

From Individual to Ecological Perspectives: My Personal Evolution

James F. Sallis, Ph.D.

San Diego State University

Master Lecture

Society of Behavioral Medicine,
Salt Lake City, March 2003

Questions for this Presentation

- Why & how did he evolve from a nice clinical psychologist to an ecologically-oriented transdisciplinary scientist?
- What took him so long?
- Why does this matter to me?

Links in the Evolutionary Process

- Floating in the water: formative influences
- First steps in the mud: attempting to study the environment
- Walking on all-fours: building some evidence
- Finally upright: improving methods & teams
- Where are we headed?

Links in the Evolutionary Process

- Floating in the water: formative influences
 - Clinical psychology, individual focus
 - Cognitive-behavioral orientation
 - Skinnerian background



B.F. Skinner

1904-1990

Environment → Behavior

Measure behavior by
Observation!

Links in the Evolutionary Process

- First steps in the mud: attempting to study the environment
 - Target behaviors: physical activity & eating (smoking, sun protection)
 - Family Health Project: inventory of parks & food stores

Sallis, J.F., Nader, P.R., Rupp, J.W., Atkins, C.J., and Wilson, W.C. (1986). San Diego surveyed for heart-healthy foods and exercise facilities. **Public Health Reports**, **101**, 216-219.

- Public health recommendations presuppose that healthful foods & exercise resources are readily available.
- We surveyed neighborhoods within 1 mile of 24 elementary schools representing all deciles of median family income
- Trained observers drove or walked all streets
- 16 exercise resources inventoried
- All food markets recorded & 71 “heart-healthy” foods inventoried

Sallis, J.F., Nader, P.R., Rupp, J.W., Atkins, C.J., & Wilson, W.C. (1986). San Diego surveyed for heart-healthy foods and exercise facilities. **Public Health Reports**, **101**, 216-219.

- 0 to 17 exercise resources per n'hood; no relation to SES
- Supermarkets had 57 of 71 healthy foods; convenience stores had 12 of 71
- Total healthy foods in n'hood related to SES ($r=.34$)
- Healthy foods per store related to SES ($r=.51$)
- Healthy foods & exercise resources correlated ($r=.57$)

Links in the Evolutionary Process

- First steps in the mud: attempting to study the environment
 - Target behaviors: physical activity & eating
 - Family health project: inventory of parks & food stores
 - Lesson: environment may regulate response to behavior change programs

Links in the Evolutionary Process

- First steps in the mud: attempting to study the environment
 - Target behaviors: physical activity & eating
 - Family health project: inventory of parks & food stores
 - Lesson: environment may regulate response to behavior change programs
 - **SCAN: environmental measures**

Observational measure for SCAN

McKenzie, T.L., Sallis, J.F., Nader, P.R., Patterson, T.L., Elder, J.P., Berry, C.C., Rupp, J.W., Atkins, C.J., Buono, M.J., & Nelson, J.A. (1991).

BEACHES: An observational system for assessing children's eating and physical activity behaviors and associated events. **Journal of Applied Behavior Analysis**, **24**, 141-151.

- SCAN: Study of Children's Activity & Nutrition.
 - PI is Phil Nader
- BEACHES: system for coding observations of children
 - Eating & PA behaviors
 - Location
 - Presence & viewing of TV
 - Social context & prompts
 - Child response & consequences
- High interobserver reliabilities

Links in the Evolutionary Process

- Walking on all-fours: building some evidence
 - San Diego Health & Exercise Study: survey items

Sallis, J.F., Hovell, M.F., Hofstetter, C.R., Faucher, P., Elder, J.P., Blanchard, J., Caspersen, C.J., Powell, K.E., & Christenson, G.M. (1989). A multivariate study of determinants of vigorous exercise in a community sample. **Preventive Medicine**, **18**, 20-34.

- Survey of 2053 adults
- Home equipment: tally of 10 items
 - $r=.23$ with vigorous exercise
- Safety & ease of exercising in n'hood
 - $r=.12$ with vigorous exercise
- Tally of convenient exercise facilities
 - $r=-.12$ with vigorous exercise

PA AND ECOLOGICAL VARIABLES IN HIGH SCHOOL STUDENTS

n=1634 students in multi-ethnic schools

<u>variable</u>	<u>p-girls</u>	<u>p-boys</u>
neighborhood safety	.09	ns
models in neighborhood	ns	ns
convenient facilities	ns	ns

Links in the Evolutionary Process

- Walking on all-fours: building some evidence
 - San Diego Health & Exercise Study: survey items
 - Low-tech GIS

Sallis, J.F., Hovell, M.F., Hofstetter, C.R., Elder, J.P., Caspersen, C.J., Hackley, M., & Powell, K.E. (1990). Distance between homes and exercise facilities related to the frequency of exercise among San Diego residents. **Public Health Reports**, **105**, 179-185.

- Addresses of 2053 adults located on grid-map
- 385 exercise facilities identified & mapped
- Density of exercise facilities around homes computed
- Free facilities not related to exercise freq
- Pay facilities within 1 to 5 km of homes significantly related to exercise freq, adjusted for SES etc
- Objective & reported facilities were unrelated

Links in the Evolutionary Process

- Walking on all-fours: building some evidence
 - San Diego Health & Exercise Study: survey items
 - Low-tech GIS
 - **SCAN analyses**

Sallis, J.F., Nader, P.R., Broyles, S.L., Berry, C.C., Elder, J.P., McKenzie, T.L., & Nelson, J.A. (1993). Correlates of physical activity at home in Mexican-American and Anglo-American preschool children. **Health Psychology, 12**, 390-398.

- 351 four-year-old children's PA observed during 4 home visits
- Variance explained by
 - Demographics 11%
 - Child (skinfold, TV viewing) 1%ns
 - Social-family (modeling, play rules) 5%ns
 - Environmental 11%
 - (freq & duration in convenient play spaces)

Links in the Evolutionary Process

- Walking on all-fours: building some evidence
 - San Diego Health & Exercise Study: survey items
 - Low-tech GIS
 - SCAN analyses
 - **SPARK**





What's Wrong With This Picture?

Sallis, J.F., McKenzie, T.L., Alcaraz, J.E., Kolody, B., Faucette, N., & Hovell, M.F. (1997). The effects of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. **American Journal of Public Health, 87**, 1328-1334.

- Health-related PE is a policy & environmental change in the schools
- 2-year intervention study in elementary schools
- 2 schools: SPARK by PE specialists
- 2 schools: SPARK by trained teachers
- 3 schools: usual PE by teachers

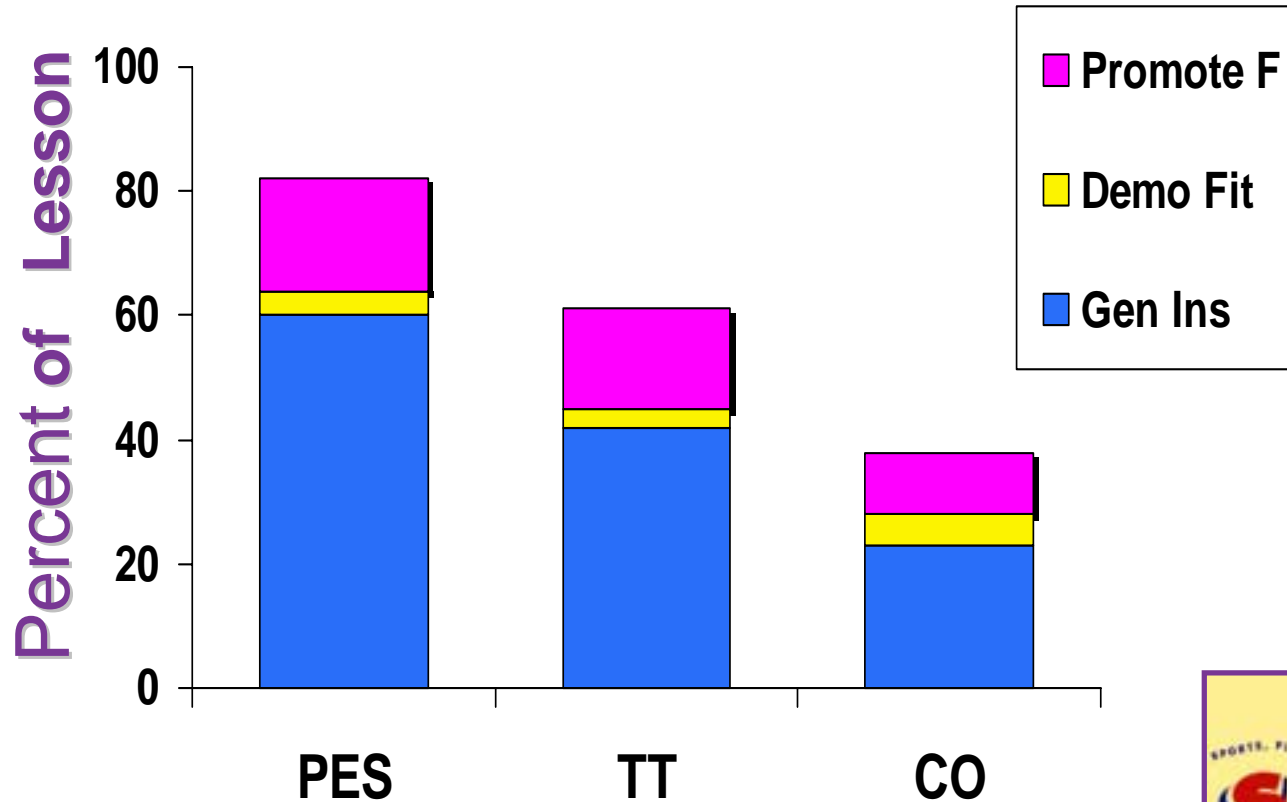
SOFIT

System for Observing Fitness Instruction Time

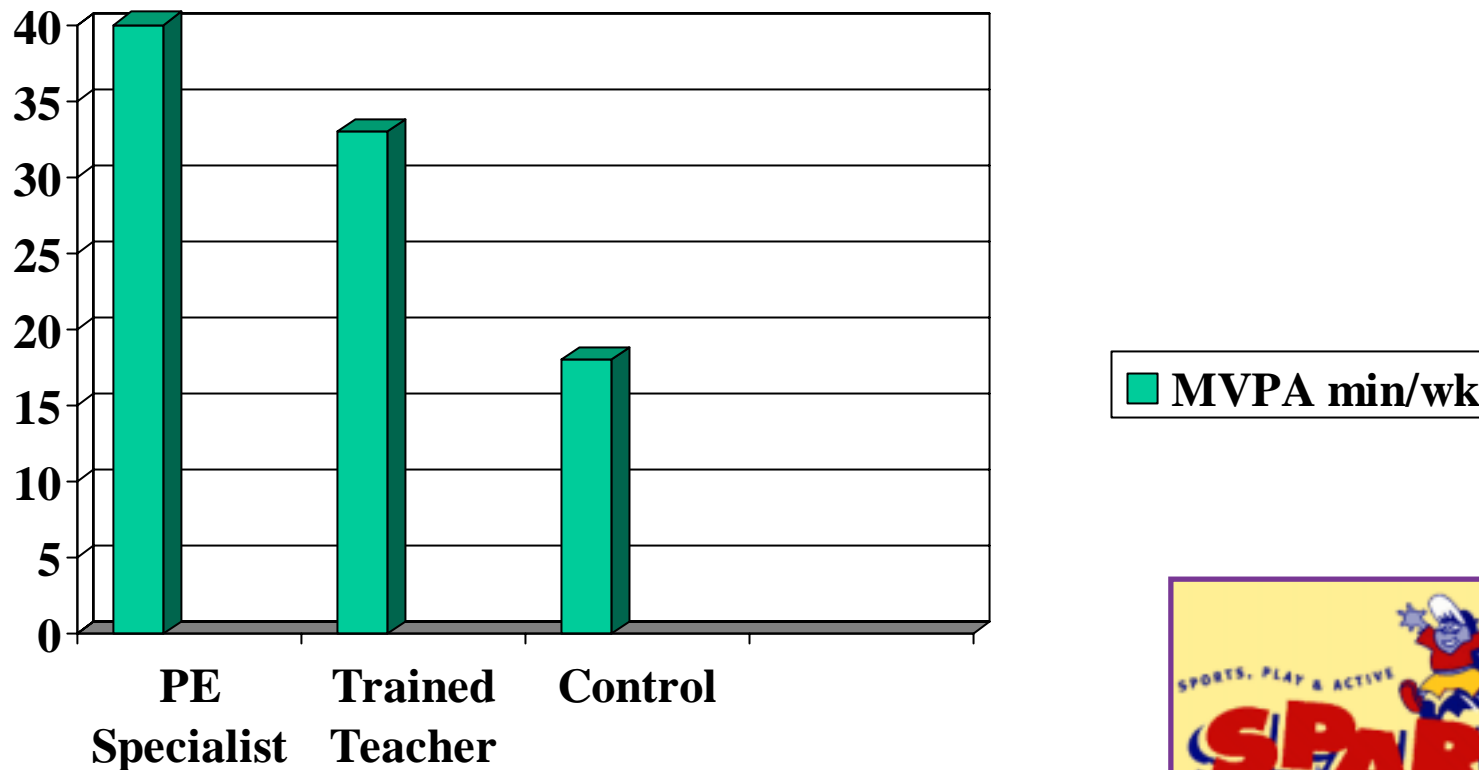
- Validated direct observation instrument
- Includes:
 - Student physical activity levels
 - Curriculum context
 - Teacher behavior
- Assesses effects of PE curriculum and staff development programs: SPARK, M-SPAN, CATCH

McKenzie, et al. (1991) Journal of Teaching in Physical Education, 11, 195-205

Teacher Behavior: SPARK Active Instruction Time



SPARK: PA in PE Results



Links in the Evolutionary Process

- Walking on all-fours: building some evidence
 - San Diego Health & Exercise Study: survey items
 - Low-tech GIS
 - SCAN analyses
 - SPARK
 - Learning to apply ecological models

Ecological Models

- “The purpose of an ecological model is to focus attention on the environmental causes of behavior and to identify environmental interventions.” (McLeroy, 1988).
- Ecological models are distinguished by their multi-level nature.
- Because ecological models typically lack specificity at all levels, other models can be integrated to enhance the specificity of all levels of influence.

Sallis, J.F., & Owen, N. (2002). Ecological models of health behavior. pp. 462-484. In K. Glanz, B.K. Rimer, & F.M. Lewis (Eds.), **Health Behavior and Health Education: Theory, Research, and Practice, 3rd edition.** San Francisco: Jossey-Bass.

Multiple types of influence on behaviors.

- Intrapersonal factors
- Social/cultural factors
- Policies
- Physical environments

Building on Lewin, Bronfenbrenner,
McLeroy, Stokols

Sallis, J.F., Bauman, A., and Pratt, M. (1998). Environmental and policy interventions to promote physical activity. **American Journal of Preventive Medicine, 15**, 379-397.

- Reviewed support for environmental correlates
- Model for implementing multi-level interventions
- Identified multiple sectors of society to be involved

A Model of Environmental and Policy Interventions to Promote Physical Activity

<u>Planning/ Advocacy</u>	<u>Agencies</u>	<u>Policies</u>	<u>Supportive Environment</u>
Coalition	local gov'ts parks/rec transport dept architects	safety facility access walk/bike indoor PA	Settings Facilities Programs
	insurance multiple	incentives behav chg progs	PA

Partnership to Promote Healthy Eating and Active Living

- Developed more specific ecological model of eating & PA.
- Elements to guide intervention strategy.
- Behavior (lifestyle) represents the intersection of the individual and the environment.

Booth, S.L., Sallis, J.F., Ritenbaugh, C., Hill, J.O., Birch, L.L., Frank, L.D., Glanz, K., Himmelgreen, D.A., Mudd, M., Popkin, B.M., Rickard, K.A., St. Jeor, S., & Hays, N.P. (2001). Environmental and societal factors affect food choice and physical activity: Rationale, influences, and leverage points. *Nutrition Reviews*, 59, S21-S39.

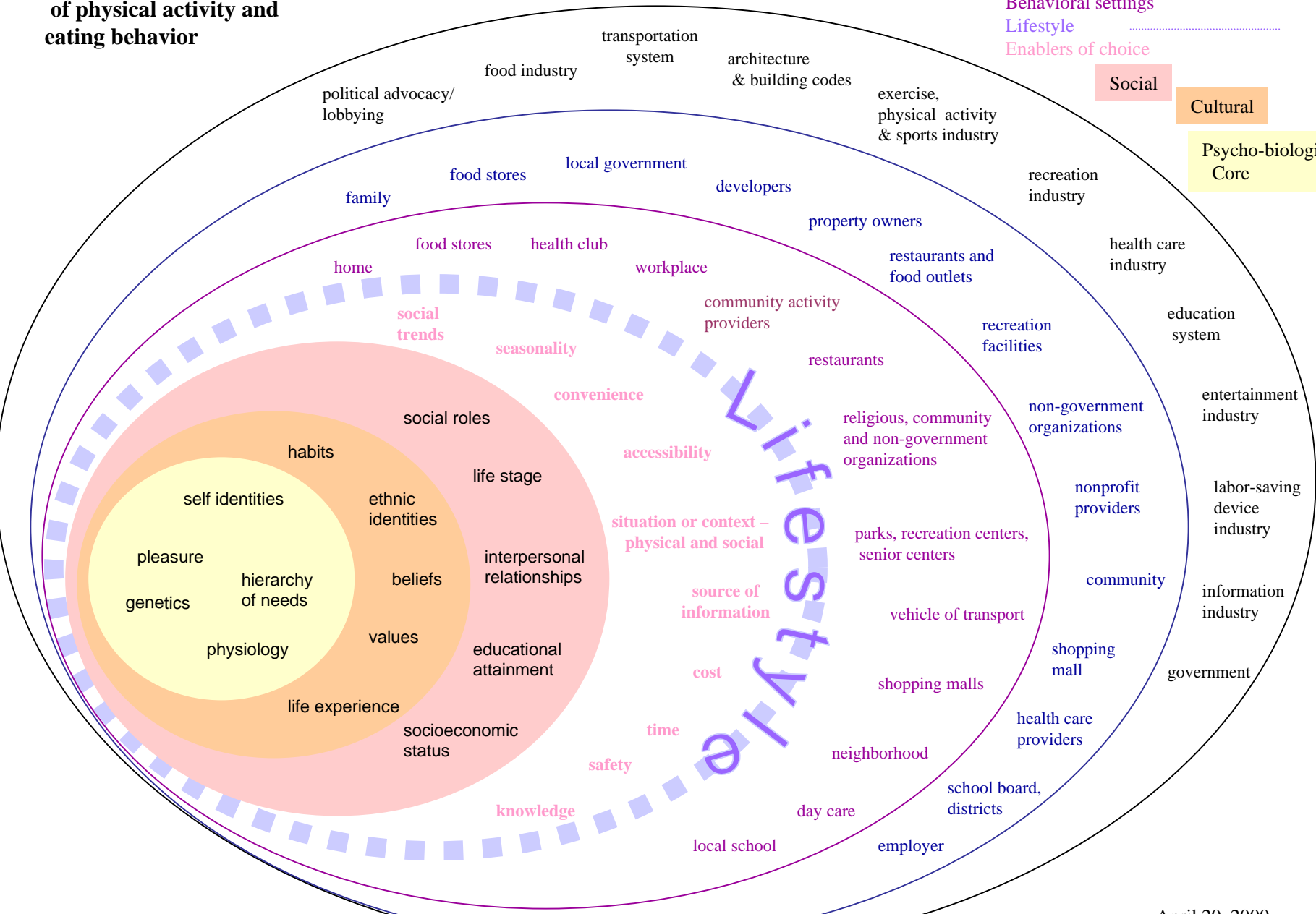
Framework for determinants of physical activity and eating behavior

Secondary leverage points
 Primary leverage points
 Behavioral settings
 Lifestyle
 Enablers of choice

Social

Cultural

Psycho-biological Core



Links in the Evolutionary Process

- Walking on all-fours: building some evidence
 - San Diego Health & Exercise Study: survey items
 - Low-tech GIS
 - SCAN analyses
 - SPARK
 - Learning ecological models
 - MSPAN

Middle School Physical Activity and Nutrition 1996 - 2000



M-SPAN Study Aims

School environment changes will:

- ❖ increase students' energy expenditure (kcal/kg) at school
- ❖ decrease students' fat intake (grams) at school
- ❖ be maintained after intervention

SOPLAY

McKenzie, T.L., Marshall, S.J., Sallis, J.F., & Conway, T.L. (2000). Leisure-time physical activity in school environments: An observational study using SOPLAY. **Preventive Medicine, 30**, 70-77.

- Observers scan target areas and record activity intensity of each person
- Three levels: sedentary, walking, and vigorous
- Simultaneous entries for time, temperature, accessibility, usability, and levels of supervision, organization, and equipment

Sallis, J.F., Conway, T.L., Prochaska, J.J., McKenzie, T.L., Marshall, S.P., and Brown, M. (2001). The association of school environments with youth physical activity. **American Journal of Public Health, 91**, 618-620.

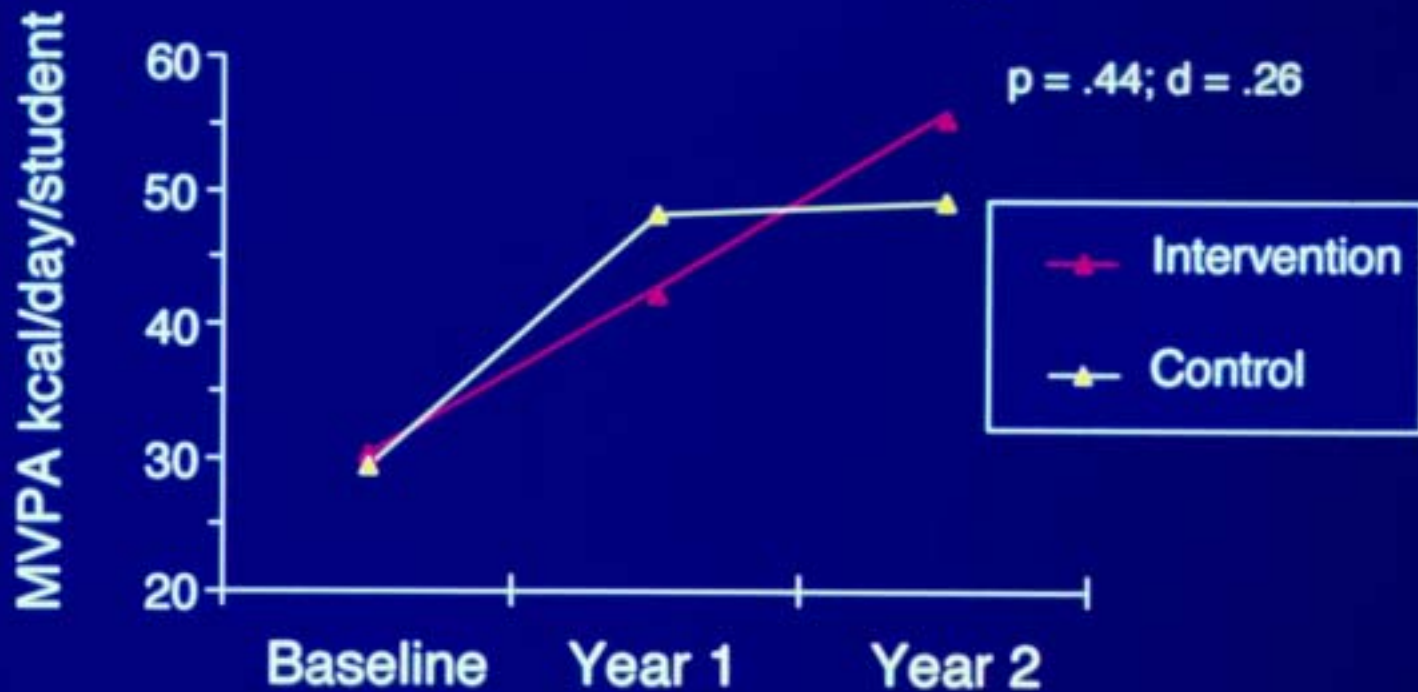
- Baseline study of students' PA on campus during during free time, assessed by SOPLAY
- Environmental correlates included play area type & size, # improvements, supervision, equipment, organized activities
- Environmental variables explained 63% of boys' and 47% of girls' PA on campus

An Ecological Approach to School PA Promotion

- ◆ Identifies times and places for PA
- ◆ Identifies policies that hinder and facilitate PA
- ◆ Provides social and physical resources
- ◆ Provides more opportunities for PA at the school

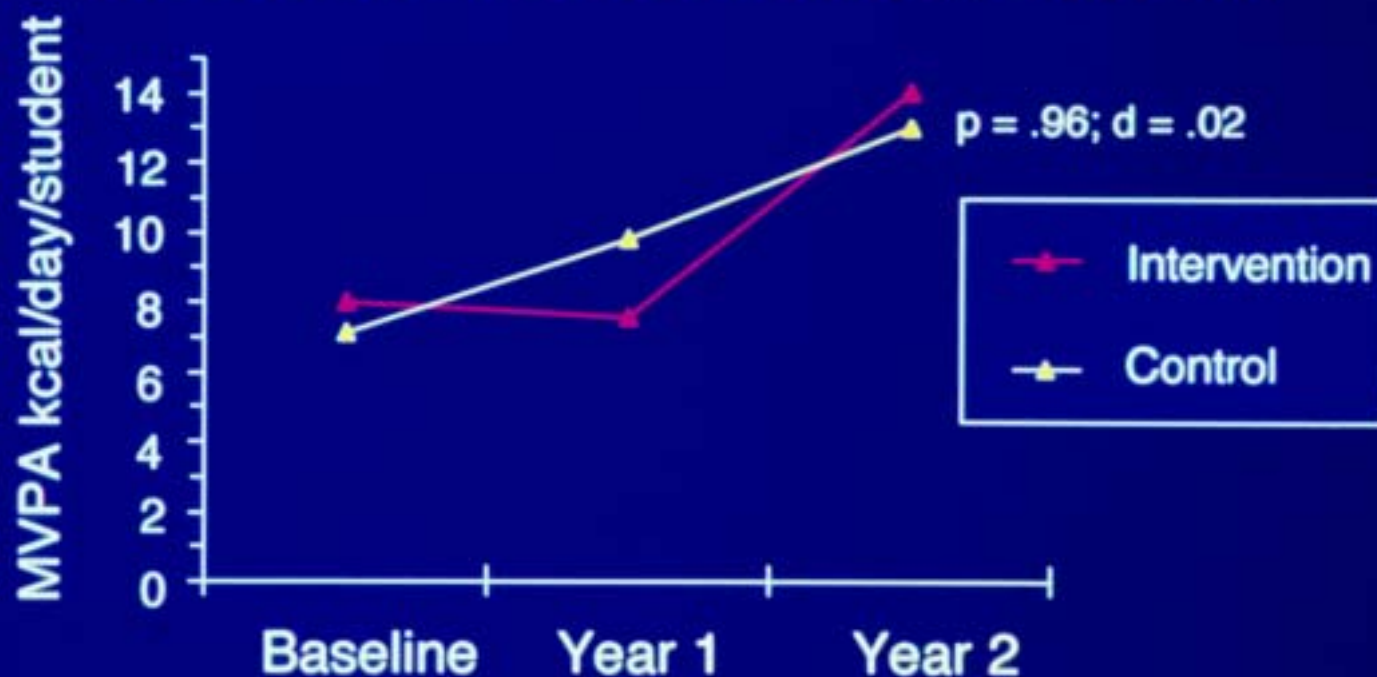
M-SPAN SOPLAY: Boys

Effects on MVPA kcal/day/student



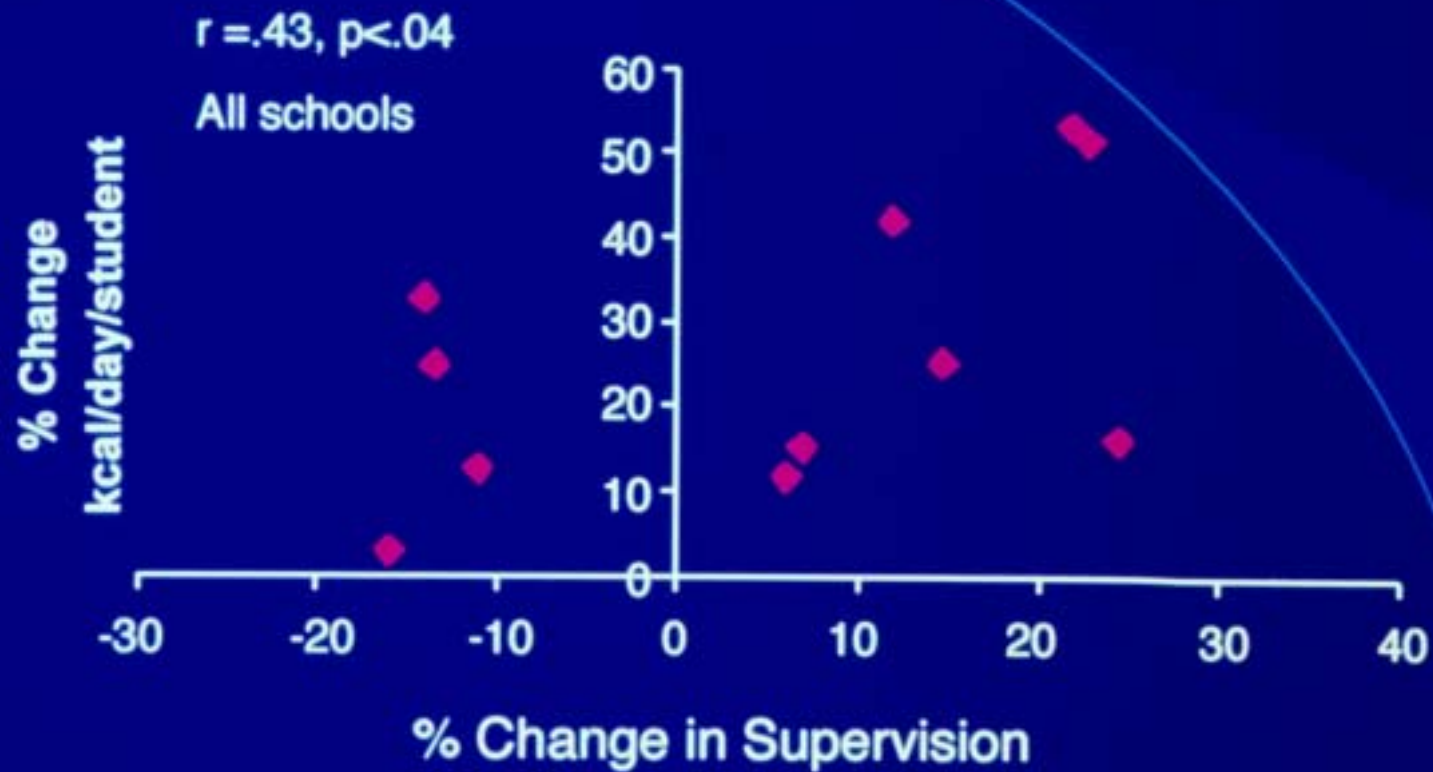
N=24 Schools; 264 days; 5046 observations

M-SPAN SOPLAY: Girls Effects on MVPA kcal/day/student



N=24 Schools; 264 days; 5046 observations

M-SPAN Intervention Schools: Changes in Kcal/day/student by Supervision



Conclusions from MSPAN

- An environmental intervention had a moderate effect on boys' PA outside of PE, but it was not significant. No effect for girls.
- Strong association between increasing PA supervision at schools and overall PA.
- Next step is to overcome barriers to implementing environmental changes at schools.

MSPAN Results

- Sallis, J.F., McKenzie, T.L., Conway, T.L., Elder, J.P., Prochaska, J.J., Brown, M., Zive, M.M., Marshall, S.J., and Alcaraz, J.E. (2003). Environmental interventions for eating and physical activity: A randomized controlled trial in middle schools. **American Journal of Preventive Medicine, 24**, 209-217.

Links in the Evolutionary Process

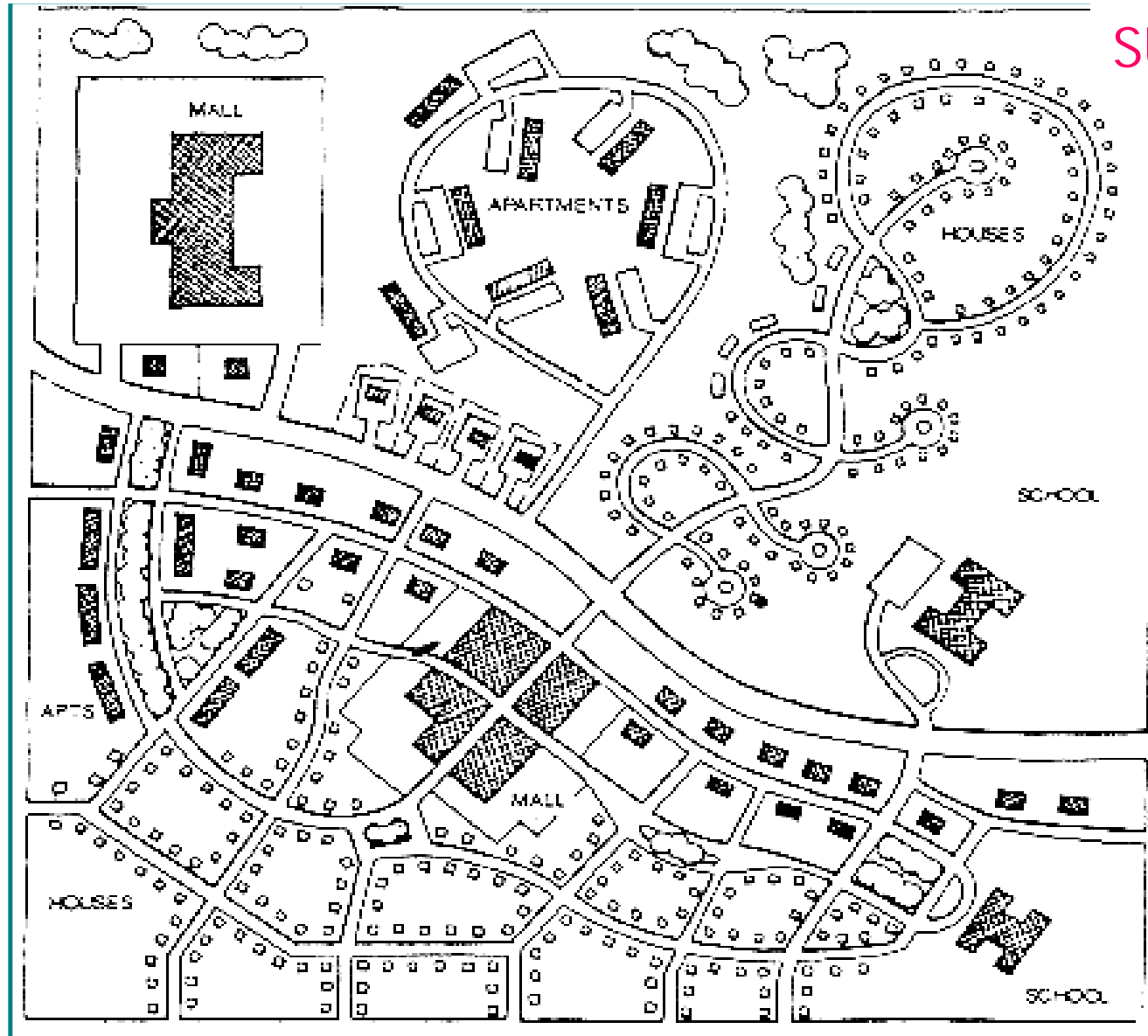
- Finally upright: improving methods & teams
 - CDC worked to bring nontraditional partners to public health
 - Planning, transportation
 - Architecture, landscape architecture
 - Economics, policy research
 - RWJF made commitment to active living, with environment & policy focus
 - Stimulated many transdisciplinary collaborations
 - Creating links among research, practice, policy

Neighborhood Form Variables Studied in Transportation and Urban Planning Fields

- Connectivity of the street network
- Land use mixture
- Residential density
- Micro-scale pedestrian design

Saelens, B.E., Sallis, J.F., & Frank, L.D. (2003). Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. **Annals of Behavioral Medicine**, **25**, 80-91.

Suburban vs Traditional Land Use Patterns

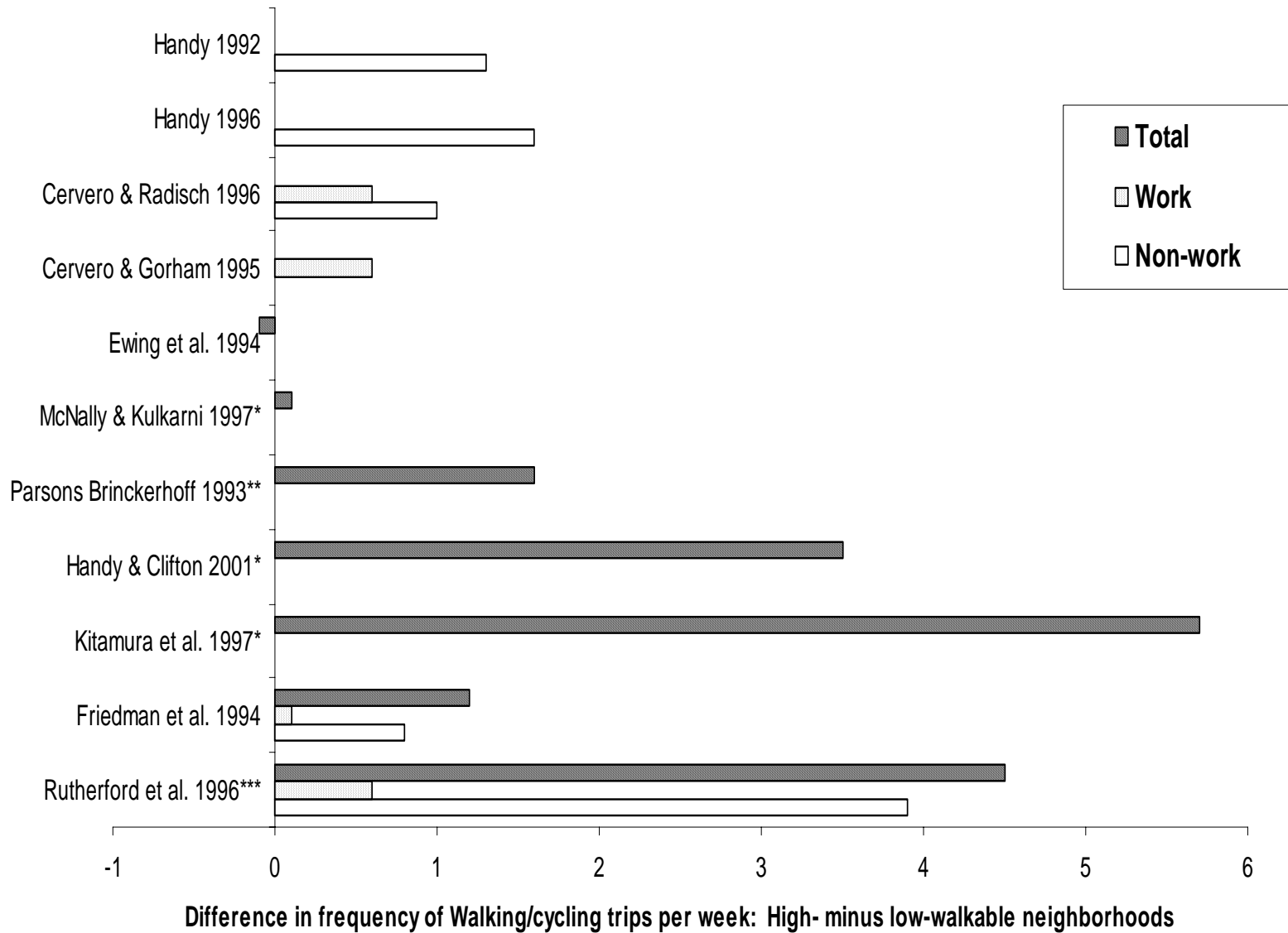


SUBURBAN

TRADITIONAL

Drawing by Frank Spielberg.

Non-motorized Trip Frequency: High versus Low Walkable Neighborhood Differences



GIS: Geographic Info Systems

- A computer software environment
- Can relate points (residences), areas (parks), & lines (streets) to one another
- Spatial & attribute data can be linked
- Layers of data can be added (crime, topography, traffic volume)
- Can be used to show spatial relations & create quantitative variables

Links in the Evolutionary Process

- Finally upright: improving methods & teams
 - CDC worked to bring nontraditional partners to public health
 - Planning, transportation
 - Architecture, landscape architecture
 - Economics, policy research
 - RWJF made commitment to active living, with environment & policy focus
 - **NQLS, NEWS**

San Diego Neighborhood Project

- Pilot study to examine how neighborhood environmental factors are related to objectively measured PA
 - Develop assessment of perceived environmental factors
 - Neighborhood Environment Walkability Survey (NEWS)
 - compare neighborhoods differing on environmental characteristics proposed related to walkability, but matched on socioeconomic status, age
 - objective measure of physical activity
 - subjective reports of amount of walking by purpose

Low-walkability Streets



High-walkability Street



High-walkability Main Street



Neighborhood Environment Differences

	High walkable	Low walkable
Residential density	3.5*	2.1
Land use mix-diversity	2.5*	1.8
Land use mix-access	3.2*	2.8
Connectivity	3.2*	2.9
Walk/bike facilities	3.0	3.2*
Aesthetics	3.0*	2.8
Pedestrian/traffic safety	3.1*	2.7
Crime safety	3.2	3.2

5 of 8 test-retest reliabilities above .77

Accelerometer Mins of Physical Activity by Neighborhood

	High walkable	Low walkable
Moderate intensity PA	188.7*	136.9
Vigorous intensity PA	18.1	6.7
Total PA	206.8*	143.6

% Overweight

35

60

Neighborhood Environment Walkability Scale (NEWS)

- Saelens, B.E., Sallis, J.F., Black, J.B., and Chen, D. (in press). Preliminary evaluation of the Neighborhood Environment Walkability Scale and neighborhood-based differences in physical activity. **American Journal of Public Health.**

NQQLS



NEIGHBORHOOD QUALITY OF LIFE STUDY

Neighborhood Quality of Life Study

(Ecological Analysis of Physical Activity)

- James Sallis--San Diego State U.
- Brian E. Saelens--Cincinnati Children's Hospital Medical Center
- Lawrence D. Frank—University of British Columbia
- Funded by NIH/NHLBI, 2001-2005

Neighborhood Quality of Life Study

Primary Aim

- Investigate whether people who live in “walkable” communities are more active, after adjusting for SES, than people who live in less walkable communities.
- “Walkability” means high density, high street connectivity, and mixed land use.

NQLS Neighborhood Categories

Walkability

Socioeconomic Status

	Low	High
Low	4 per city	4 per city
High	4 per city	4 per city

Neighborhood Quality of Life Study

Environmental Variables

Objective (GIS)

- Residential density
- Employment density
- Street connectivity
- Land use mix
- Walking infrastructure
- Distance to PA facilities
- Crime rate
- Weather

Perceived

- Residential density
- ---
- Street connectivity
- Land use mix
- Walking infrastructure
- Distance to PA facilities
- Crime/safety
- Neighborhood aesthetics

Neighborhood Quality of Life Study

Primary Outcome Variables

- Total PA accelerometer
- Moderate intensity PA accelerometer
- Walking IPAQ (long)
 - Occupation
 - Recreation
 - Transportation

Current status of NQLS

- Collecting data in Seattle region
- Finalizing neighborhood selection in Baltimore region
- www.nqls.org

Links in the Evolutionary Process

- Where are we headed?
 - Active Living Research (formerly ALPES)

Active Living Research

A Robert Wood Johnson Foundation National Program

James F. Sallis, Program Director

Leslie S. Linton, Deputy Director

Julie Weitzel, Research Coord.

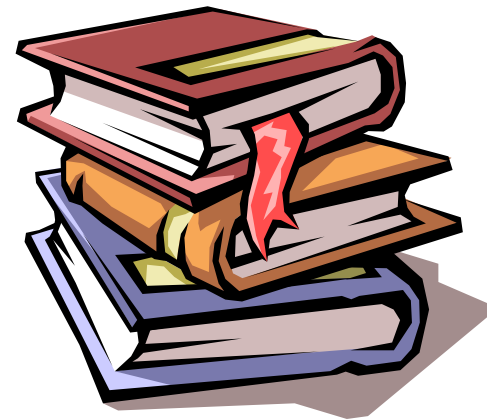
Katherine Kraft, Program Officer

C. Tracy Orleans, Snr Prog Officer

www.activelivingresearch.org

ALR Vision

- To encourage trans-disciplinary collaboration and build a research field that identifies environmental factors and public and private policies that have the potential to influence physical activity and sedentary behavior.
- Results from this new field are expected to inform policy changes that will promote active living among Americans.
- Results will be widely communicated



Purpose of ALR

- To manage a \$12.4 million research fund over 4 years so as to build a new research field that will influence advocacy and policy



ALR Measurement CFP: Funded 12/02 for \$700,000

- Measuring environments
 - 3 studies on community design
 - 3 studies on recreational spaces
- Measuring behavior in environments
 - 1 study of high-tech people counters
- Combined measure of travel behavior & PA
 - 1 study of high-tech e-diary

CFP 2: Released October 2002

- Correlational studies of land use & community features with PA
- Correlates of the use of parks and recreational facilities
- Evaluate opportunistic interventions
- New investigator awards

\$3.5 million set aside for this round

Let's Review the Initial Questions

- Why & how did he evolve from a nice clinical psychologist to an ecologically-oriented transdisciplinary scientist?
 - It was necessary to make progress in creating solutions to the problems of physical inactivity and poor diet
 - The data demanded changes in approach

Let's Review the Initial Questions

- What took him so long?
 - He's a slow learner
 - Studying individuals using surveys is inherently easier than studying environments
 - Need to devote time & get help to explore new disciplines
 - RWJF & CDC accelerated the learning curve

Let's Review the Initial Questions

- Why does this matter to me?
 - Maybe it doesn't
 - Many people believe the “action” in science is at the intersection of disciplines
 - A case study of the value of learning new models & methods
 - My evolutionary path is just one example of many paths taken by SBM scientists
 - I hope some of you can extract some value from this story

Final Words

- Keep challenging yourself throughout your career
- Have fun!



www.drjamesallis.sdsu.edu