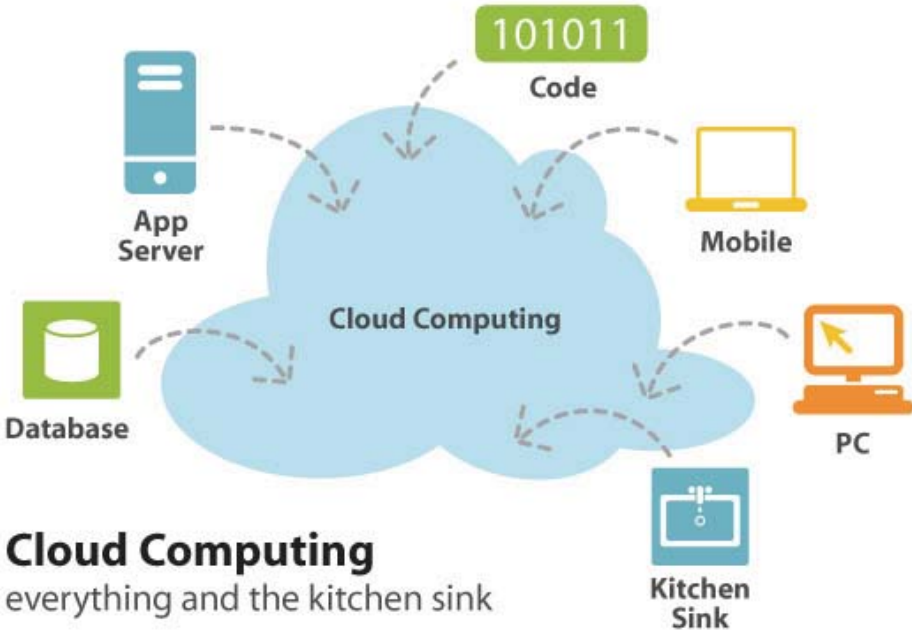
We can confirm that Twitter was blocked in Egypt around 8am PT today. It is impacting both Twitter.com & applications. (1/2)

about 10 hours ago via web by SG
Retweeted by 100+ people

twitterglobalpr
Twitter Comms

The power of these media…

And finally it's the Cloud…



amazon web services™

Projects in Sensing and Intervention

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PALMS

SMART

CYCORE

mDIET & ConTxt

CITISENSE

PALMS

Physical Activity Location Measurement System

An integrated suite of **sensors** and **software** to enable **continuous capture and analysis** of data on **temporal & spatial** characteristics of **physical activity and other data** important to exposure biology research

PALMS supports gathering data from multiple participants within studies and aggregating and comparing data between and among multiple researchers across studies

Funded through the NIH Gene, Environment and Health Initiative
Exposure Biology Program
NIH/NCI Grant 1 U01 CA130771

Exposure Biology Program: Deliverables

FY07	FY08	FY09	FY10	FY11

Environmental Sensors

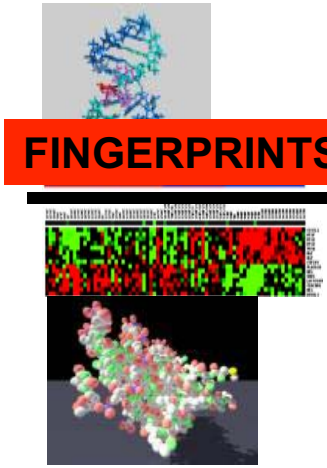
- Diet/Physical Activity
- Chemicals/Biologics
- Psychosocial Stress/Addictive Substances

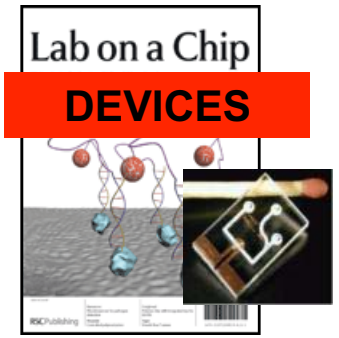
APPLICATION

Genome Wide Association

Biological Response

- Biomarkers
- Centers–biomarkers/biosensors
  - Inflammation
  - Oxidative stress
  - Programmed cell death
  - Epigenetic markers





Importance of Place

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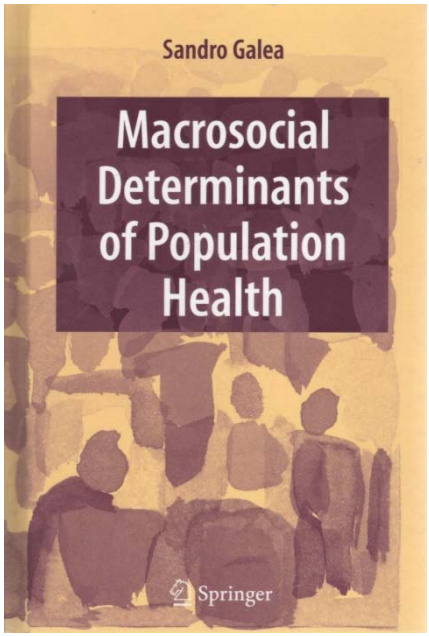
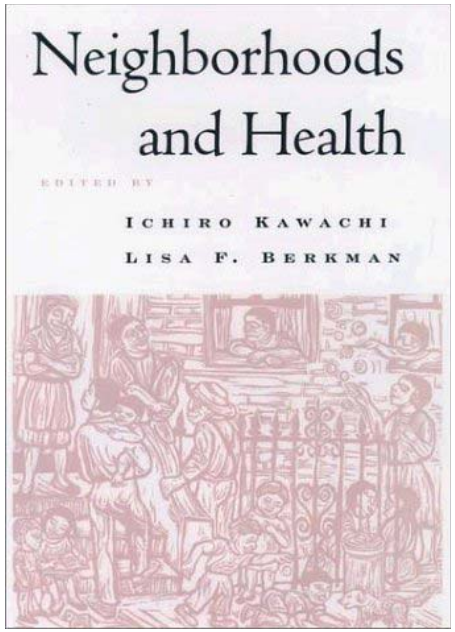
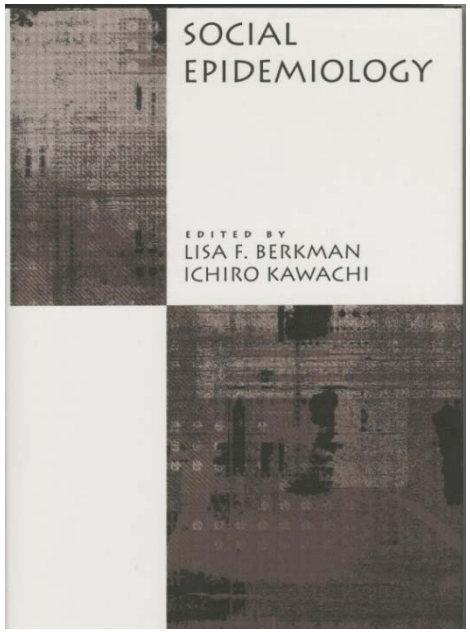
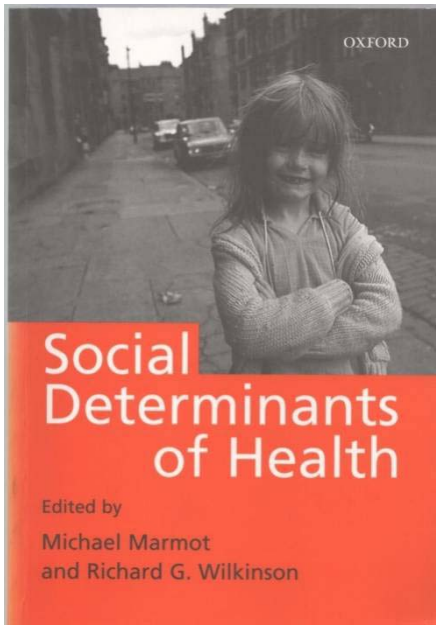
in the Health of Individuals and Populations

- Disease clusters
- Toxic exposure
- Health disparities
- Stress & incivilities









Temporal-spatial Context

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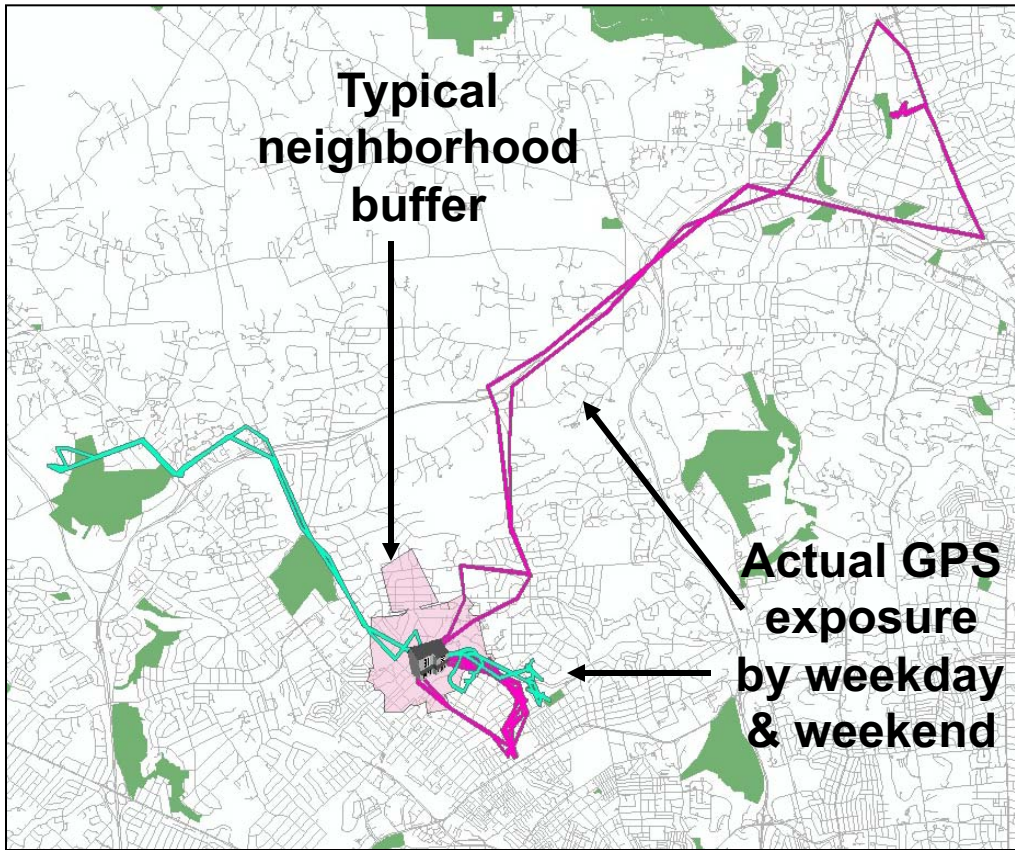
- Is related to health behaviors, morbidity & mortality
- Moderates intervention effects & and is a modifiable component in interventions

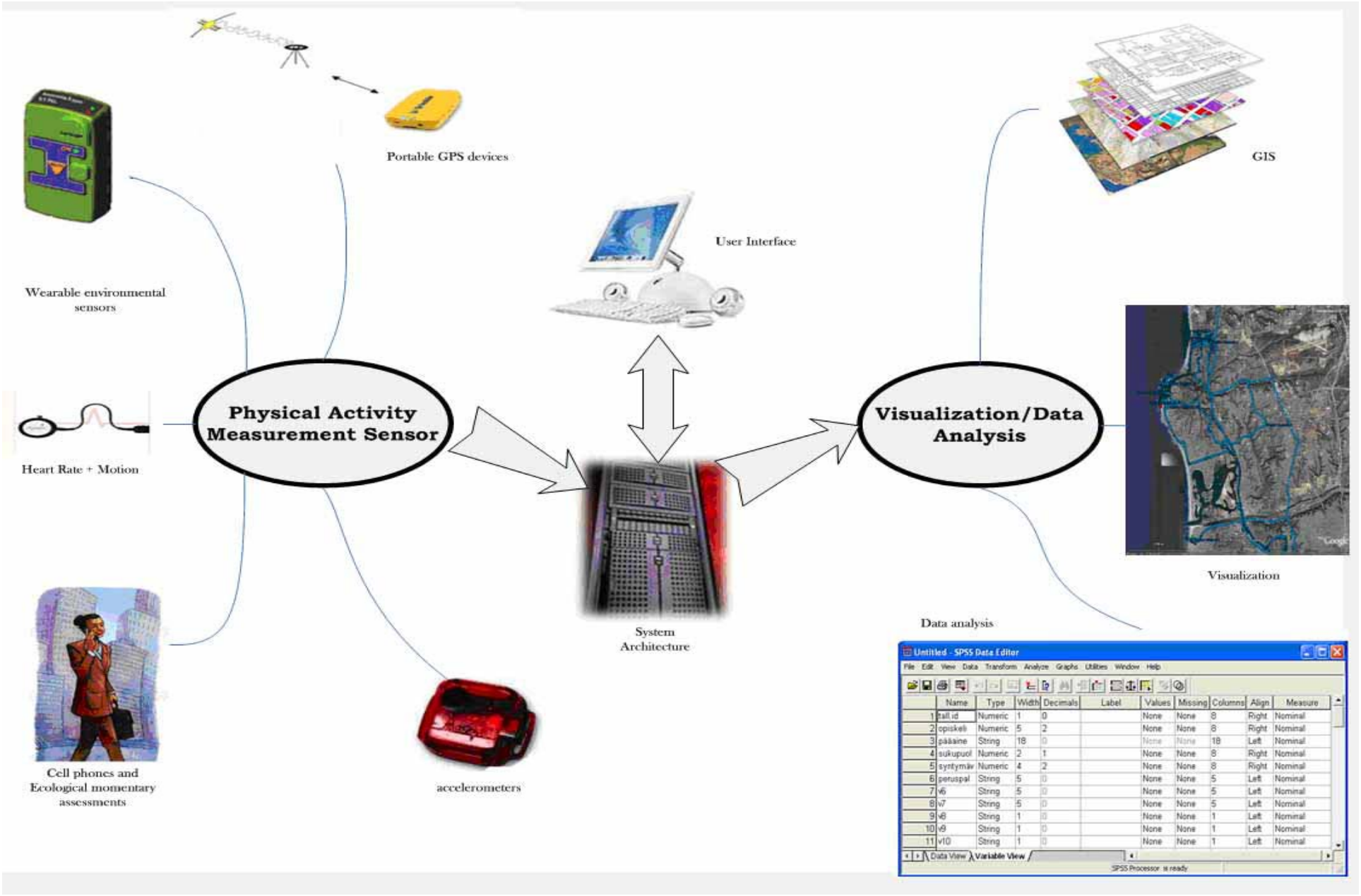
-- Current studies estimate temporal-spatial effects based upon residence or school/work location rather than actual exposure

-- Little is known about how PA type, frequency, intensity and duration, or episodes of extended sedentary behavior moderate these exposures

-- Concurrent & continuous measurement of PA/sedentary behavior and exposures of interest will be essential if health researchers are to understand these relationships



PALMS Overview



PALMS Sensors

Physical Activity and Heart Rate

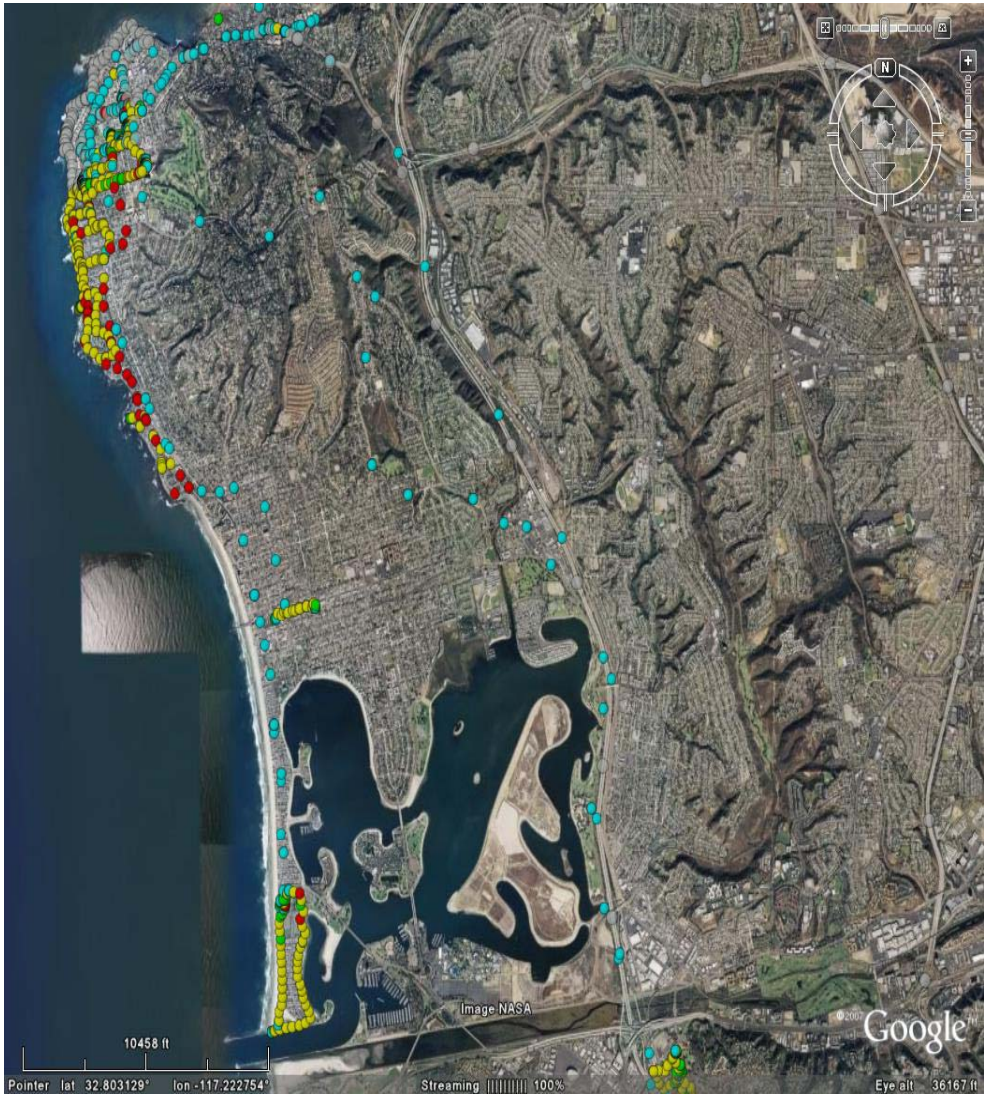
- **M – Actigraph**
- **M – Actical**
- **HR+M - Actiheart**
- **HR+M – Actitrainer**
- **HR+M + respiration + skin temp – Bioharness**

Location – GPS Dataloggers

- **GlobalSat DG-100**
- **GlobalSat BT-335**
- **Qstarz 1000**
- **Any GPX device**

Motion & heart rate sensors tell us **how active** a person is but not when or where…

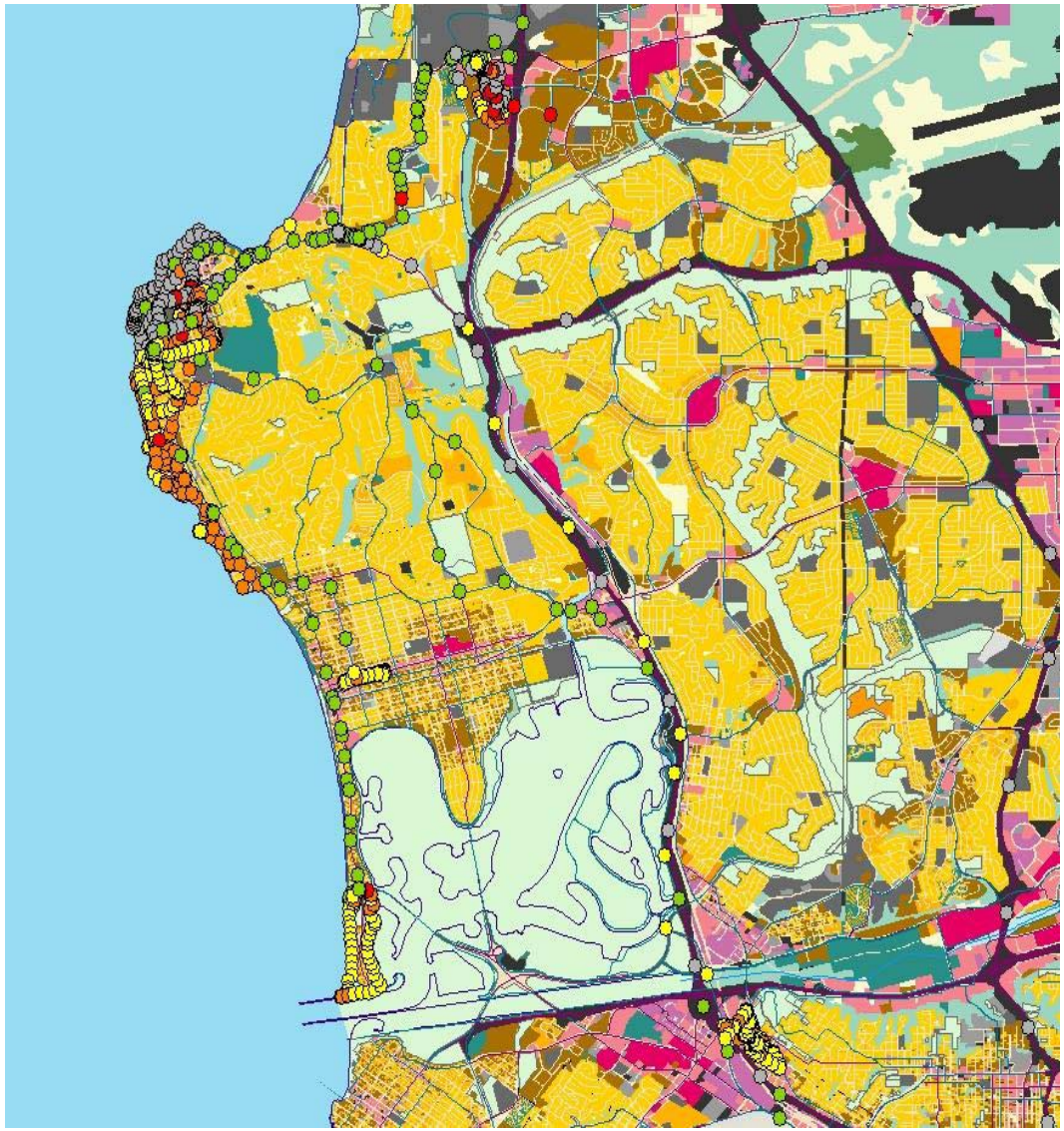
Combined with GPS, We Know **Where** Physical Activity Occurs



Heart rate shown in Google Earth

resting
light
moderate
vigorous

Placing these data within GIS Provides **Context**



Heart rate shown in ESRI ArcGIS against land use

GPS Data

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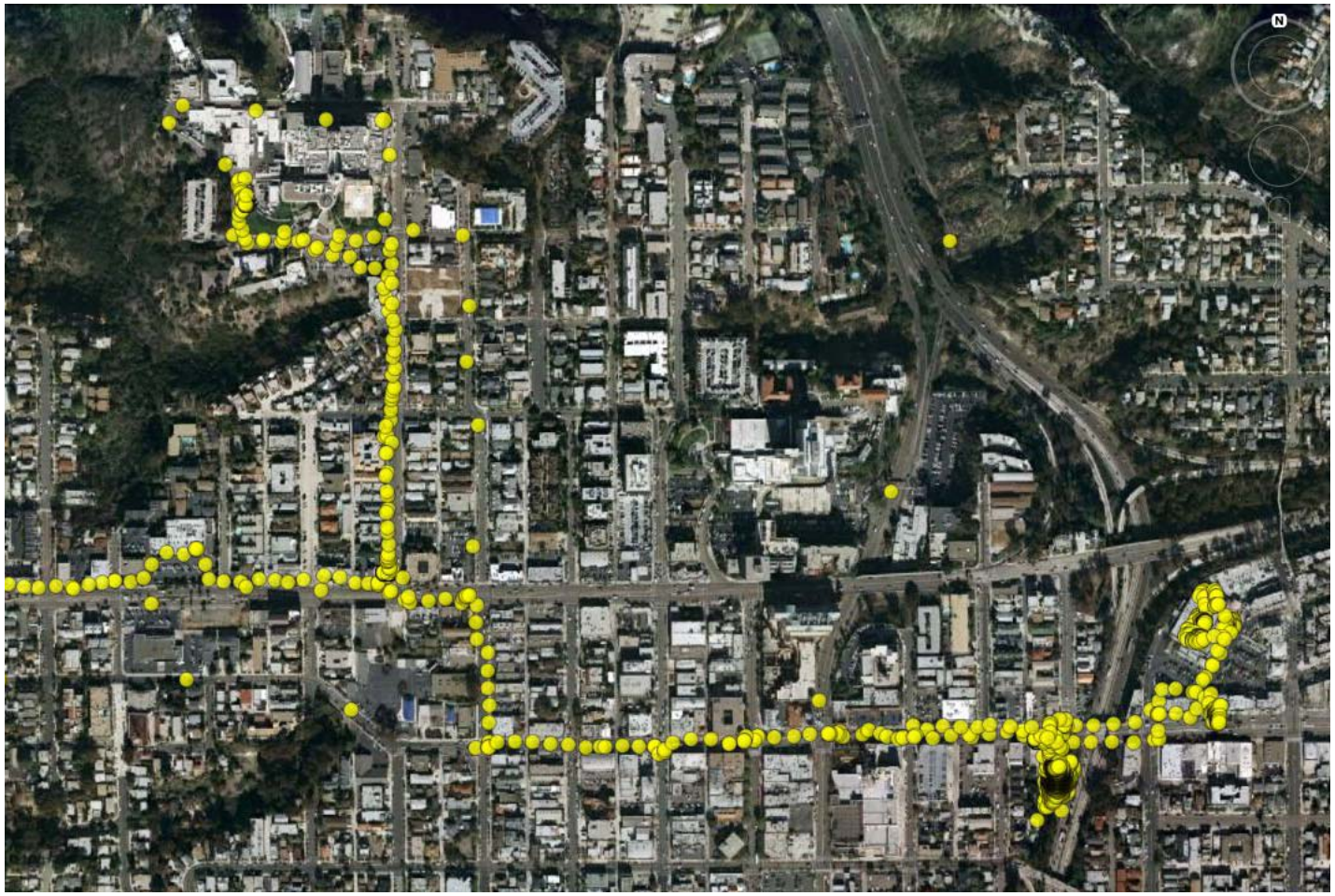
Research Question: How much time is spent in residential neighborhoods and how does this affect our estimates of the relationship between health and place?



Example:

one subject's neighborhood

collected over 3 days

15 second epoch

Determine Indoor / Outdoor

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Research Question: Is time spent outdoors related to cancer outcomes, mental health status or pollution exposures of interest?

Tracking indoor and outdoor time

30 second epoch

Indoors

Outdoors

Identify Mode of Transport

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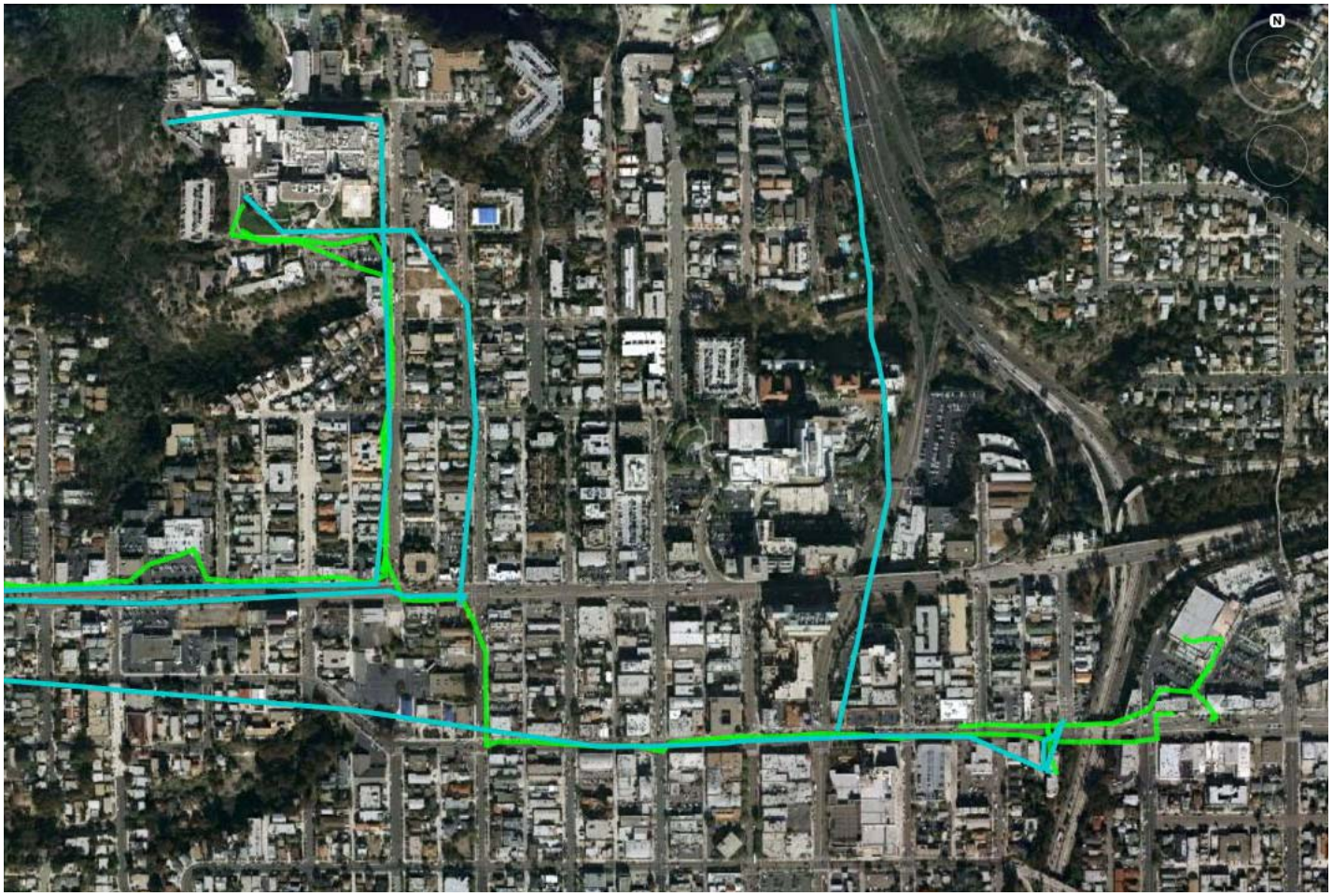
Research Question: Is active commuting (walking or cycling) or time spent in car related to obesity?



Vehicle

Pedestrian

Bicycle

Detect Locations & time spent

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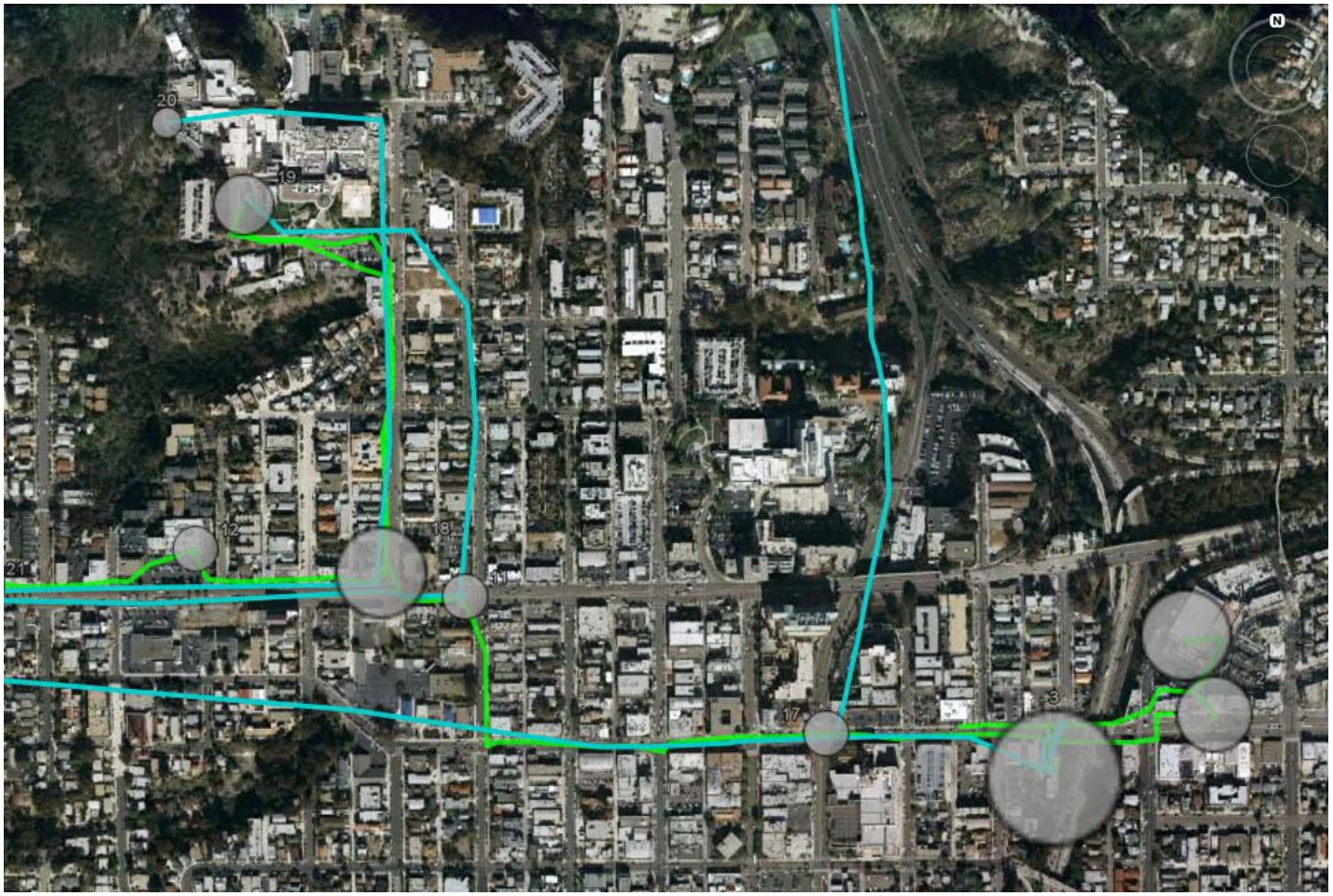
Research Question: Are places where people spend lots of time associated with unhealthy behaviors (e.g. snacking) or toxin exposure?



Size of gray areas reflect relative amount of time at location

Merge GPS & Activity Data

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Research Question: Which park features support the most physical activity?

Sedentary

Light

Moderate

Isolate Periods of Sedentary Time

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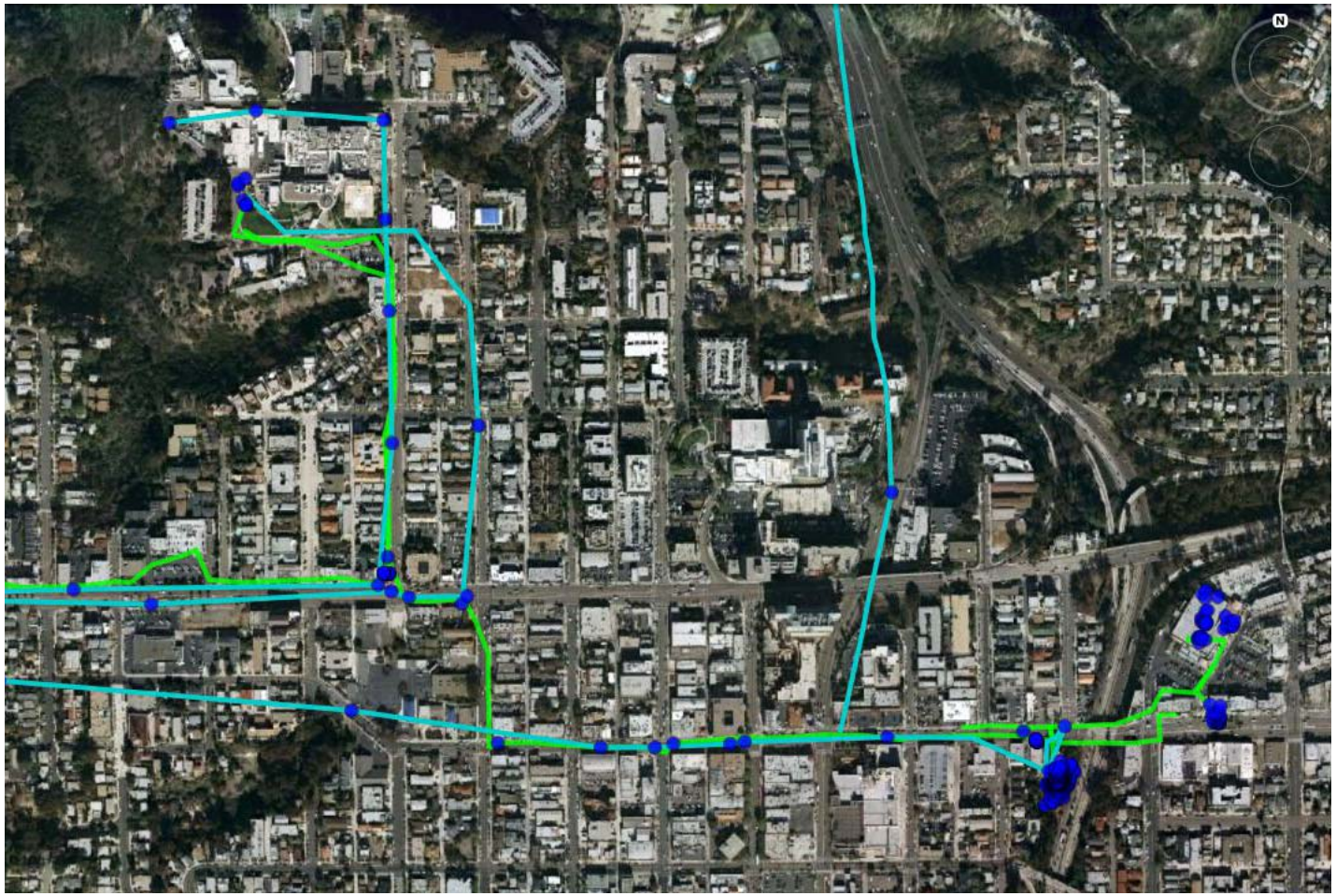
Research Question: Which locations entail prolonged periods of sitting and how might these relate to incidence (or treatment) of metabolic syndrome?



Sedentary

PALMS Researcher Support

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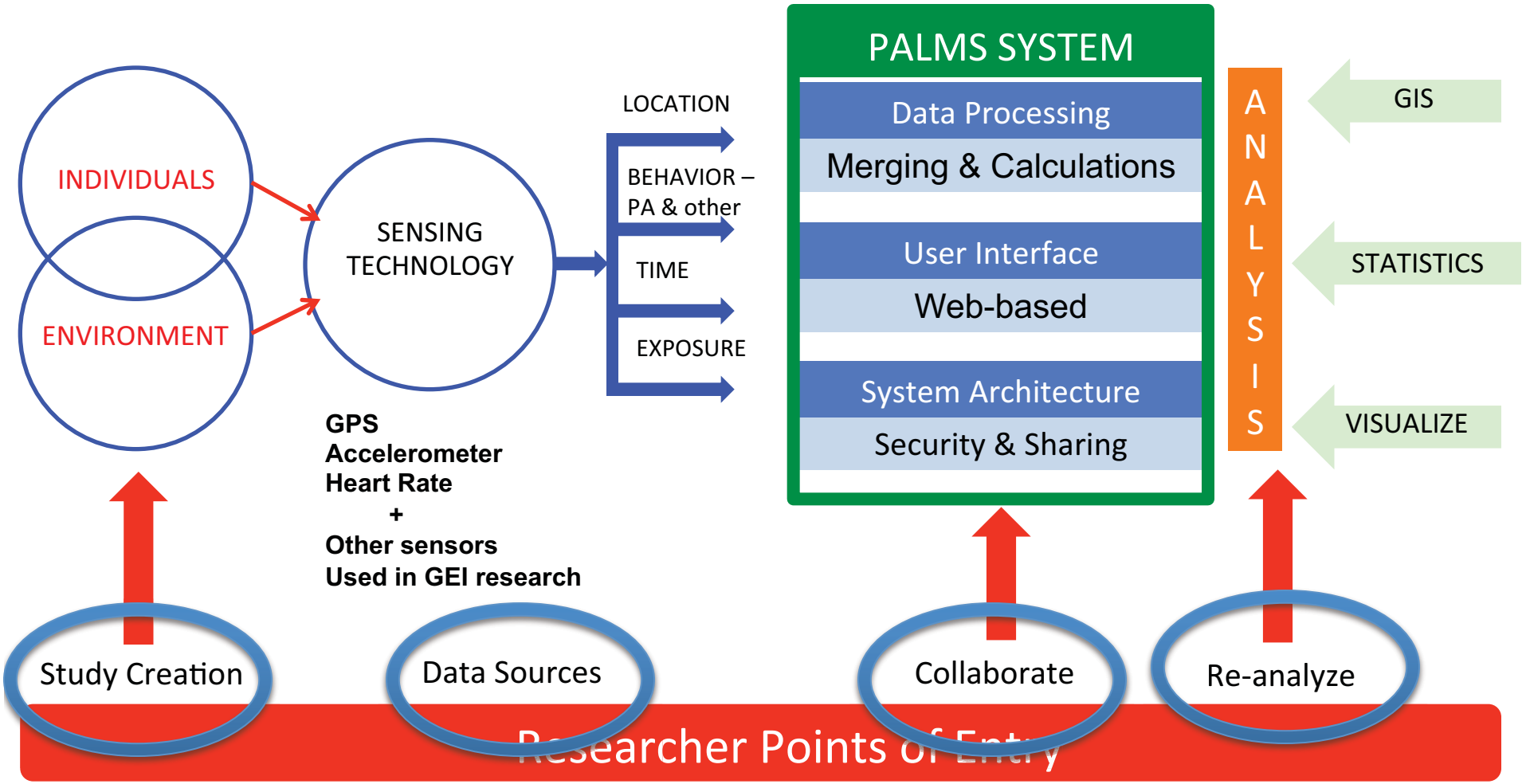

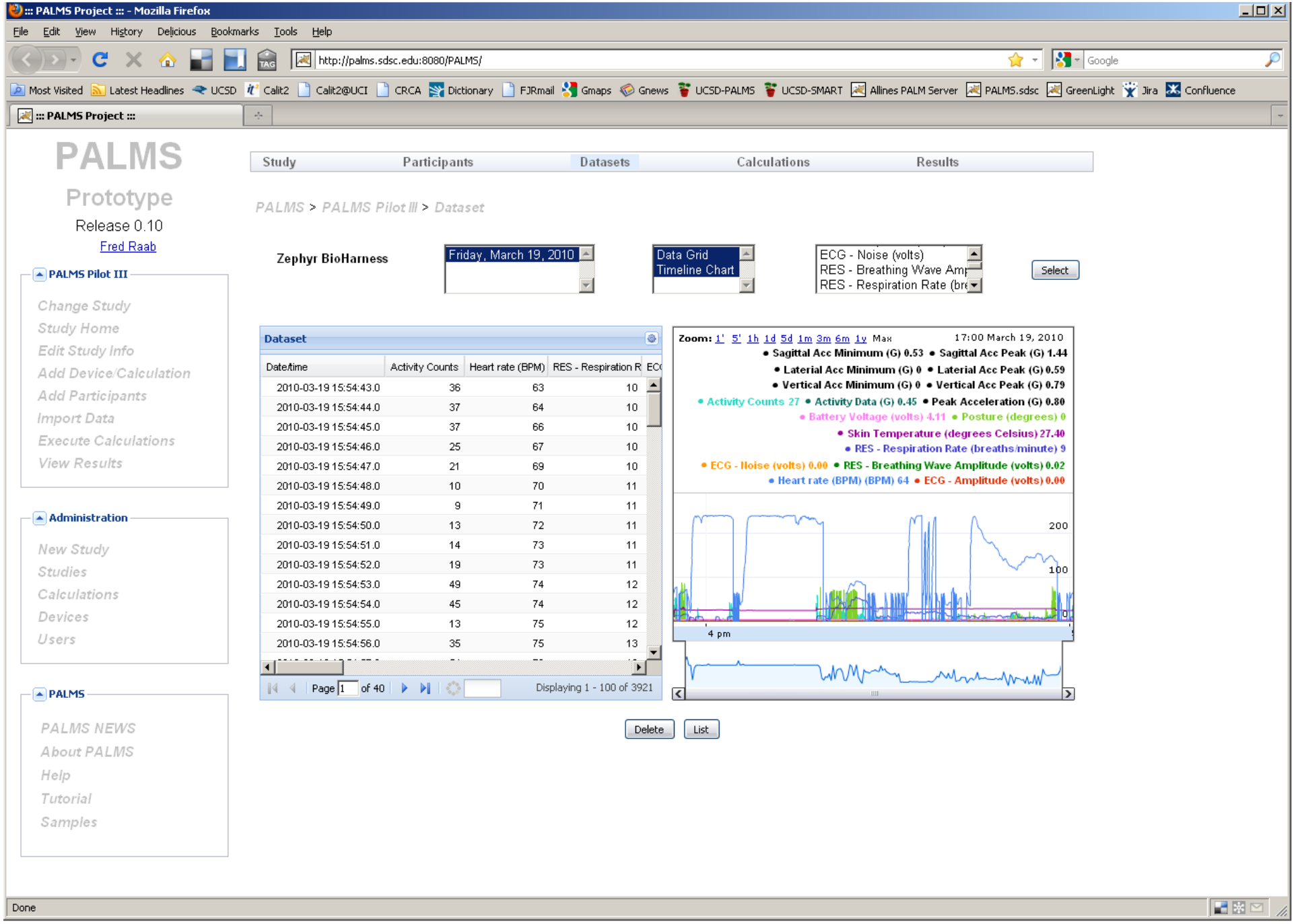
::: PALMS Project ::: - Mozilla Firefox
File Edit View History Delicious Bookmarks Tools Help
http://palms.sdsc.edu:8080/PALMS/
Most Visited Latest Headlines UCSD Calit2 Calit2@UCI CRCA Dictionary FJRmail Gmaps Gnews UCSD-PALMS UCSD-SMART Allines PALM Server PALMS.sdsc GreenLight Jira Confluence
::: PALMS Project :::
PALMS
Prototype
Release 0.10
Fred Raab
PALMS Pilot III
Change Study
Study Home
Edit Study Info
Add Device/Calculation
Add Participants
Import Data
Execute Calculations
View Results
Administration
New Study
Studies
Calculations
Devices
Users
PALMS
PALMS NEWS
About PALMS
Help
Tutorial
Samples
Study
Participants
Datasets
Calculations
Results
PALMS > PALMS Pilot III > Dataset
Zephyr BioHarness
Friday, March 19, 2010
Data Grid
Timeline Chart
ECG - Noise (volts)
RES - Breathing Wave Amp
RES - Respiration Rate (br
Select
Dataset
Date/time
Activity Counts
Heart rate (BPM)
RES - Respiration R
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2010-03-19 15:54:44.0 37 64 10
2010-03-19 15:54:45.0 37 66 10
2010-03-19 15:54:46.0 25 67 10
2010-03-19 15:54:47.0 21 69 10
2010-03-19 15:54:48.0 10 70 11
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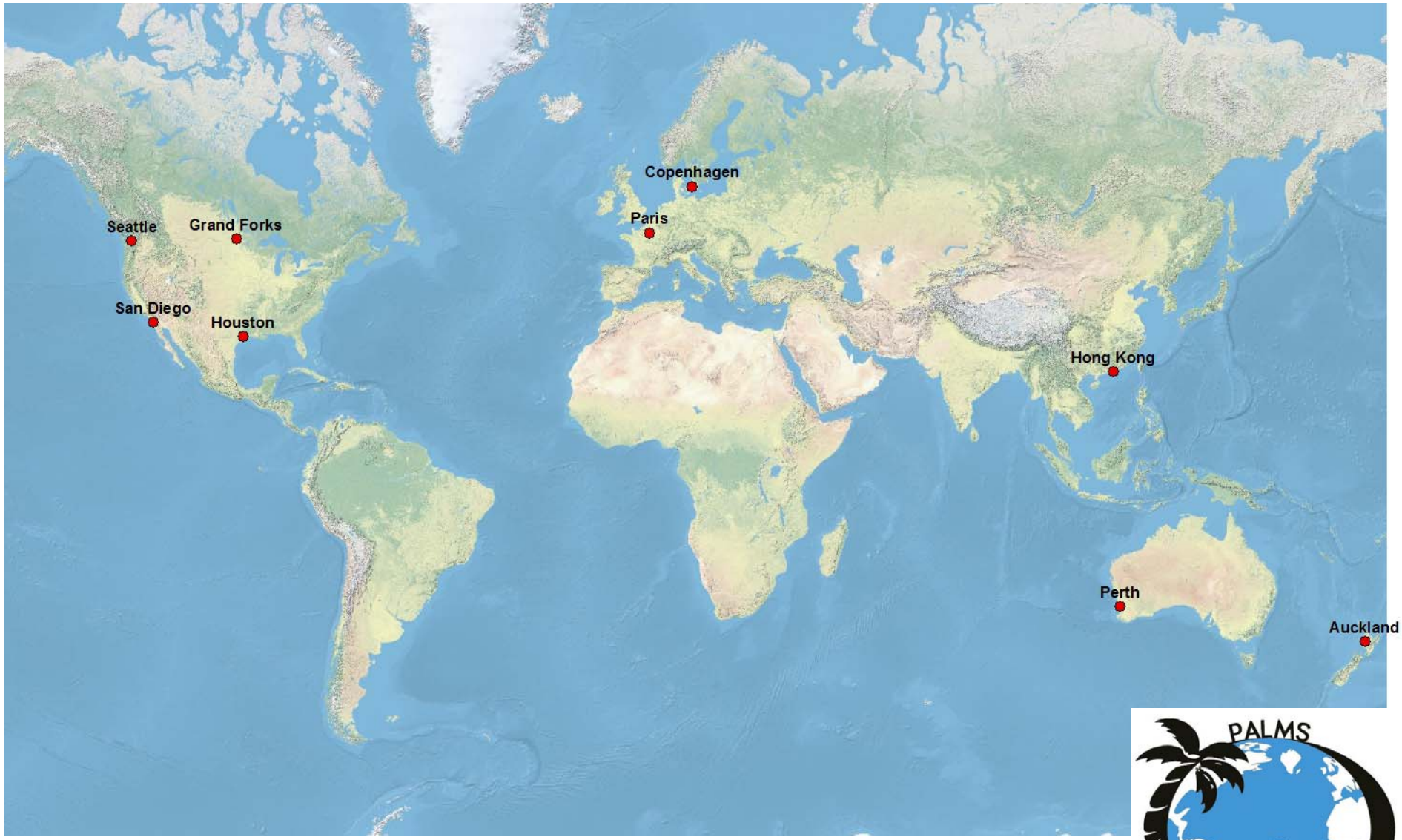
2010-03-19 15:54:55.0 13 75 12
2010-03-19 15:54:56.0 35 75 13
Page 1 of 40
Displaying 1 - 100 of 3921
Zoom: 1' 5' 1h 1d 5d 1m 3m 6m 1y Max
17:00 March 19, 2010
Sagittal Acc Minimum (G) 0.53 Sagittal Acc Peak (G) 1.44
Lateral Acc Minimum (G) 0 Lateral Acc Peak (G) 0.59
Vertical Acc Minimum (G) 0 Vertical Acc Peak (G) 0.79
Activity Counts 27 Activity Data (G) 0.45 Peak Acceleration (G) 0.80
Battery Voltage (volts) 4.11 Posture (degrees) 0
Skin Temperature (degrees Celsius) 27.40
RES - Respiration Rate (breaths/minute) 9
ECG - Noise (volts) 0.00 RES - Breathing Wave Amplitude (volts) 0.02
Heart rate (BPM) (BPM) 64 ECG - Amplitude (volts) 0.00
200
100
0
4 pm
Delete
List
Done

PALMS Users Worldwide (5 – 7 days of data for 1000+ participants



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Current issue

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PALMS was recently featured in article on measuring the human "exposome"

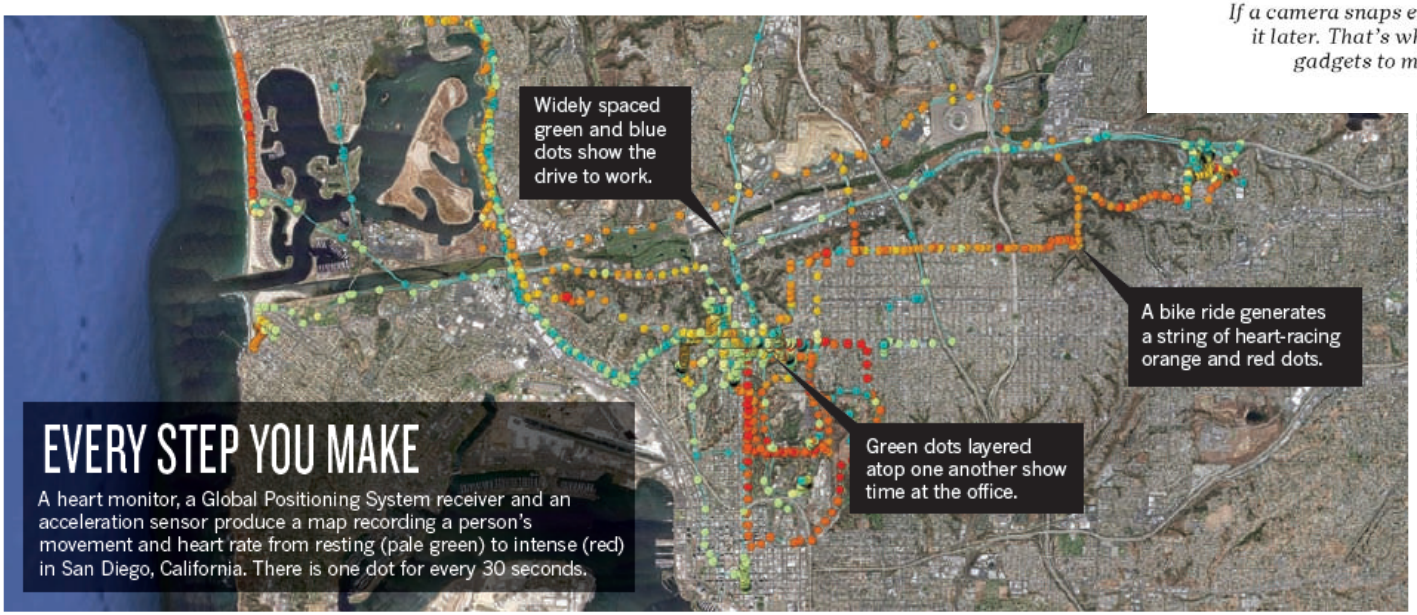
Feb 16, 2011

NEWS FEATURE

EVERY BITE YOU TAKE

If a camera snaps everything you eat, you can't lie about it later. That's why scientists are building high-tech gadgets to measure the human 'exposome'.

BY BRENDAN BORRELL



SOURCE: PALMS PROJECT

PALMS

CYCORE

CYber-infrastructure for COmparative Effectiveness REsearch

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PURPOSE

To improve **cancer-related comparative effectiveness research** by better capturing data on physiological, behavioral and psychological status from research participants at home and as the go about their daily lives.

PIs: MD Anderson: **Susan Peterson, PhD, Karen Basen-Enquist, PhD, Alex Prokhorov, MD & Wendy Demark-Wahnefried, PhD**

PIs: UCSD/Calit2: **Kevin Patrick, MD, MS, Ingolf Krueger, PhD, Chaitan Baru, PhD**

Funded by a Grand Opportunity RC2 grant from NCI/NIH
Program Officer: Brad Hesse, PhD

THE UNIVERSITY OF TEXAS MD Anderson Cancer Center
Making Cancer History®

CYCORE

CYCORE

Cyber-infrastructure for Comparative Effectiveness Research

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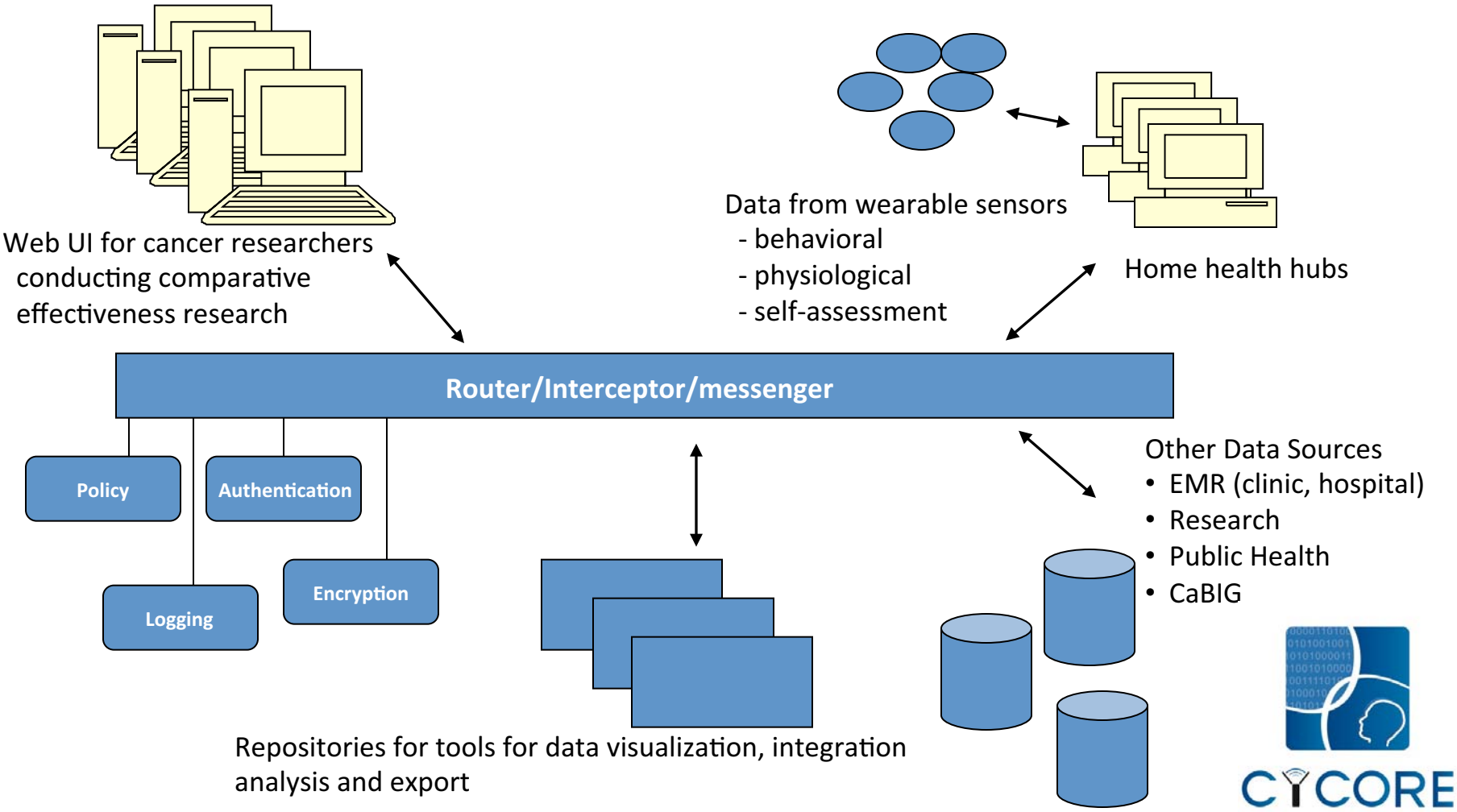
CORE SYSTEMS ARCHITECTURE



Wireless Devices -

- **Weight scale**
- **BP Monitor**
- **Accelerometer**
- **Pulse Oximeter**
- **GPS**
- **Zephyr Bioharness**
- **Easily extensible to other devices as needed**

CYCORE Home Health Hub

Additional planned sensing at home:
-- Ecological Momentary Assessment
-- Video capture of behaviors and other observable outcomes
-- CO Monitor for expired air in smokers

CYCORE

From Sensing to Intervention: - "Wireless Persuasion"

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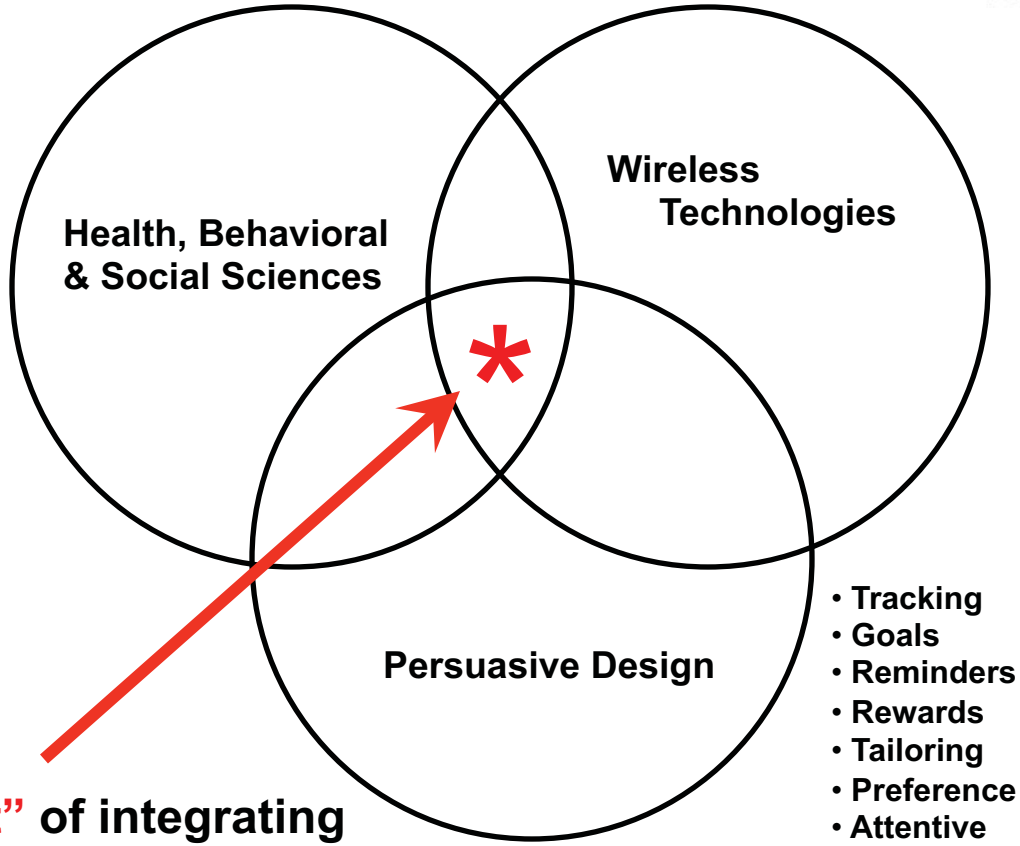
- Medical care
- Public health
- Personal health
- Social Networks



- Mobile phone apps
- Body area networks
- Wearable sensors
- Ecosystem of external sensors (home, work, etc.)
- SMS/MMS
- Cloud computing
- Server analytics, data mining

- Tracking
- Goals
- Reminders
- Rewards
- Tailoring
- Preference based
- Attentive
- Ecological
- Context Aware
- Cybernetic

- Cog Sci
- Media/Comm
- Beh Sci
- Soc Sci
- Hum/Comp Interaction

The "sweet spot" of integrating wireless & design to promote improved health behaviors

mDIET

Mobile **D**iet **I**ntervention through **E**lectronic **T**echnology

CENTER FOR WIRELESS & POPULATION HEALTH SYSTEMS

PURPOSE

Randomized Clinical Trials to evaluate the use of Text Messages (SMS) to improve dietary behaviors and weight outcomes in obese men and women.

mDIET

mobile **D**ietary **I**ntervention **T**hrough **E**lectronic **T**echnology

Research question:

Can a behavioral intervention delivered primarily through text messages be effective in promoting short term weight loss in overweight/obese adults?

Funded by a grant from the National Cancer Institute
R21 CA115615-01A1

Types of mDIET Messages

Type of Text or Picture Message	Example
Motivational Sayings	***Never say never, you can do it! Keep up the good work!)***
Nutrition & Physical Activity Tips	***Try 10 baby carrots and a tablespoon of fat-free dressing for a 100 calorie snack; Want extra steps? Take the stairs today***
Nutrition & Physical Activity Reminders	***Remember to move more today to reach your 12,000 step goal; Be sure to practice portion control strategies at your next meal***
Short-Term Goal Reminders	***Think about what you can do in the next 4 hours to be healthy***
Behavior Questions	***Have you practiced portion control strategies today? Have you reached your 12,000 step goal today?***
Weekly Weight Questions	***What is your weight?***
Weekly Weight Graphs	***Chart of weekly weights***
Portion Control Picture Messages	***Pictures of portion sizes***

MMS used for Images and Graphs

Add a variety of colorful vegetable to your shopping list this week. Choose green, red, orange and yellow veggies.

A one-cup serving size is about the size of a tennis or baseball.

Nice progress. You're on your way to reaching your goal. It will take time, but you have the motivation to succeed.

Personalized Text Messages

- **Eating Behaviors**
  - 4 items on the EBI were emphasized (based on our own logic rules)
- **Name**
  - Some text messages included their first name (*e.g. Congrats, Maria! You continue to improve. You're clearly working hard and it shows).*
- **Grocery Store**
  - Participants were asked to identify the grocery store that they most frequently visit (*e.g. Did you buy fruits and vegetables from Trader Joes this week?)*
- **Social Supporter**
  - Participants were asked to identify someone in their personal life (family member, friend, co-worker) that could part of their social support system (*e.g. Have you been telling Mark about your weight loss success?)*

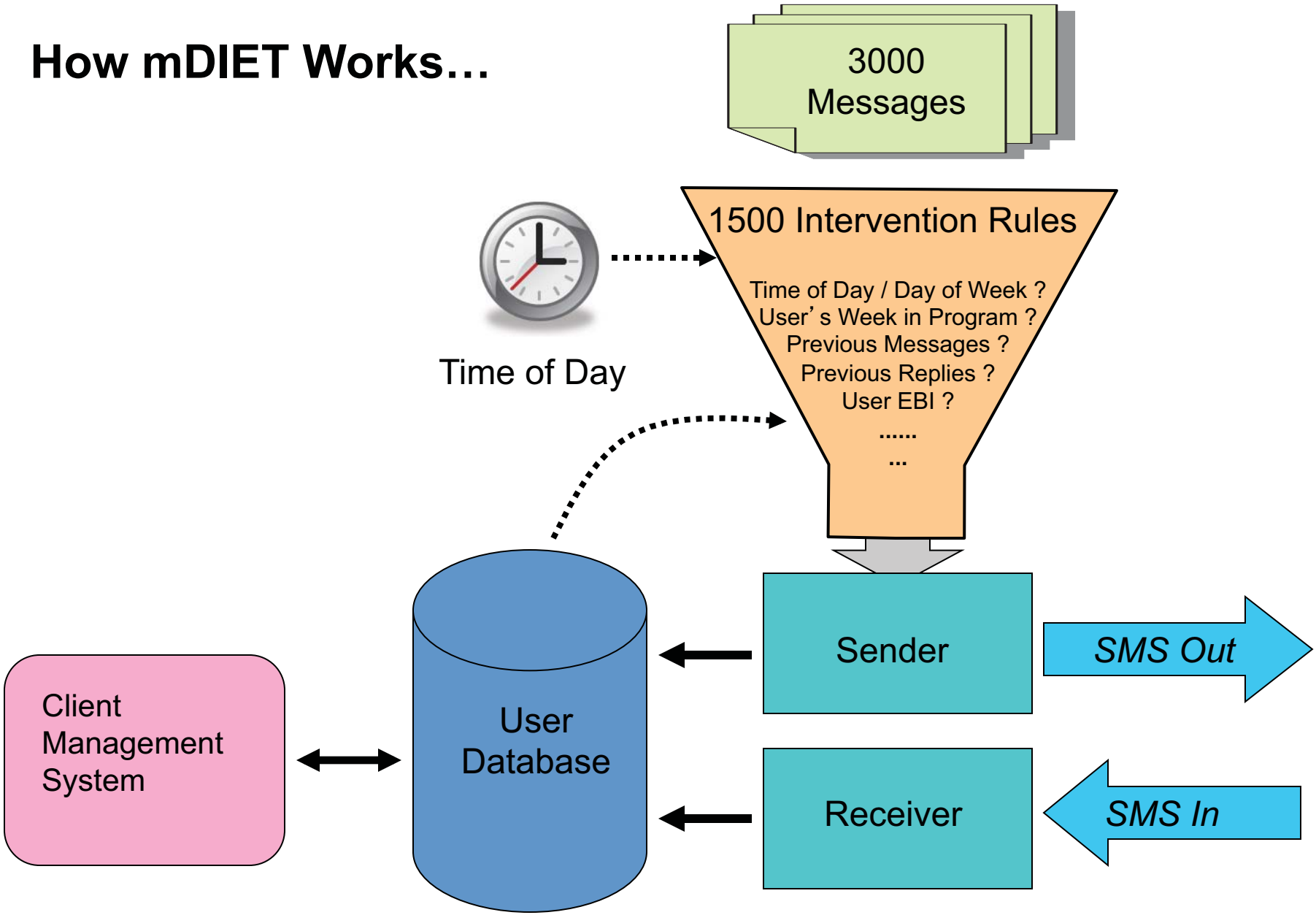
Rule-based Dialogues

Messages sent are based on the user's previous responses

Cell Phone Message Activity

Week	Timestamp	Message Type	Message
6	7/28/2007 7:00:55 PM	Sent	Have you tried substituting your meals with more vegetables, beans and whole grains lately (Y or N)
6	7/28/2007 7:36:21 PM	Response	NO
6	7/28/2007 7:36:22 PM	Sent	Try substituting your meat dish today with beans, tofu or vegetables to eat more with less calories.
7	7/29/2007 7:00:29 AM	Sent	What is your weight today? (Please enter your weight.)
7	7/29/2007 7:49:49 AM	Response	166
7	7/29/2007 7:49:50 AM	Sent	Great! You've lost weight. You are making progress. Get motivated by challenging yourself to improve for next week.
7	7/29/2007 4:01:37 PM	Sent	Consider this: leaving food on your plate will reduce your calorie intake.
7	7/29/2007 7:01:32 PM	Sent	Did you clean your plate the last time you ate? (Y or N)
7	7/29/2007 7:42:18 PM	Response	YES
7	7/29/2007 7:42:20 PM	Sent	It's alright. Take it one meal at a time and get in the habit of not finishing everything on your plate.
7	7/30/2007 7:00:47 AM	Sent	Remember: When you're at home, you can only eat what's in your house. Replace the high cal foods with low-cal foods!
7	7/30/2007 8:10:11 AM	Response	OK, will do.

How mDIET Works…



mDIET Pilot Study

Randomized Controlled Trial:

Participants were randomized to either an Intervention (mDIET) or Control group:

<u>mDIET</u>

- **Weight loss program using text and MMS messages along with modest amount of adjunctive intervention elements**

<u>Control</u>

- **Usual care**

Participants completed 3 in-office measurement visits over a 4 month period

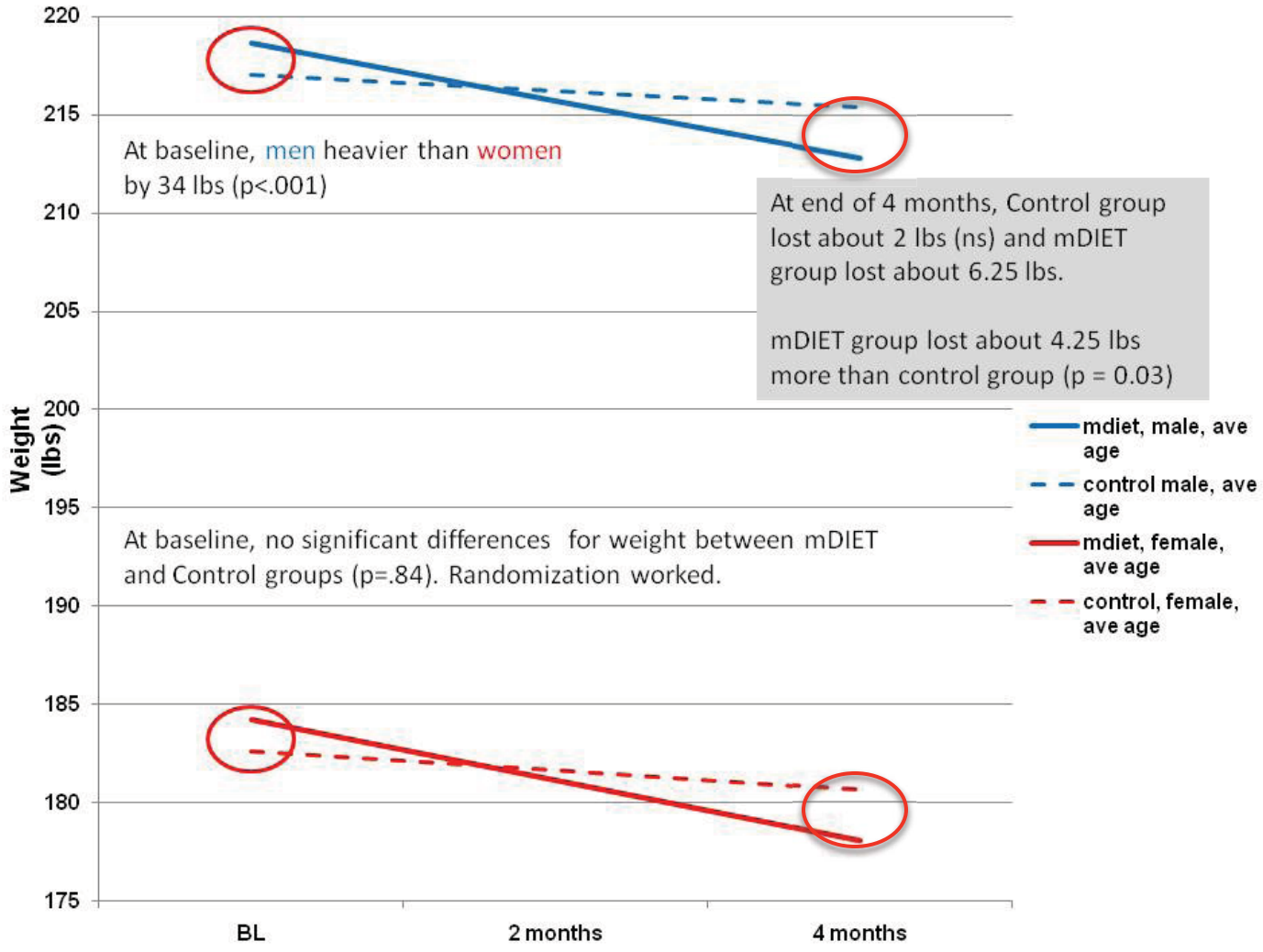
Sample N = 63, 81% Women (Mean = 45.9 years)
Race/Ethnicity

76.2%	**Caucasian or White**
15.9%	**African American or Black**
3.2%	**Asian American/Pacific Islander/Native Hawaiian**
4.8%	**Prefer not to state**
22.2%	**Hispanic**

mDIET

Mobile **D**iet **I**ntervention through **E**lectronic **T**echnology

CENTER FOR WIRELESS & POPULATION HEALTH SYSTEMS



Participant Feedback on mDIET

- “Steady reminder – keeping health on my mind”
- “Felt commitment every day – could not let myself forget my goals”
- “They served as an excellent reminder to watch what I ate”
- “Keeps me focused”
- “Constant reminders to believe in myself and make the right choices”
- “I found that texting your weight every week was extremely helpful”
- “I miss my 6am message!”

Overall satisfaction with mDIET program for weight loss *95.6% of participants would recommend mDIET to friends/family*

mDIET

Mobile **D**iet **I**ntervention through **E**lectronic **T**echnology

Resulted in the first report in the literature of an RCT evaluating SMS/MMS for weight loss

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Original Paper

A Text Message–Based Intervention for Weight Loss: Randomized Controlled Trial

Kevin Patrick[1], MD, MS; Fred Raab[1]; Marc A Adams[1,2], MPH; Lindsay Dillon[1], MPH; Marian Zabinski, PhD; Cheryl L Rock[1], PhD, RD; William G Griswold[3], PhD; Gregory J Norman[1], PhD

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Abstract

Background: To our knowledge, no studies have evaluated whether weight loss can be promoted in overweight adults through the use of an intervention that is largely based on daily SMS (Short Message Service: text) and MMS (Multimedia Message Service: small picture) messages transmitted via mobile phones.

Objective: This paper describes the development and evaluation of a text message–based intervention designed to help individuals lose or maintain weight over 4 months.

Methods: The study was a randomized controlled trial, with participants being exposed to one of the following two conditions, lasting 16 weeks: (1) receipt of monthly printed materials about weight control; (2) an intervention that included personalized SMS and MMS messages sent two to five times daily, printed materials, and brief monthly phone calls from a health counselor. The primary outcome was weight at the end of the intervention. A mixed-model repeated-measures analysis compared the effect of the intervention group to the comparison group on weight status over the 4-month intervention period. Analysis of covariance (ANCOVA) models examined weight change between baseline and 4 months after adjusting for baseline weight, sex, and age.

Results: A total of 75 overweight men and women were randomized into one of the two groups, and 65 signed the consent form, completed the baseline questionnaire, and were included in the analysis. At the end of 4 months, the intervention group (n = 33) lost more weight than the comparison group (□1.97 kg difference, 95% CI □0.34 to □3.60 kg, $P = .02$) after adjusting for sex and age. Intervention participants' adjusted average weight loss was 2.88 kg (3.16%). At the end of the study, 22 of 24 (92%) intervention participants stated that they would recommend the intervention for weight control to friends and family.

Conclusions: Text messages might prove to be a productive channel of communication to promote behaviors that support weight loss in overweight adults.

Trial Registration: Clinicaltrials.gov NCT00415870; http://clinicaltrials.gov/ct2/show/NCT00415870 (Archived by WebCite at http://www.webcitation.org/5dnolbkFt)

(J Med Internet Res 2009;11(1):e1) doi:10.2196/jmir.1100

KEYWORDS

Mobile phone; obesity; SMS; text message; health behavior

Next Phase: ConTxt & Text4Diet ™

CENTER FOR WIRELESS & POPULATION HEALTH SYSTEMS

ConTxt -

1-year Randomized Trial among 300 Overweight/Obese Adults beginning 8/11

English and Spanish Language

3-arms: SMS only, SMS + Brief Phone Counseling; Usual Care

Primary Outcome: Weight status at 1-year
Secondary Outcomes: Behaviors related to weight control

Text4Diet™ –

Santech, Inc. is developing a commercial version with enhanced SMS functionality including secure SMS if desired

mobile social

SMART Social Mobile Approach to Reduce Weight

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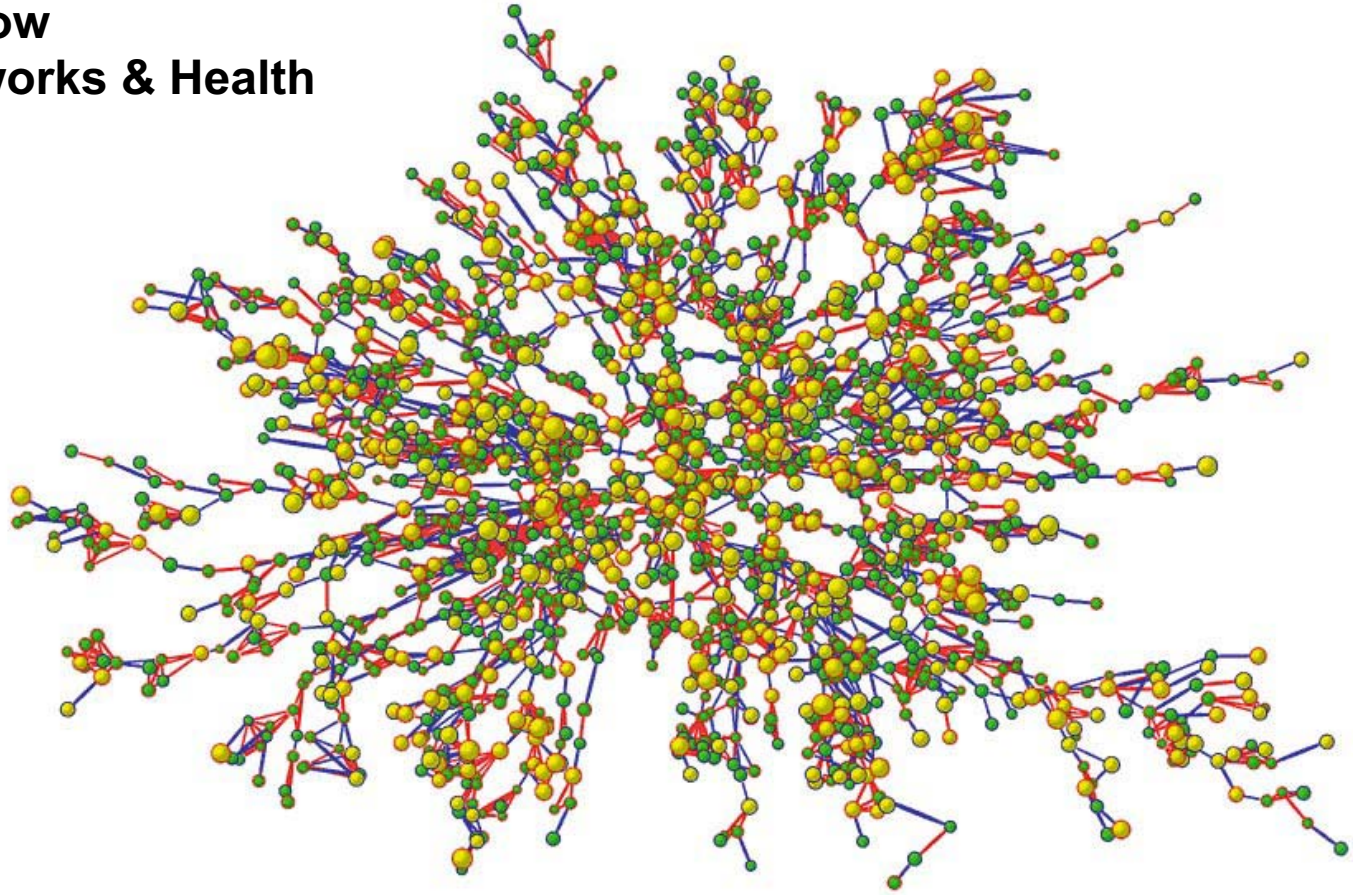
PURPOSE

To leverage **social networks, social media, mobile phones**, and **the web** for weight loss among 18-35 year old young adults.

Funded with a 5-year grant from NHLBI/NIH

Take What We Know About Social Networks & Health And Turn It Into Interventions To Improve Health…



Largest Connected Subcomponent of the Social Network in the Framingham Heart Study in the Year 2000.

Each circle (node) represents one person in the data set.
The size of each circle is proportional to the person's body-mass index.

Christakis & Fowler, The spread of obesity in a large social network over 32 years. New England Journal of Medicine, 2007

mobile → social

SMART

Social Mobile Approaches to Reduce Weight

CW PHS
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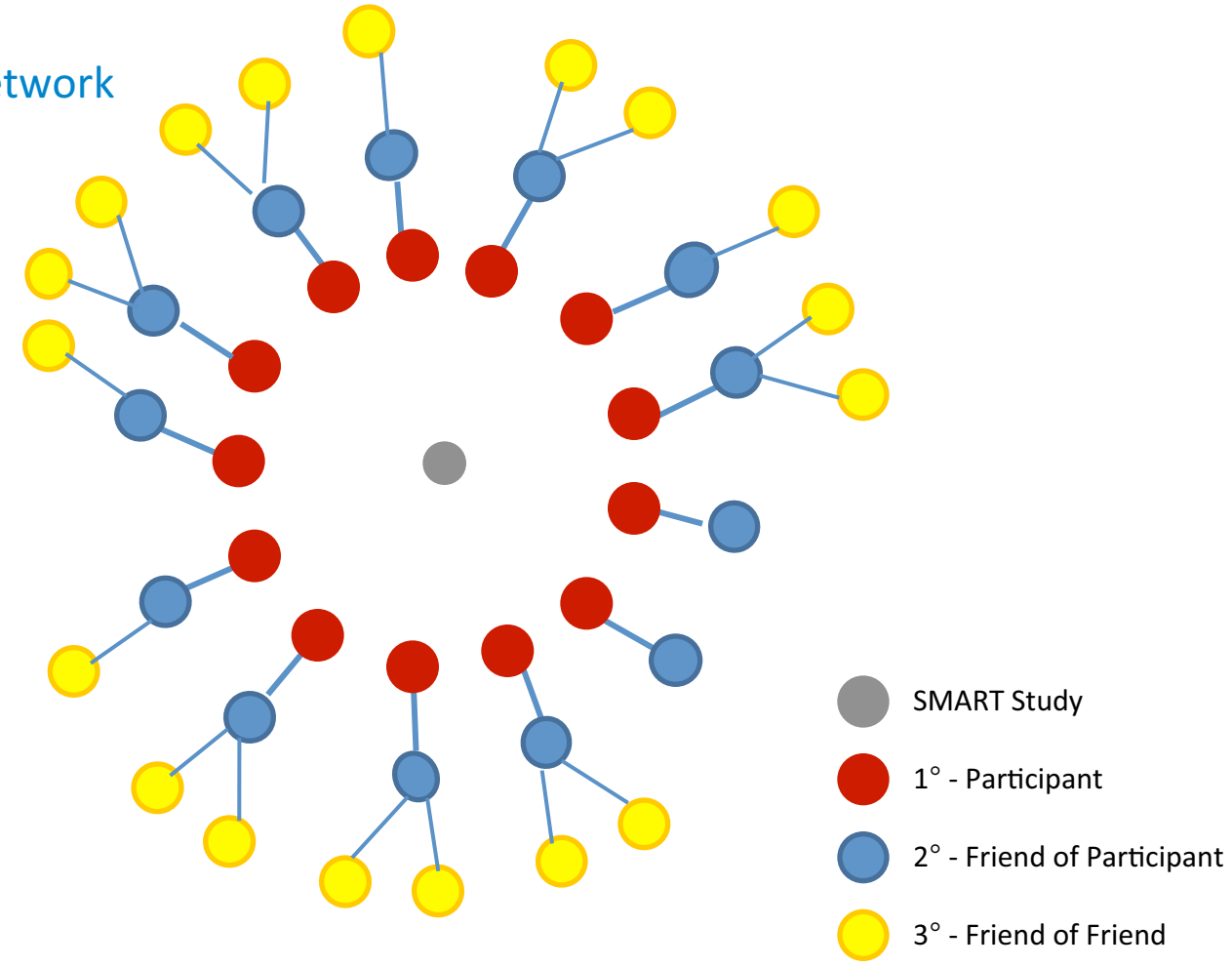
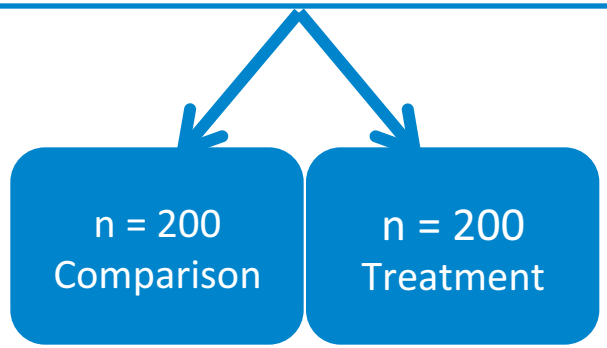
INTERVENTION

Facebook an intact social network
+
Mobile Phone txt messaging
+
Smartphone mobile apps
+
Website



Study Design:

400 Subjects, 18-35 years old male & female,
Weight: 25 < BMI ≤ 34.9
University students
at four colleges in the San Diego area



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- Owns a personal computer
- Owns a mobile phone and uses text messaging
- Facebook user / willing to start using Facebook

- **RECRUITMENT BEGINS:** March 2011

- **ENROLLMENT BEGINS:** April/May, 2011

Collaborators and platforms:

facebook

STANFORD
SCHOOL OF MEDICINE
Stanford University Medical Center

Treatment Modalities

Web

SMART Database Server

Facebook

Mobile

txt
apps
m.web

Treatment: Mobile Apps

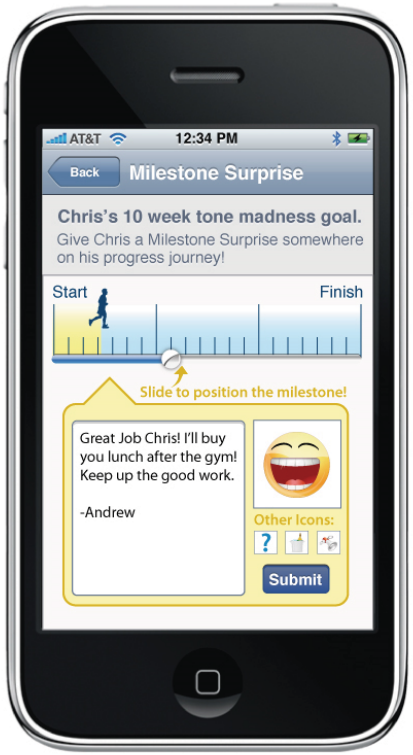
Mobile + Facebook Apps

APP	TARGET BEHAVIORS & STRATEGIES					
	Self-Monitoring	Intention Formation	Goal-Setting	Goal Review	Feedback	Knowledge
Be Healthy		X	X	X		
Track Me (EMA)	X	X			X	X
Goal Getter			X	X	X	
Facts / Quizzes					X	X

Goal Getter

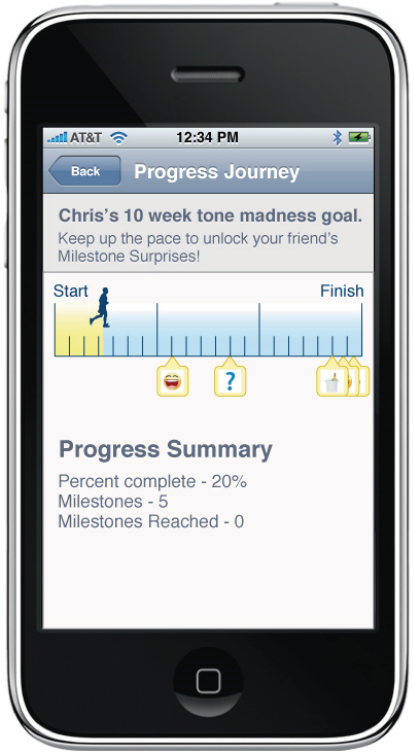
Goal Getter!

Friend's View
Setting a Milestone Surprise for a friend.



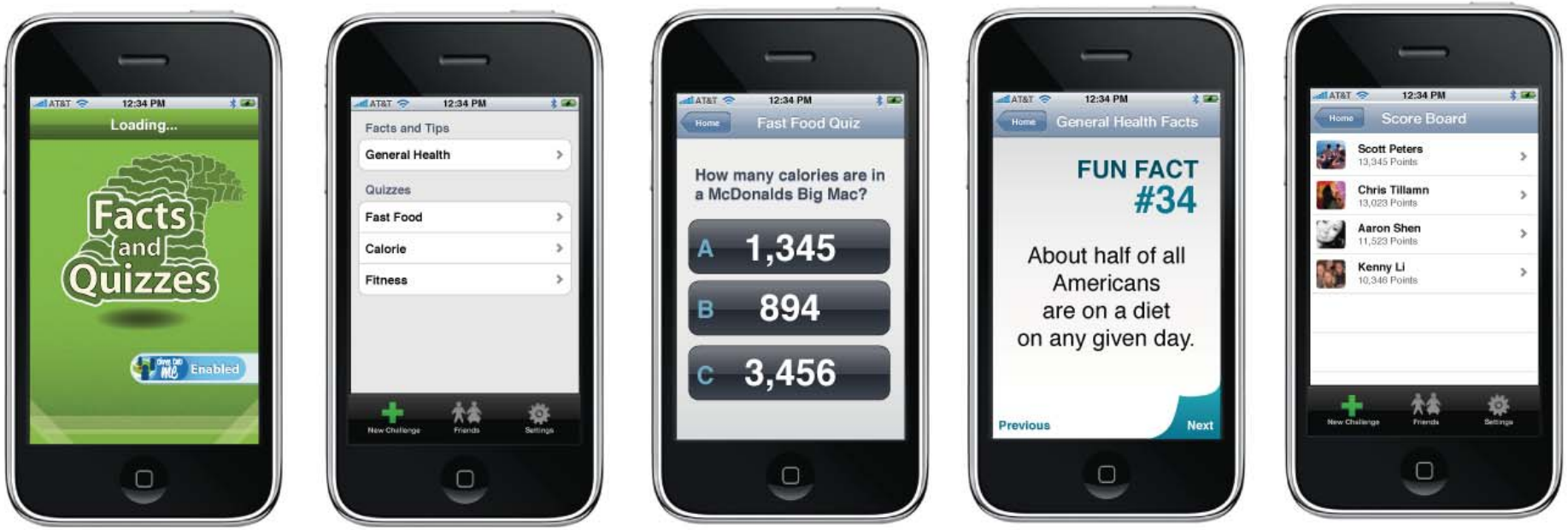
User's View
Sharing your progress to get surprises.

User's View
Viewing your progress and milestones.



User's View
Viewing your progress, and a reached milestone.

Facts & Quizzes



Facebook Apps

–Every individual is responsible for 1 healthy –meal idea in a week.

–Individuals go to Eating Club Group Facebook Page and create an invite.

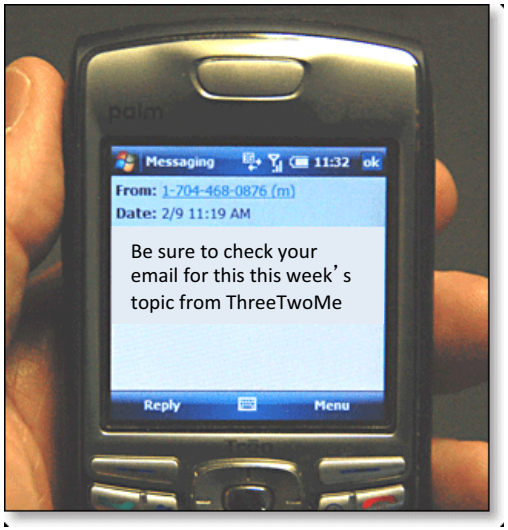
–Invites include the healthy concept, whether its not eating dessert, eating vegan, or splitting a meal.

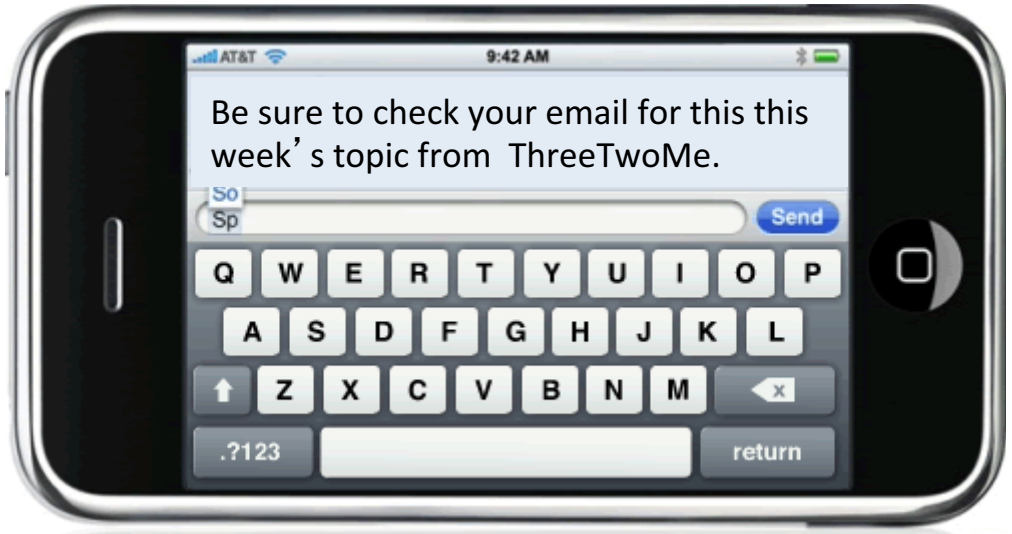
–Those ideas are listed in the Description and the invite is sent with secret setting so as not to highlight 'dieting' type behavior.

–Members can see their healthy meals on the Group Page and on their Profile's Events Page.

–Pair holds each other accountable for decisions made at the table.

Treatment: Txt Msgs





SMART is using "State of the Science" Behavioral Theory & Principles

Core Behavior Strategies
Self-monitoring
Intention Formation
Goal Setting
Goal Review
Feedback on performance

Michie et al., 2009

Theoretical Principles
Social Cognitive Theory
Ecological Theory
Social Network Theory
Theories of Operant Learning
Theories of Tailored Health Communications
Self Regulation Theory
Behavioral Choice Theory

Treatment Roadmap

A step-wise intervention built upon *core* self-regulation strategies

- A **16-week step-wise program**
- The **16-week program repeated six times** in the course of 2-year RCT
- The following will be introduced with each new cycle:
  - New skills
  - More detailed and advanced skills
  - Reinforce core strategies and introduce new strategies
  - New and refined apps based on user experience and feedback
  - Re-address, in new ways, skills the participant may be having difficulty with (based on analysis of previous cycles)
- Flexible program:
  - Enables participants to enter trial at the first step
  - Program to enable highly tailored content throughout based on progress

Hypotheses we are considering related to Social Networks & Intervention effects

Participants who receive support messages from at least one of their closest social contacts on Facebook are more likely to succeed at weight loss than those who do not.

Participants who are socially active with a greater number of contacts on Facebook are more likely to succeed than those who are not.

Participants who are in highly transitive networks (their friends are friends with one another) are more likely to succeed than those who are not.

Participants with close friends on Facebook who discuss diet, physical activity and other study-related behaviors in status messages are more likely to succeed than those who do not have such friends.

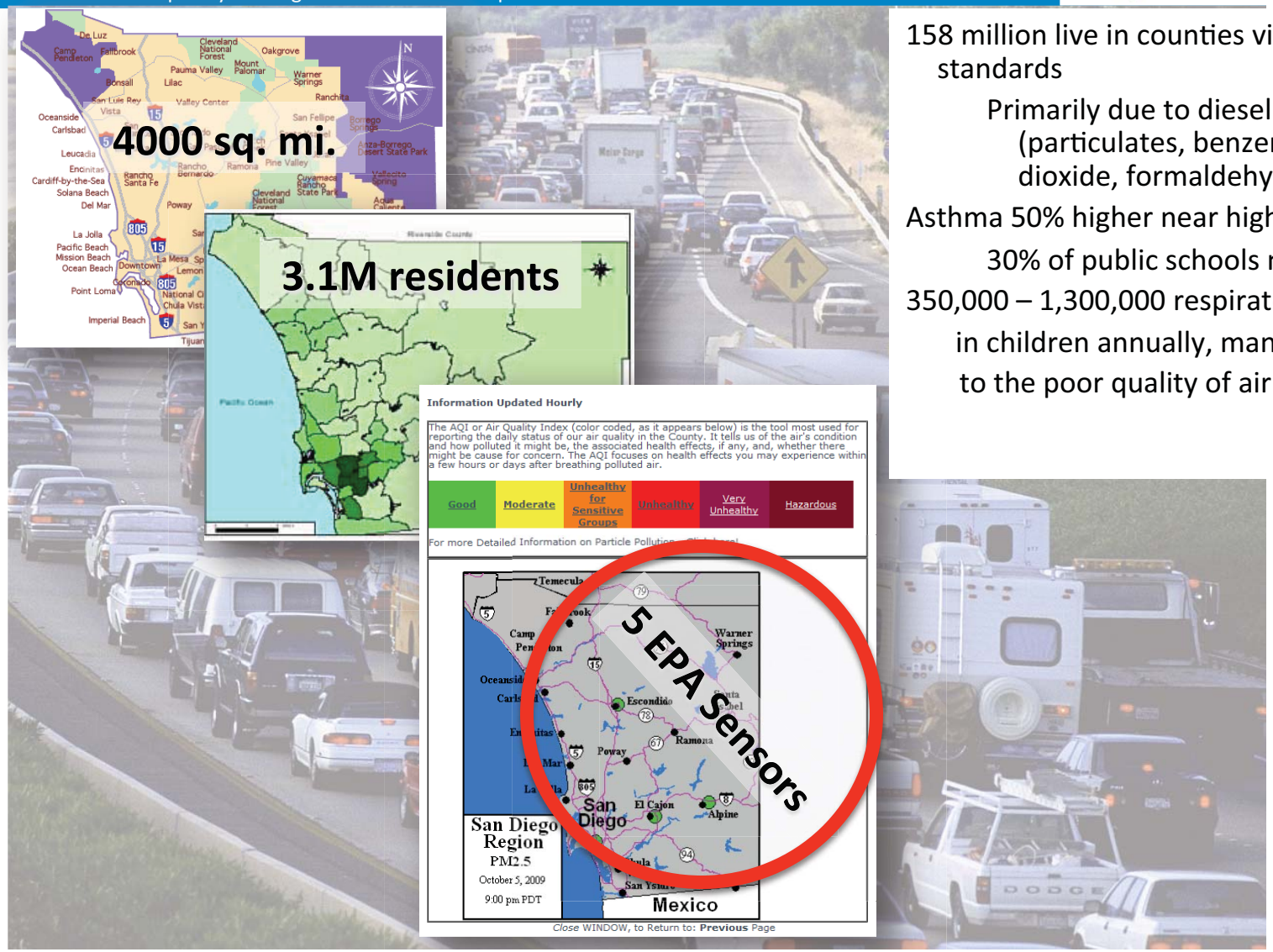
In part, it's about collecting data from Sensors…

It's also about data-driven interventions via Mobile and Social Media…

And ultimately about integrating the two in real time…

CITISENSE

Mobile-phone-based Participatory Sensing for Environmental Exposures



158 million live in counties violating air standards

- Primarily due to diesel trucks & autos (particulates, benzene, sulfur dioxide, formaldehyde, etc.)

Asthma 50% higher near highways

- 30% of public schools near highways

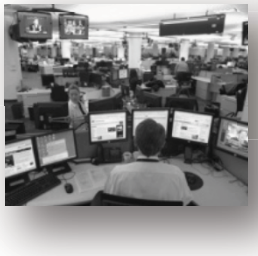
350,000 – 1,300,000 respiratory events in children annually, many due to the poor quality of air

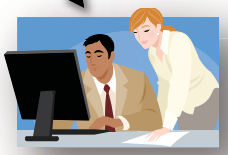
CITISENSE

Mobile-phone-based Participatory Sensing for Environmental Exposures

CW PHS

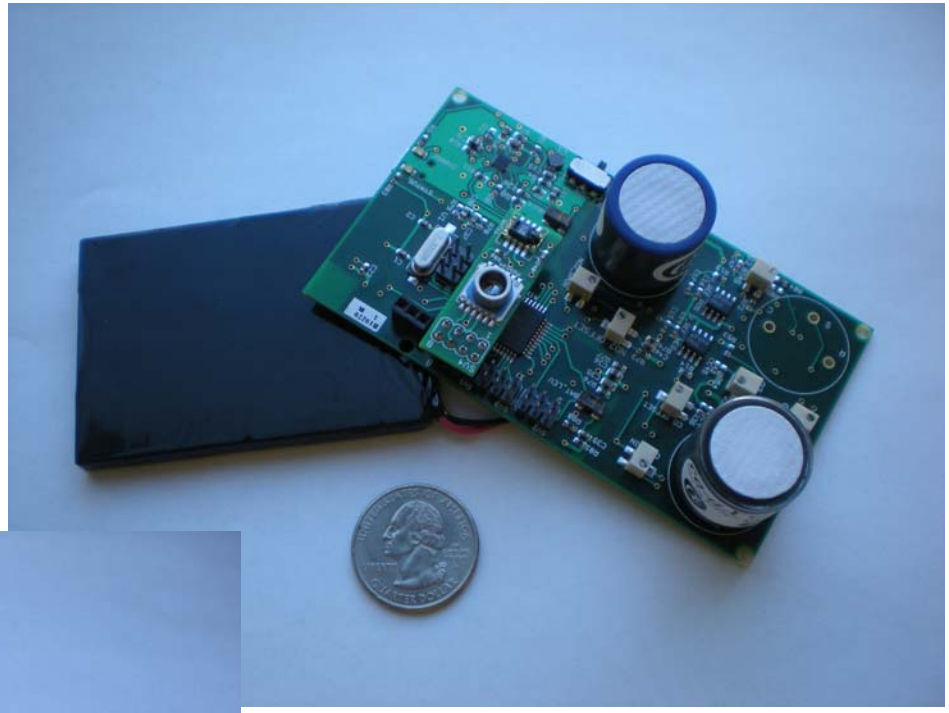
WIRELESS & HEALTH SYSTEMS

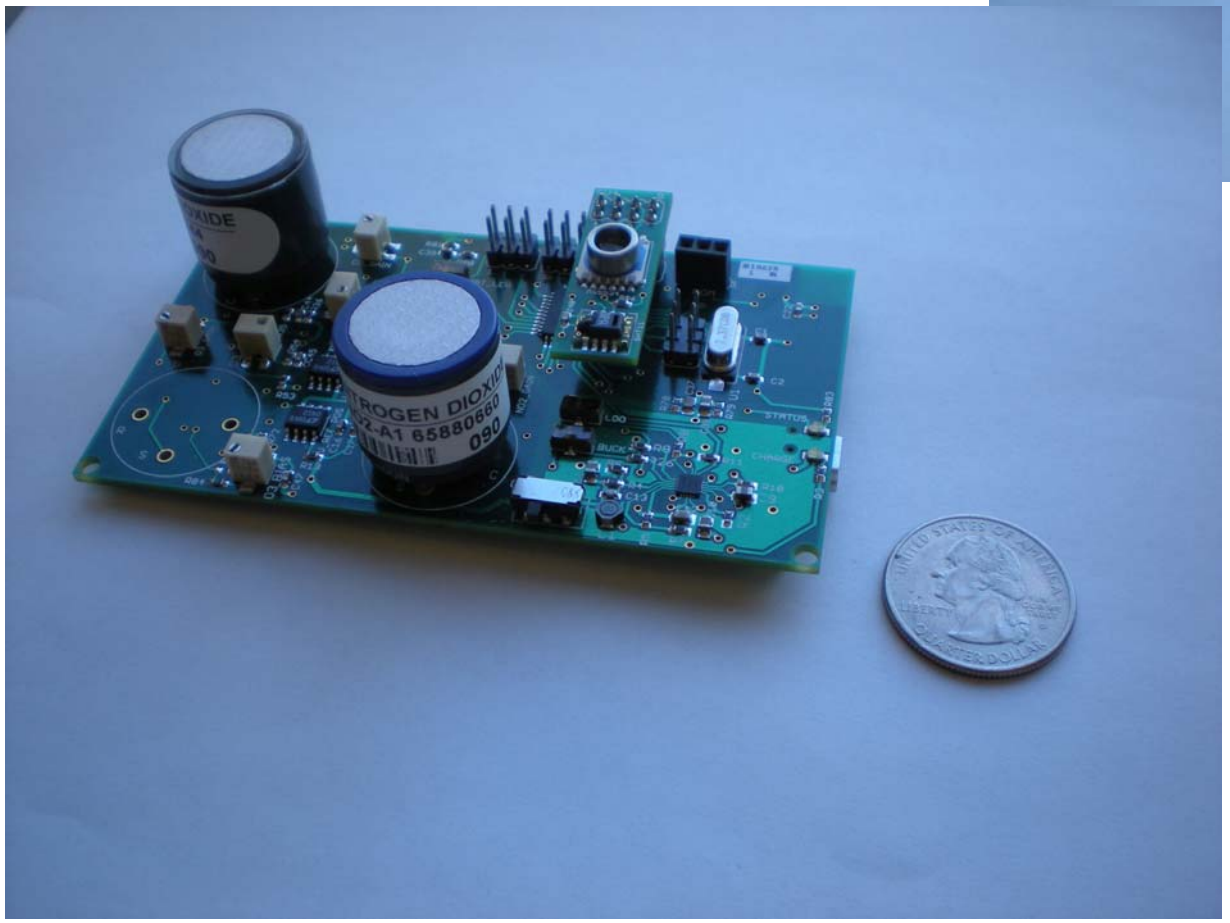




PI: Bill Griswold, PhD
Co-PI: Kevin Patrick, MD, MS

CitiSense Sensor Board

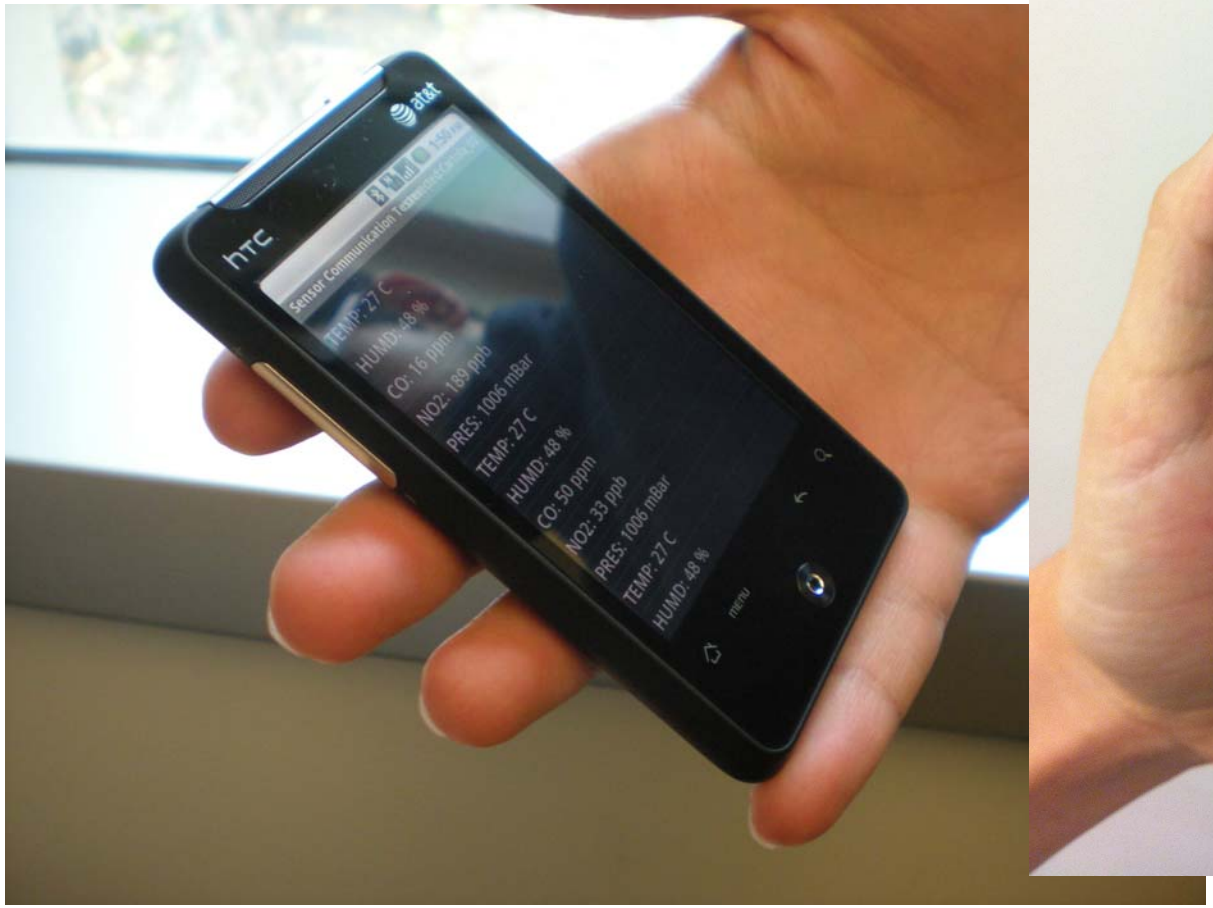


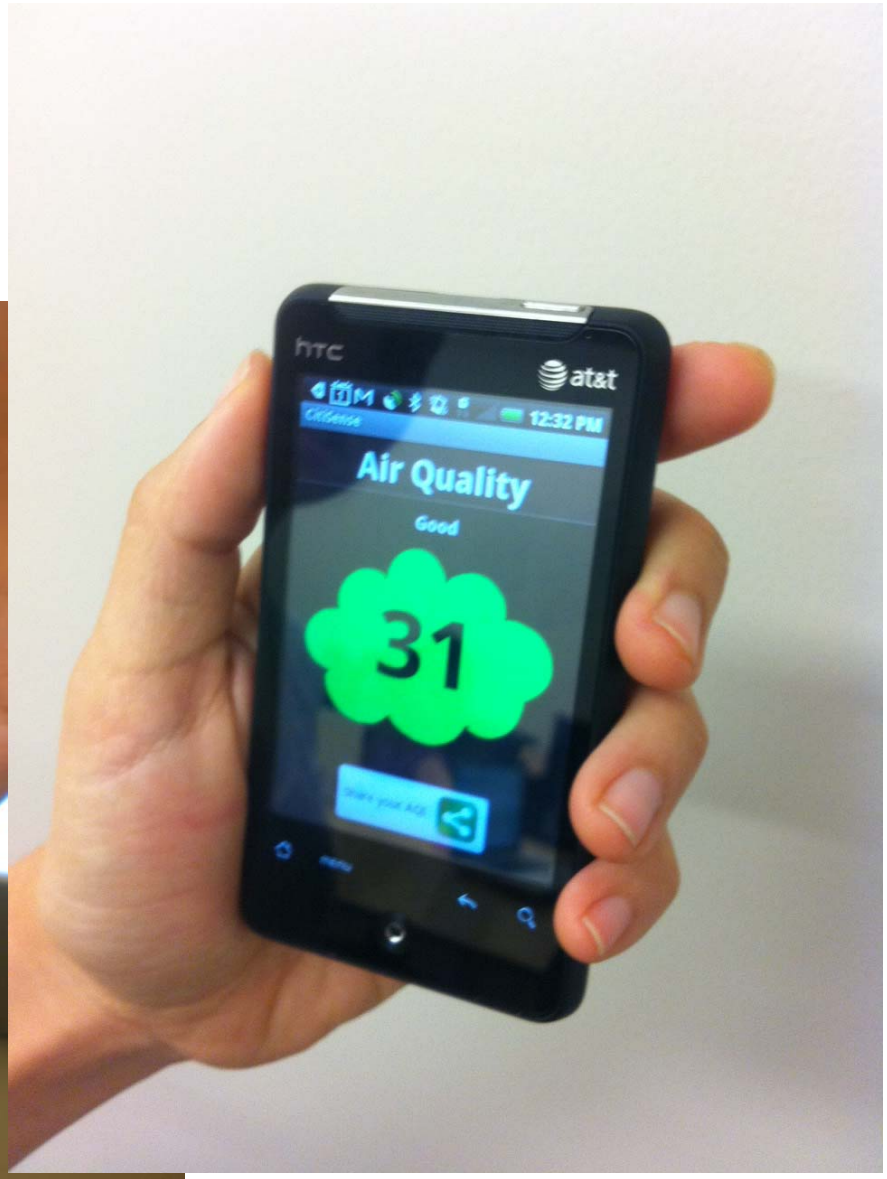


NOX (nitrogen oxides)
CO (carbon monoxide)
Temperature
Pressure
Humidity

Connects via Bluetooth radio to mobile phone

CitiSense Android Phone Interface (beta)

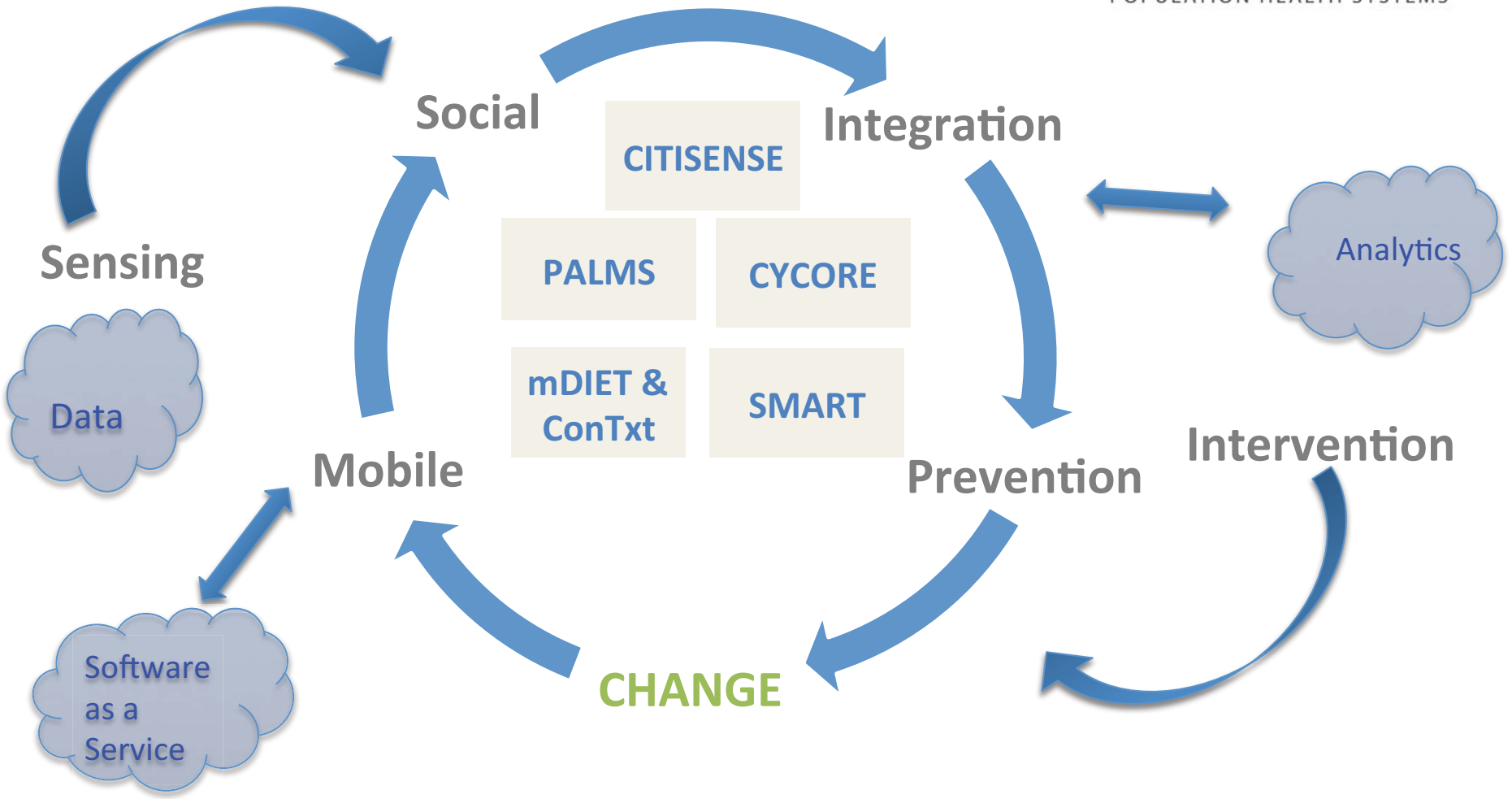




Developing UI to allow users to understand local air quality and to share with others via Facebook & Twitter…

True "Health Systems" Change

CENTER FOR WIRELESS & POPULATION HEALTH SYSTEMS



In Conclusion…
What is the Unique Role For Each of Us?

CENTER FOR WIRELESS & POPULATION HEALTH SYSTEMS

"**LIST**"

Technologies

Systems

Institutions

Leadership

Julio Frenk, MD, PhD
Dean, Harvard School of Public Health


Thank You!
cwphs.ucsd.edu