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AND SOCIAL SCIENCES RESEARCH
NATIONAL INSTITUTE OF HEALTH

Innovative Technologies for
Longitudinal Birth Cohort Study
Visit Assessments
July 19, 2011



Emerging Technologies to Measure Psychosocial Variables

Robert M. Kaplan
Director, OBSSR

NIH Associate Director for Behavioral and Social Sciences



<http://obssr.od.nih.gov>



CDC Key Winnable Battles for Public Health

Tobacco



**Nutrition,
Physical Activity,
Obesity and
Food Safety**

**Healthcare-
Associated
Infections**



**Motor
Vehicle
Injuries**

**Teen
Pregnancy**



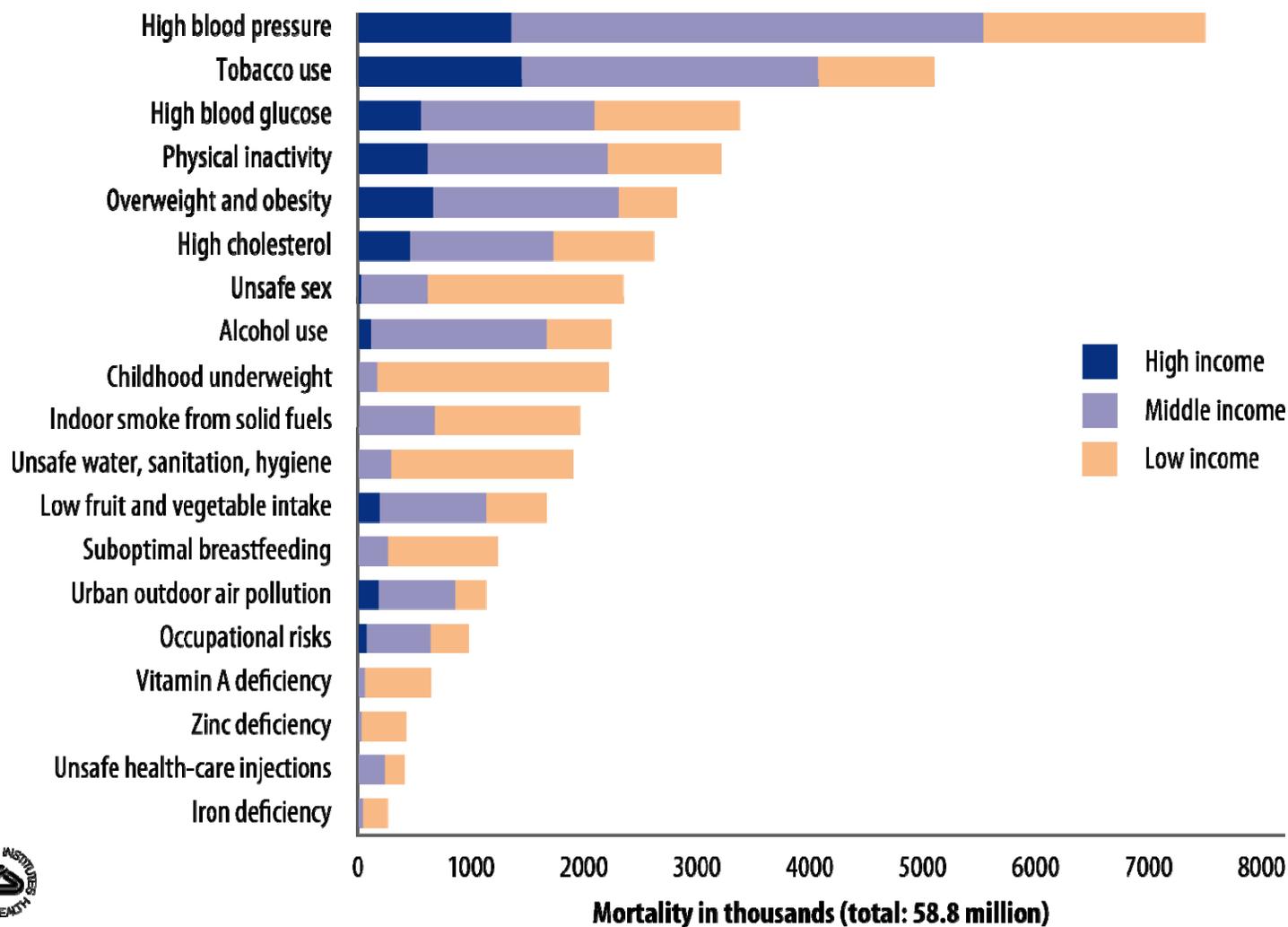
HIV





- Oxford Health Alliance's key message:
- 3 risk factors –
 - tobacco use, poor diet, lack of physical activity
- Contribute to Four chronic diseases –
 - heart disease, type 2 diabetes, lung disease and some cancers
- Which, contribute to more than 50 per cent of deaths in the world

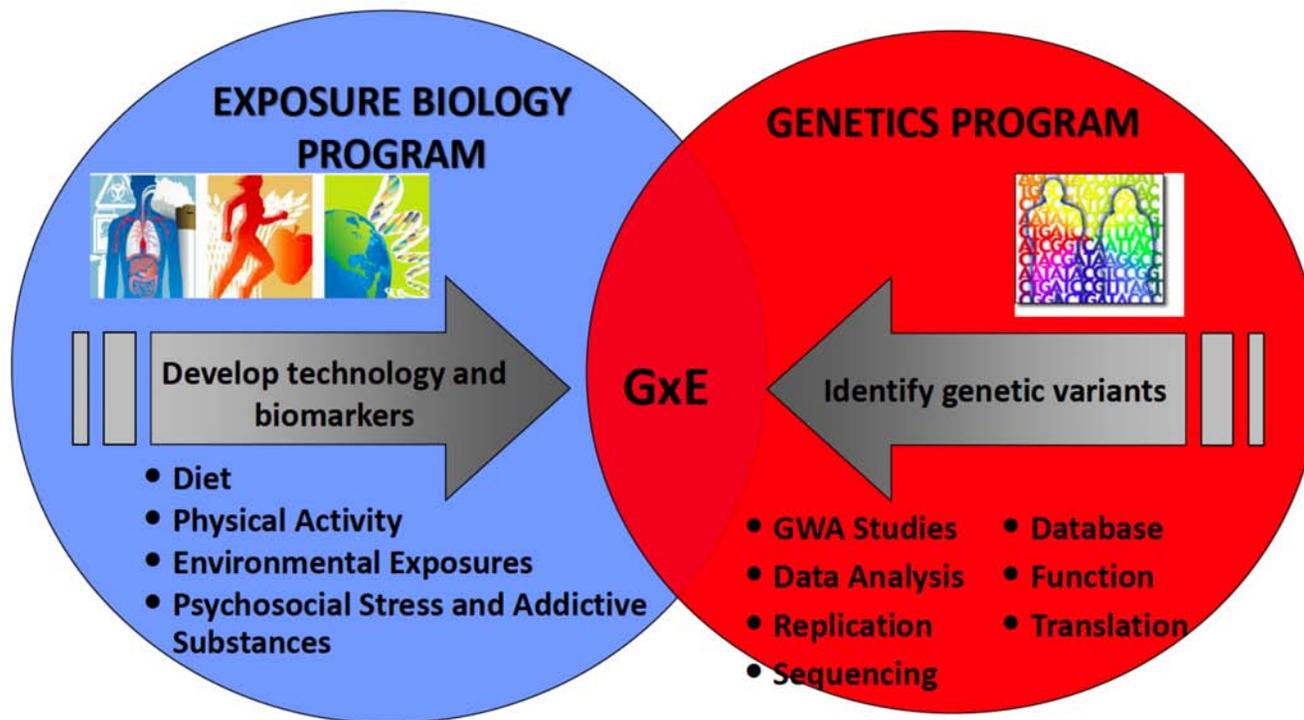






OBSSR Lead Kay Wanke
NIH Genes, Environment and Health Initiative
Exposure Biology Program

Genes, Environment and Health Initiative: The Vision





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The Exposome (from Kevin Patrick, UCSD)



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POPULATION HEALTH SYSTEMS

Historical approaches to measuring behaviors and environment -

Self report via questionnaires every few day or months (if that...)

Biomarkers of exposure, some good but others that are often indirect and imprecise or focused on only one thing

Direct measurement of the environment across a broad geographic area yielding only crude inferences about person-level exposures in time and space. Moreover, these are almost always focused only on air and water.





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The Exposome (from Kevin Patrick, UCSD)

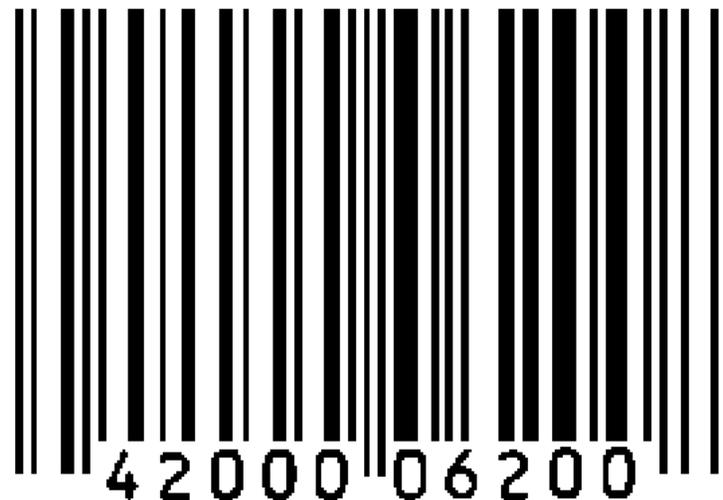
“At it’s most complete, the exposome encompasses life-course environmental exposures (including lifestyle factors), from the prenatal period onwards...”

-- Christopher Paul Wild





Genome



Exposome

Together these lead to whether disease occurs or health is promoted...



(from Kevin Patrick, UCSD)



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The Exposome

(from Kevin Patrick, UCSD)

“Unlike the genome, the exposome is a highly variable and dynamic entity that evolves throughout the lifetime of the individual...”

-- Christopher Paul Wild





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Genome



Exposome



In utero...

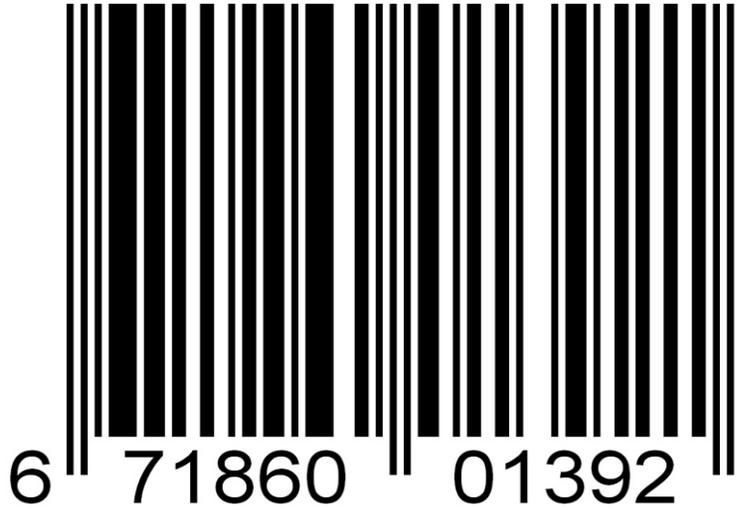


(from Kevin Patrick, UCSD)





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Genome



Exposome

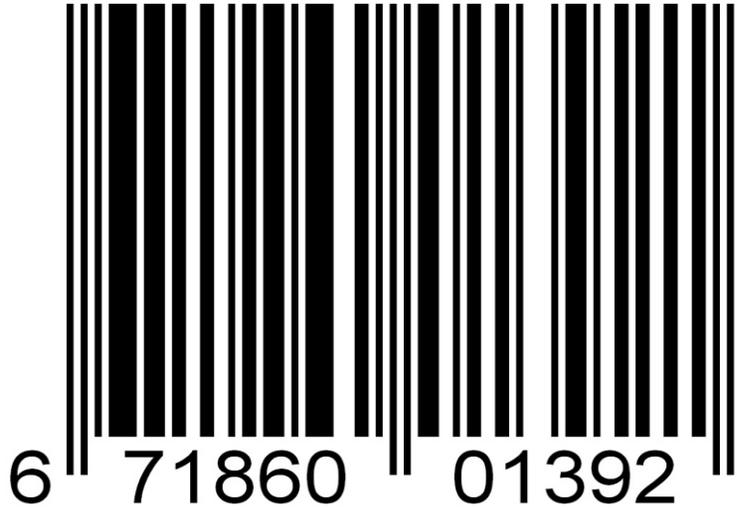


childhood...





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Genome



Exposome



In adolescence...



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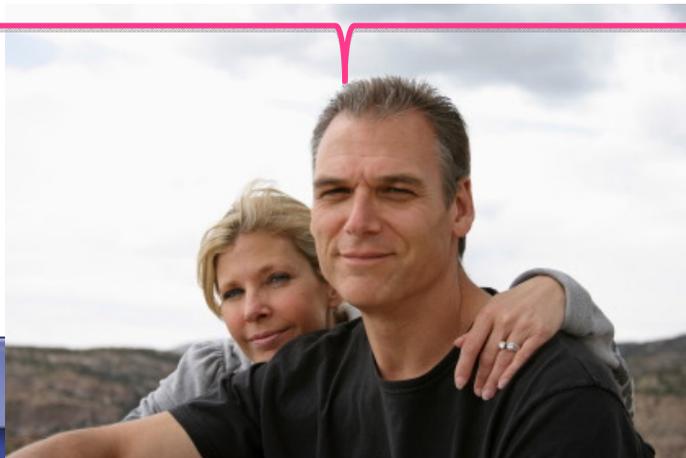


Genome



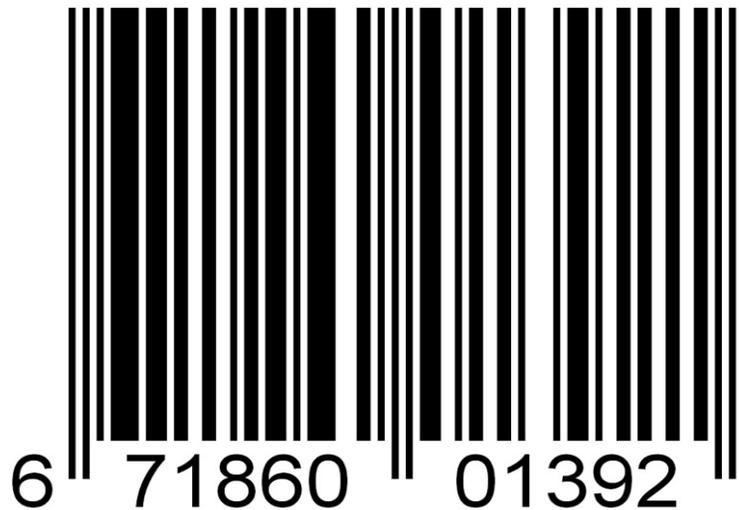
Exposome

In adulthood...





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Genome

Exposome

In old age...



www.TopFoto.co.uk

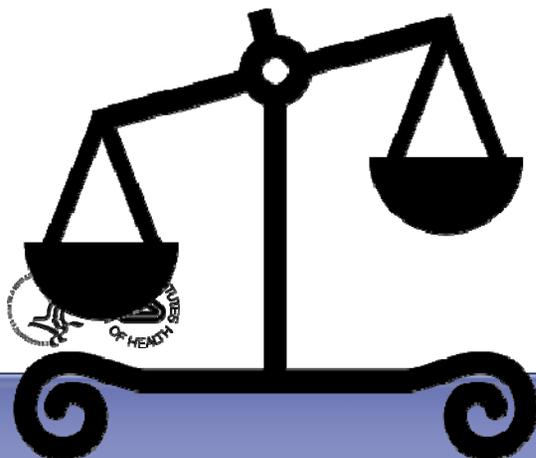


The Exposome

“The imbalance in measurement precision of genes and environment has consequences, most fundamentally in compromising the ability to fully derive public health benefits from expenditure on the human genome...”

“There is a desperate need to develop methods with the same precision for an individual’s environmental exposure (and behaviors) as we have for the individual’s genome.”

-- Christopher Paul Wild





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The game is changing

5+ Billion Mobile Phone users

- UN International Telecomm Union (2011)

**14.2 Million iPads sold, 2010
(75% of the market)**

- Wikipedia (2011)



(from Kevin Patrick, UCSD)





Growth of Mobile

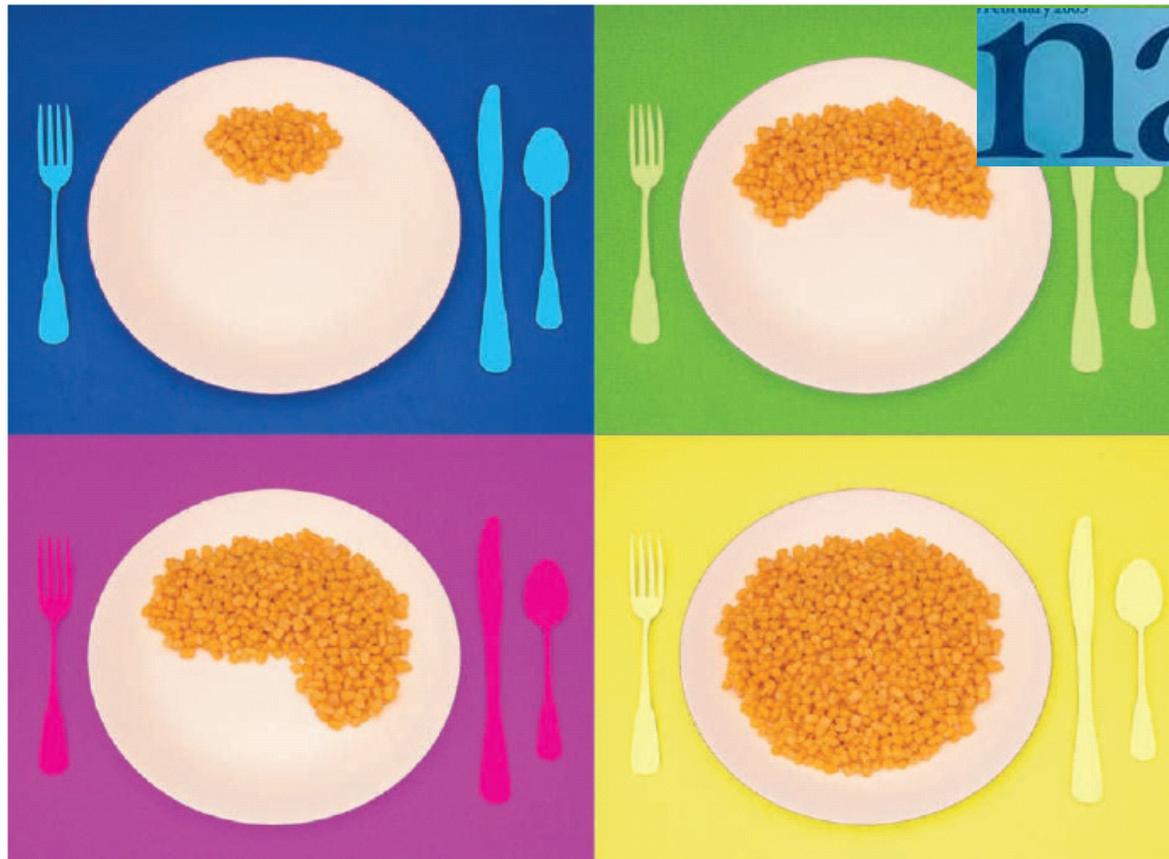




I think we can safely assume the promise of apps radically revolutionizing our health is heavily inflated. So, then, what good are health apps? Health apps are the equivalent of old school public health advertising. Just as I see an ad when I get on the subway telling me this soft drink has 40 packets of sugar, I whip out my iPhone and see the Livestrong app on my homescreen reminding me that I need to eat well. I don't really want to use it because it's such a drag."

Jay Parkinson of Future Well, 2011





international weekly journal of science
nature

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



Food Intake Recording Software System: Version 4 (FIRSSt4)

PI: Tom Baranowski, Baylor College of Medicine

- Uses Web-based software to assess 24-hour recalls
- Adapts the NCI Automated Self Administered 24-hour Recall (ASA24) for children ages 8-13
- Calculates nutrient and food intake
- English and Spanish
- Utilizes alternative phonetic spell check algorithms
- Freely available Web-based tool





Improving Dietary Assessment Methods Using the Cell Phone and Digital Imaging

PI: Carol Boushey, Purdue University

- Uses a mobile phone as a food record
- Image processing to identify food in real time
 - Supplement with search list
 - Calculates volume to estimate portion size
- Calculates nutrient and food intake



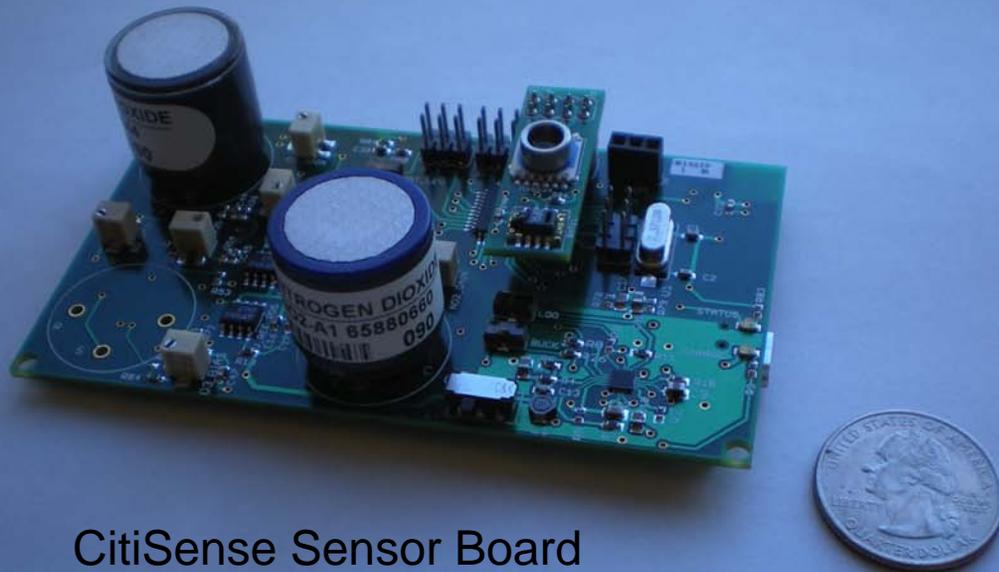


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CITISENSE

Mobile-phone based Participatory Sensing for Environmental Exposures

PI: Bill Griswold, PhD, UCSD CSE
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



Current Status: PALMS Devices

Physical Activity and Heart Rate

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



(from Kevin Patrick UCSD)



Location - GPS Dataloggers

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





Merged GPS & Activity Data

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



(from Kevin Patrick, UCSD)

Sedentary

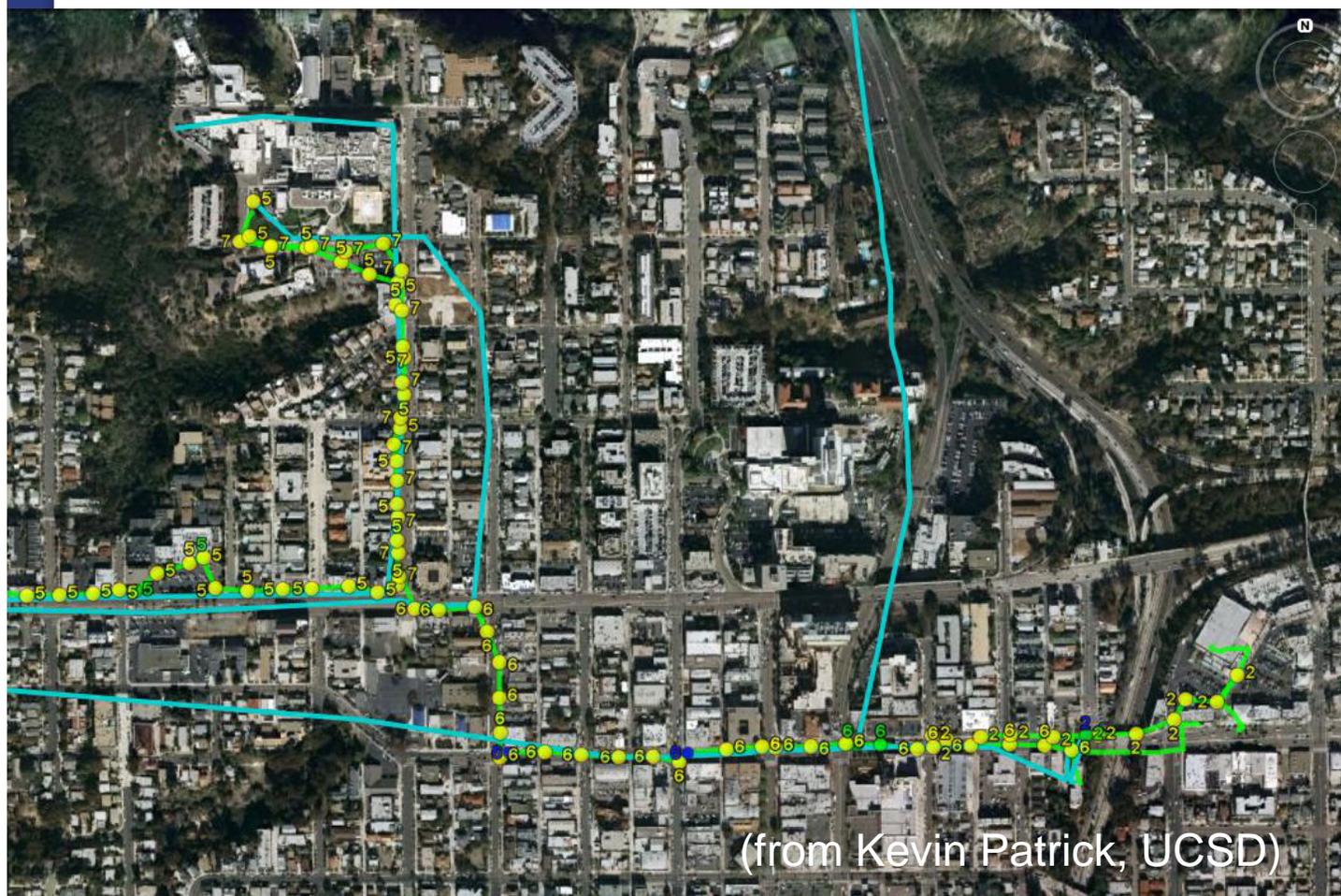
Light

Moderate



Detect Bouts of Activity

Research Question: Are small, low quality neighborhood parks better than large regional parks for continuous minutes of MVPA?



How long do participants engage in periods of intense physical activity?

Where are participants getting sustained activity?

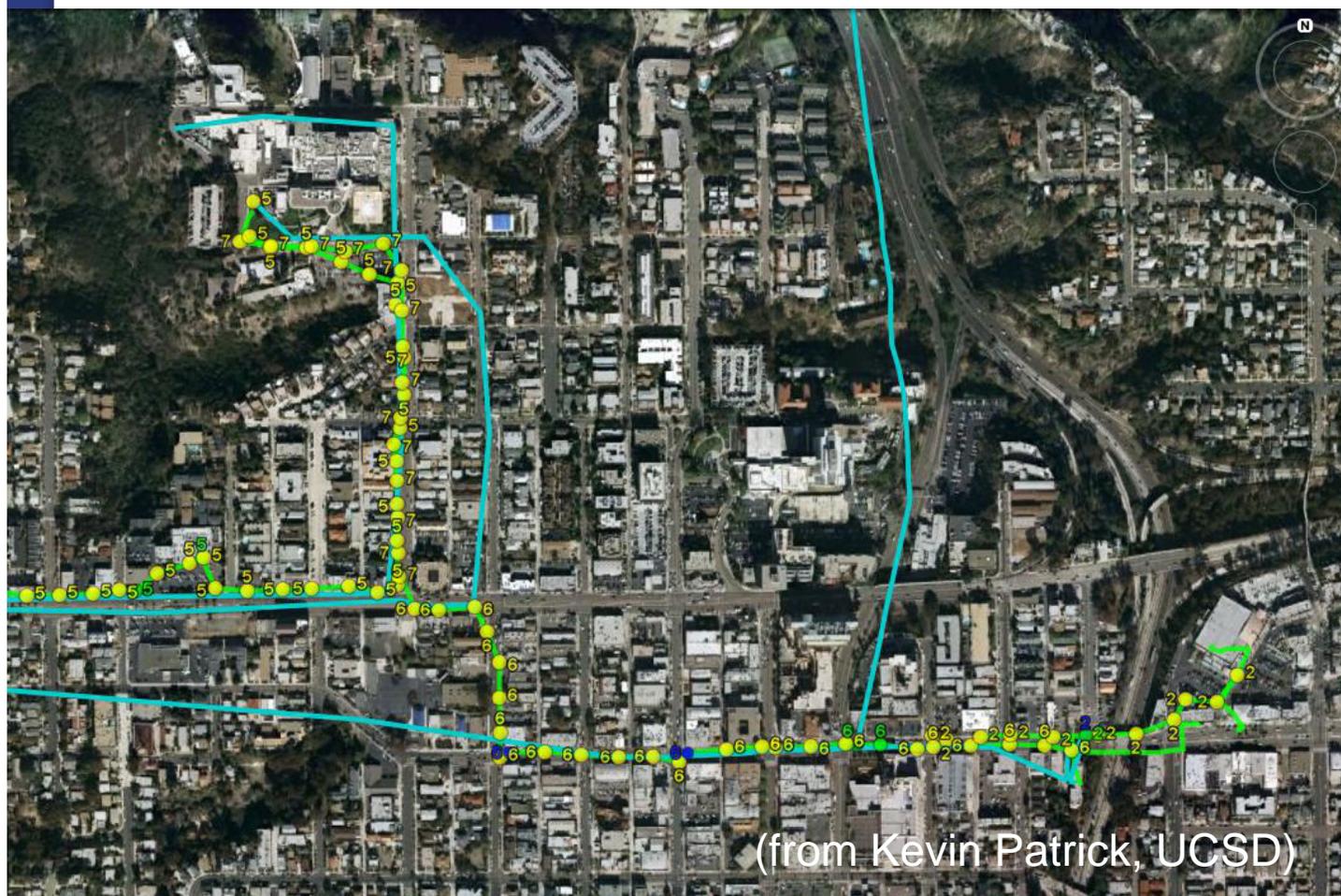
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Moderate



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(from Kevin Patrick, UCSD)

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Light

Moderate



What will be required?

Move well beyond the “electronic medical record” as we know it

New research designs – RCTs will not be able to keep up...

**New methods of data fusion and synthesis
– multilevel, multidimensional, spatial/temporal**

New generation of (and many more) health data analysts

New approaches to handling privacy of health-related information

New approaches to health data security



New approaches to health technology design and experience



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OBSSR Activities

**Systems Science Institute
Pittsburgh, May 2011
OBSSR Lead Patty Mabry**

**mHealth with Qualcomm, June
2011
OBSSR Lead Wendy Nilsen**

**Big Data Initiative: Data
Visualization
OBSSR Lead Tisha Wiley**

**Harmonizing Psychosocial
Information in the EMR
OBSSR Lead Maureen Boyle**



NATIONAL INSTITUTES OF HEALTH

2011 mHealth

SUMMER TRAINING INSTITUTE

June 18-24, 2011

ESTANCIA LA JOLLA HOTEL
LA JOLLA, CALIFORNIA





OBSSR: Workshop: Reducing Barriers to Mobile Technology Usage in Behavioral and Social Sciences Research (6/10), mHealth Training Institute

NIEHS/NHGRI (plus NCI, NHLBI, NIDA, NIAAA, and others): Genes, Environment and Health Initiative (<http://gei.nih.gov/exposurebiology/>)

NIDA Meeting: Digital Media and Communication Technologies in Adolescent Drug Abuse Treatment (April 26, 2010)

NLM NLM tools: Pillbox, ReUnite, HEPL, WISER, MedlinePlus Mobile, REMM

- Meeting: The ePatient: Digital and Genomic Technologies for Personalized Health Care (April 6, 2010)

NICHD: NICHD tools: fetal development app, pill reminder app

NIA/NIBIB: Meeting: Personal Motion Technologies for Healthy Independent Living (6/10)

NCI: NCI's Developer Challenge: Enabling Community Use of Data for Cancer Prevention and Control





“Social scientists are getting to the point in many areas at which enough information exists to understand and address major previously intractable problems that affect human society.”

—Gary King, *Science*, Feb 11 2011

“Visualizations are absolutely critical to our ability to process complex data and to build better intuitions as to what is happening around us.”

--Peter Fox & James Hendler, *Science*, Feb 11 2011

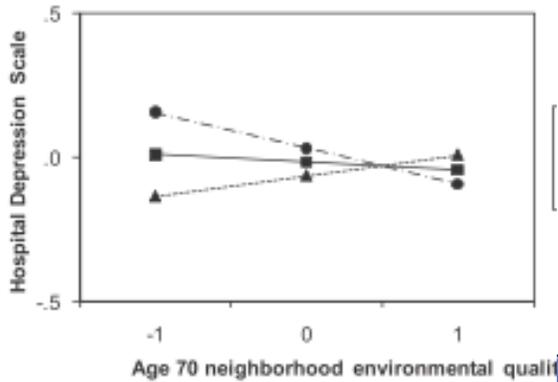
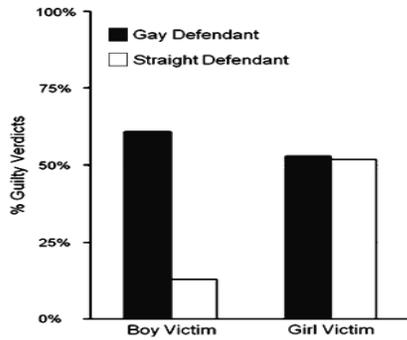
“In an uncharted world of boundless data, information designers are our new navigators.”

--Natasha Singer, *NYT*, April 2, 2011

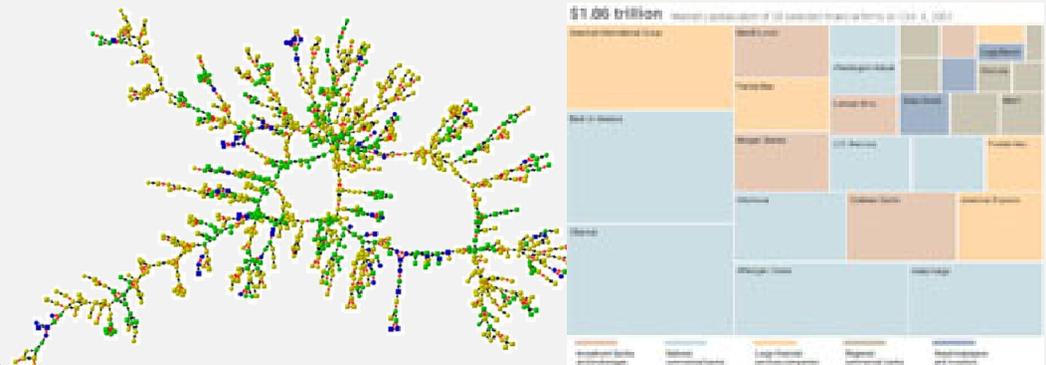
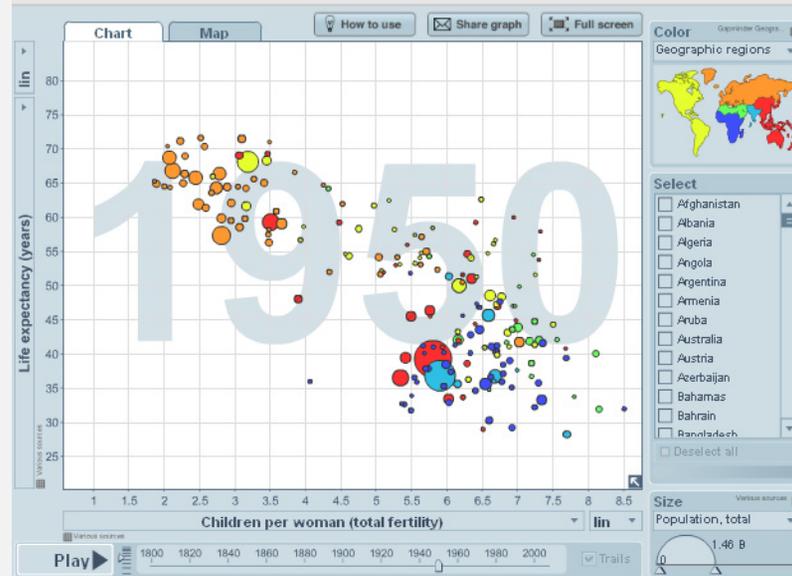


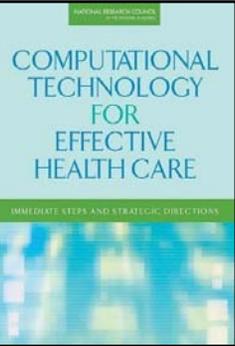


TRADITIONAL VISUALIZATIONS



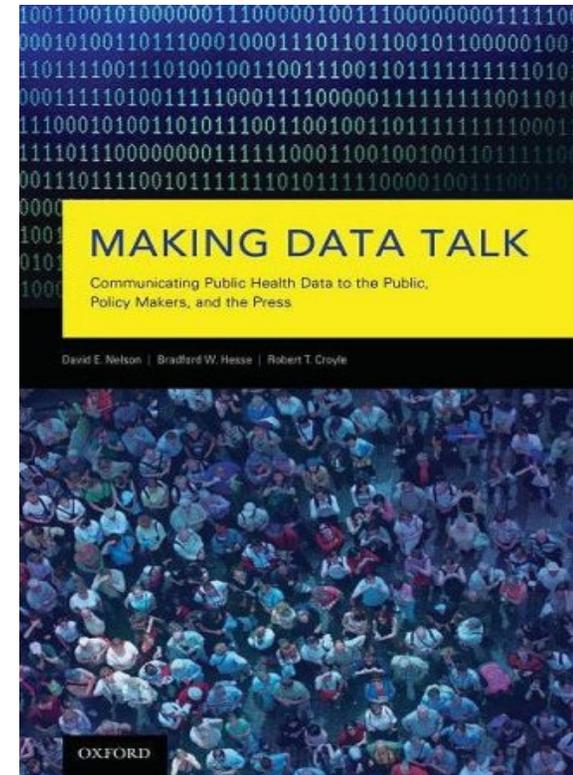
NEW VISUALIZATIONS





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- Communication
- Usability
- Data Visualization
- Decision Support



proximity



similarity



continuity



closure



area



symmetry



Source: Nelson DE, Hesse BW, Croyle RT. Making Data Talk: Communicating Health Data to the Public, Policy, and the Press. New York, NY: Oxford; 2009.



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OBSSR Efforts in Visualization

- Visual Analytics for Complex Data in Health Research: A Sandbox Workshop for Social Science Researchers





- Questions and Suggestions

