

Population Health and Dissemination and Implementation Science: A Great Plains Rural Community Trial Example

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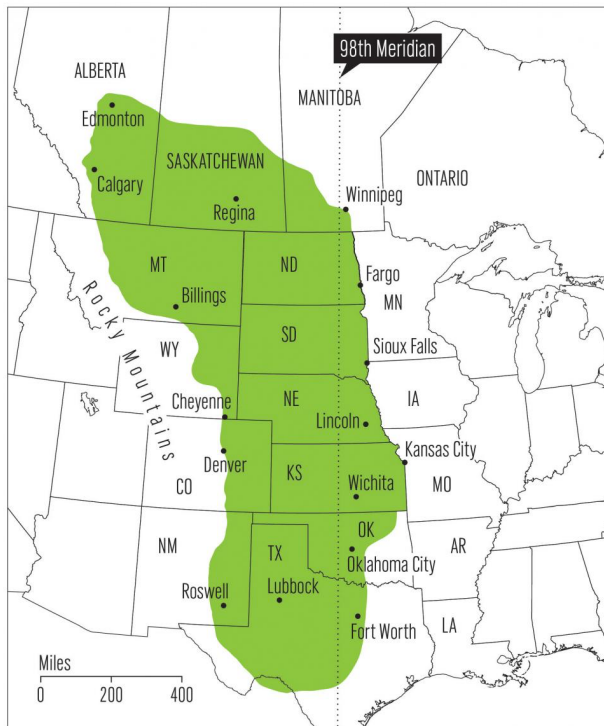
Agenda

- Part 1 - A Great Plains Rural Randomized Community Trial Example
- Part 2 – “Implementation Science” for Population Health
 - What are the units of population health improvement studies?
 - Implementation and Effectiveness – Type 3 Hybrid Designs
 - Effectiveness
 - What is the population in population health?
 - Implementation
 - What are measures of implementation in population health community systems?
 - Observation as method of assessing community population setting implementation

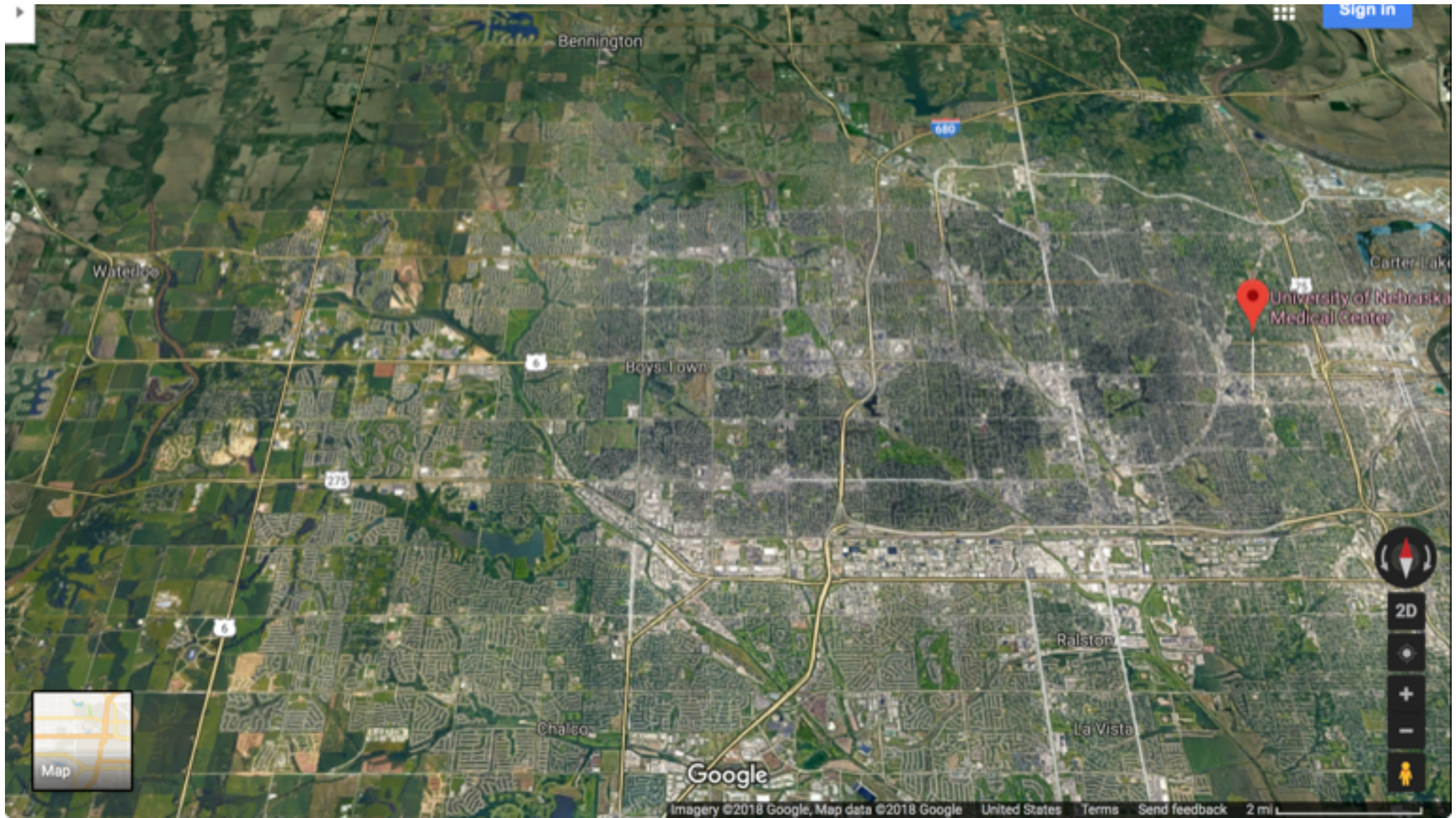
Community-Level Health Promotion Study Section [CLHP]

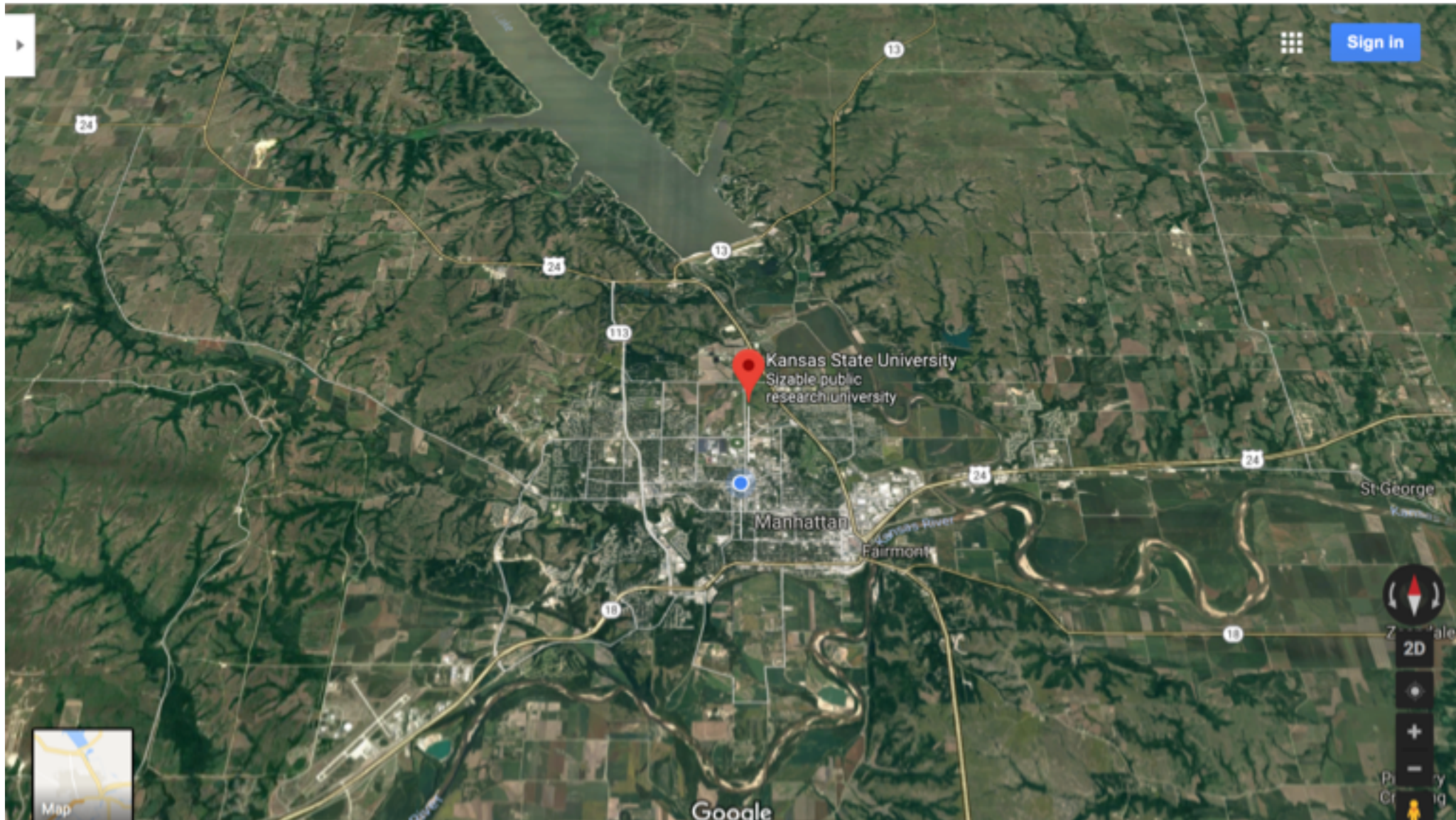
- The Community-Level Health Promotion (CLHP) Study Section reviews applications that develop and test the efficacy and effectiveness of community-level interventions aimed at preventing or moderating health risks and/or adherence to disease treatments across the lifespan.
 - Studies may utilize randomized experimental and quasi-experimental designs in which the unit of assignment, the study setting, or the study target is the community or other multi-person entity.
 - Study outcomes include mental and physical health, illness and disorder, risk and protective behaviors, behavior change, health beliefs and attitudes, and normal development and functioning.
 - Research approaches may include quantitative, qualitative, mixed-methods, multilevel strategies, cross-sectional, longitudinal, or cohort comparison designs, and experimental and quasi-experimental designs.
- T-4 Population Health

Great Plains Communities



- A sparsely-populated region with highly variable weather set against grassy, rolling land, the Great Plains stretches westward from the Missouri River at Omaha and Kansas City to the Rocky Mountains, and northward from the Texas Panhandle into the Canadian Prairie Provinces.
- The region invites inquiry into the relationships between its natural environment and the cultures brought to it by its various inhabitants, as scholars and residents work both to preserve healthy eco-systems and build thriving human communities.









Communities

Linear Systems

- Predictable
- Elements
 - Can be studied in isolation
- Homogeneous
 - Average Effects
- Static

Complex Social Ecological Systems

- Unpredictable
- Elements
 - Interact to create whole elements (systems of systems) that can not be studied in isolation.
- Heterogeneous
 - Interaction Effects
- Dynamic
 - Nothing is sustainable

Community Development Approach

- Community Capacity Development
 - “Refers to the process through which individuals, organizations and societies obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time. (United Nations Development Program, 2009).”
- Learning Healthcare Systems
 - Quality Improvement Science
- Precision Health
- Implementation Science
- Ecological Systems Science
- General Systems Theory

Whole-of-Community Systems Intervention For Youth Population Physical Activity

- The proposed work will address a critical public health need by evaluating the impact of a ***whole-of-community multi-level adaptive systems intervention*** on implementation of community change and youth population PA.
 - 1RO1 CA215420-01A1, National Institutes of Health, National Cancer Institute
 - Dzewaltowski, David A. (PI)
 - 01/04/2018- 12/31/2022



WELLSCAPES LEADERSHIP



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Omnibus Hypothesis

- Our intervention is based on a hierarchical patch dynamics paradigm, given that communities are “wellness landscapes” of spatially heterogeneous geographic areas, characterized by a patchwork of interacting organization and activity settings.
- Our omnibus hypothesis is that intervention communities (plus organizations and leaders nested within) will have synergy and capacity to implement evidence-based practices, adapting to continuously changing local system drivers to create a whole-of-community ecosystem of diverse and equitable youth PA opportunities.
 - *Social ecosystem diversity and equitable opportunities is a community strength, rather than a limitation or failure to implement a standard protocol.*
 - *It is this mosaic of systems of small systems that is necessary to impact population health.*

Wellscapes

- Hybrid Type 3 – Implementation and Effectiveness
- Two-wave staggered-start community randomized trial with four volunteer rural communities

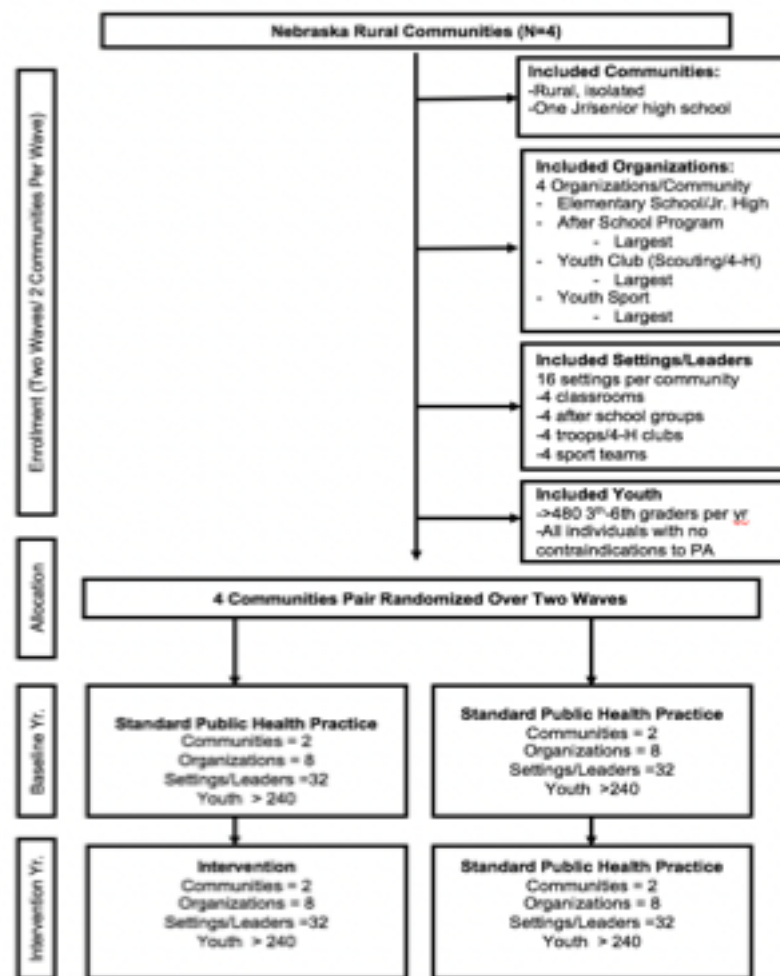


Figure 2 – CONSORT Diagram

Implementation-Effectiveness

- **Implementation Outcome**

- For baseline and intervention years, one day per month in the fall (3 days) and spring (3 days), organization activity settings (e.g., classrooms, teams) that house 480 children in 3rd through 6th grades will be assessed, resulting in observed community condition data, PA accelerometer data, and setting reach data (children % attendance by gender, ethnicity, free/reduced lunch status, and grade).

- **Population Health Outcomes**

- Estimates of population level PA with the use of the calibrated self-report Youth Activity Profile

Population Health Improvement System Intervention

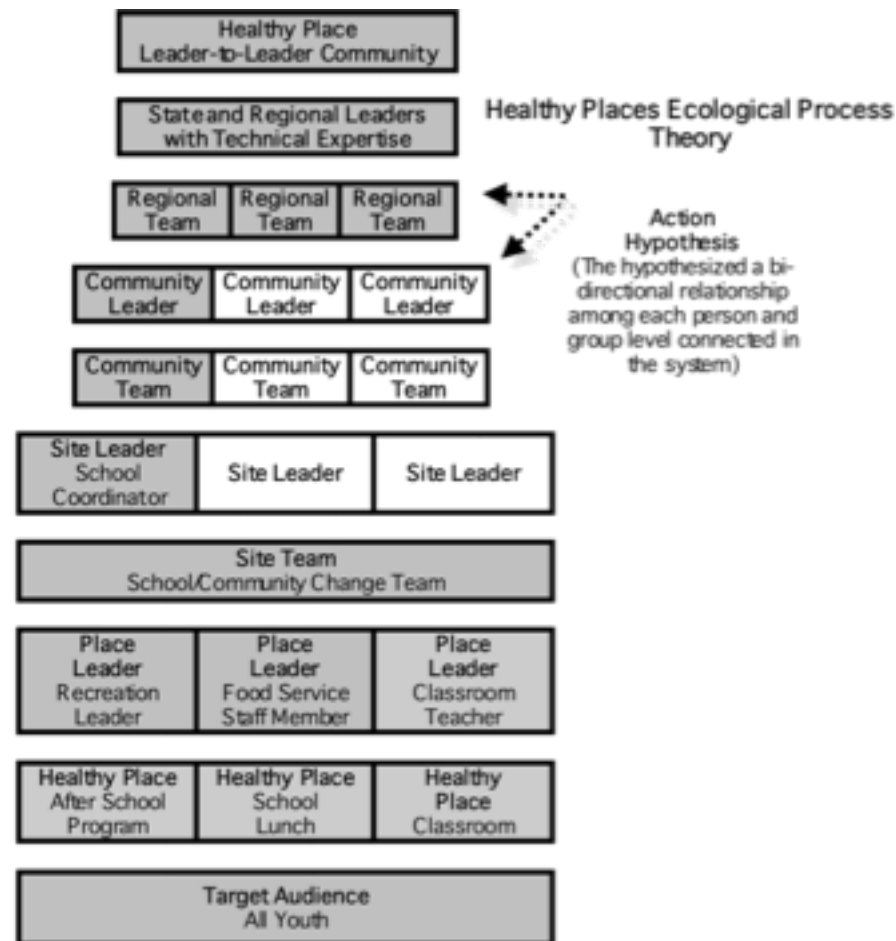
- **System Definition and Boundaries**
 - Community
- **Sensor of System State**
 - Community Data System and Feedback
 - Implementation Outcome
 - Evidence-Based PA Practices
 - (1) stacking time segments of PA episodes within an organization's daily routine
 - (2) improving the quality of PA episodes (% time in PA)
 - Population Outcome
 - Physical Activity
 - Locally Defined Outcomes
- **Embedded Population Health Improvement System**
 - Local multi-level system population health improvement system infrastructure
 - Local health department facilitated community hub (Community Hub, Organization Wellness Teams, Activity Setting/Leaders)
- **Community-Driven Development Process**
 - Investigate, Design, Practice, Reflect Cycle

Essential Element 1 – Community Data and Feedback System



Essential Element 2 – Embedded Population Improvement System

- Local Health Department Facilitated Community Hub



Dzewaltowski, D. A., Estabrooks, P.A., Johnston, J.A., & Gyurscik, N. (2002). Promoting physical activity through community development. In J. L. Van Raalte & B. W. Brewer (Eds.), *Exploring Sport and Exercise Psychology* 2nd Edition, Washington, DC: American Psychological Association.

Embedded Population Health Improvement System

Dzewaltowski et al. / Healthy Youth Places 587

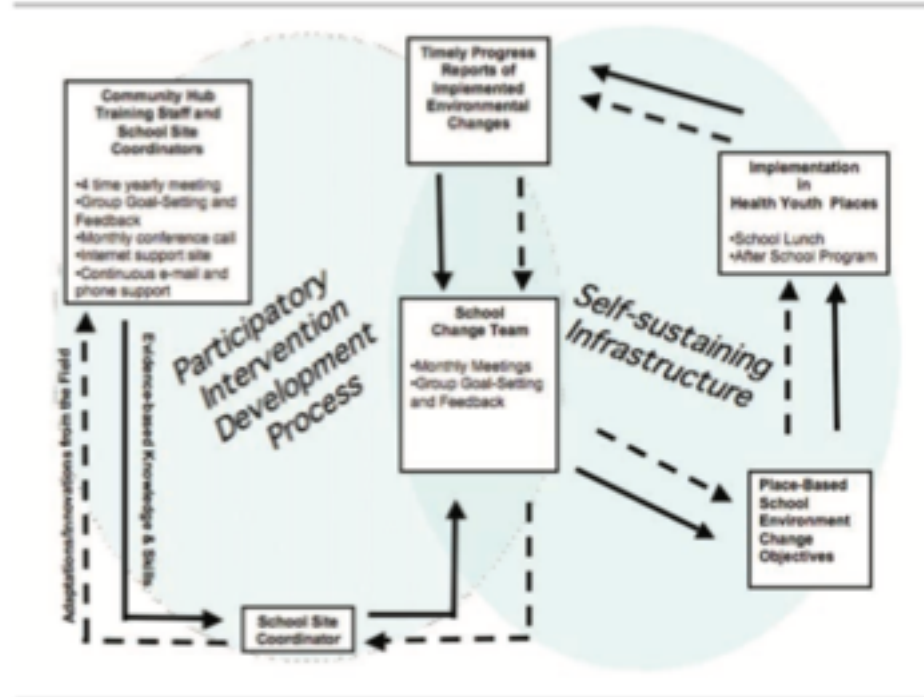


Figure 2. The Healthy Youth Places intervention model.

Dzewaltowski DA, Estabrooks PA, Welk G, Hill J, Milliken G, Karteroliotis K, Johnston JA. Healthy youth places: a randomized controlled trial to determine the effectiveness of facilitating adult and youth leaders to promote physical activity and fruit and vegetable consumption in middle schools. *Health Educ Behav*. 2009 Jun;36(3):583-600.

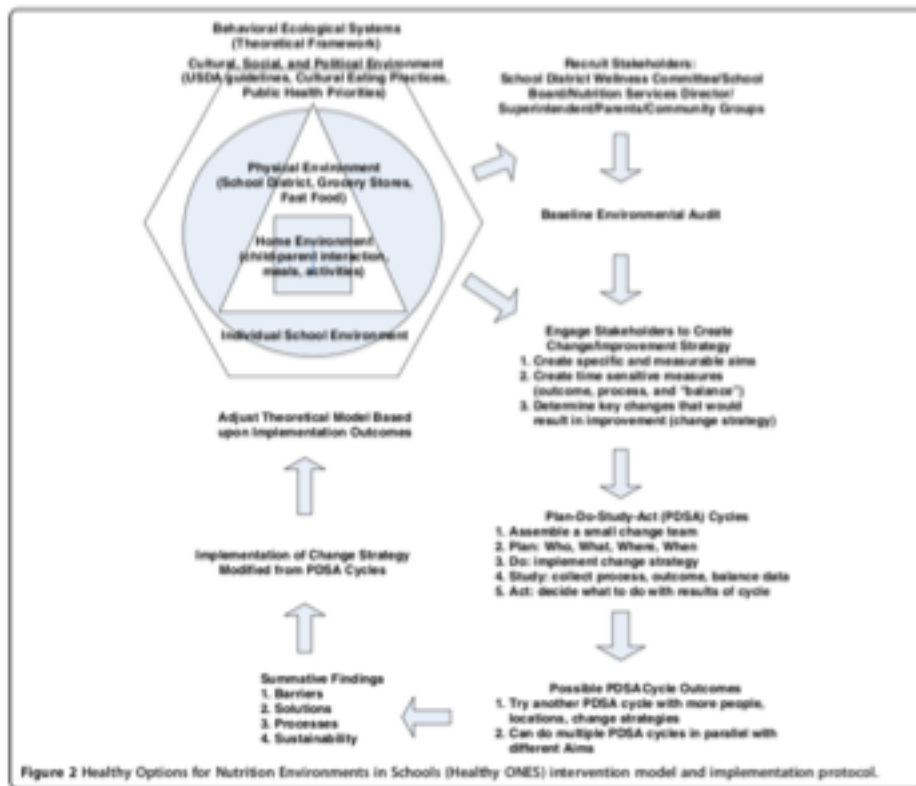


Figure 2 Healthy Options for Nutrition Environments in Schools (Healthy ONES) intervention model and implementation protocol.

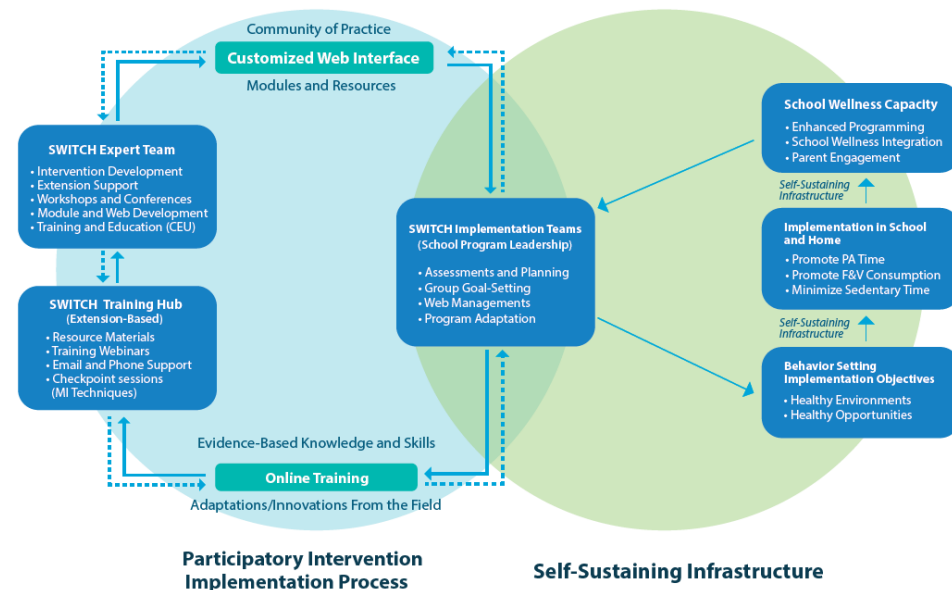
Coleman, K.J., Shordon, M., Caparosa, S.L., Pomichowski, M.E., & Dzawaltowski, D.A. (2012). The Healthy Options for Nutrition Environments in Schools (Healthy ONES) group randomized trial: Using implementation models to change nutrition policy and environments in low income schools. *International Journal of Behavioral Nutrition and Physical Activity*, 9, 80.

"Helping Kids to Switch
What They Do, View, and Chew"



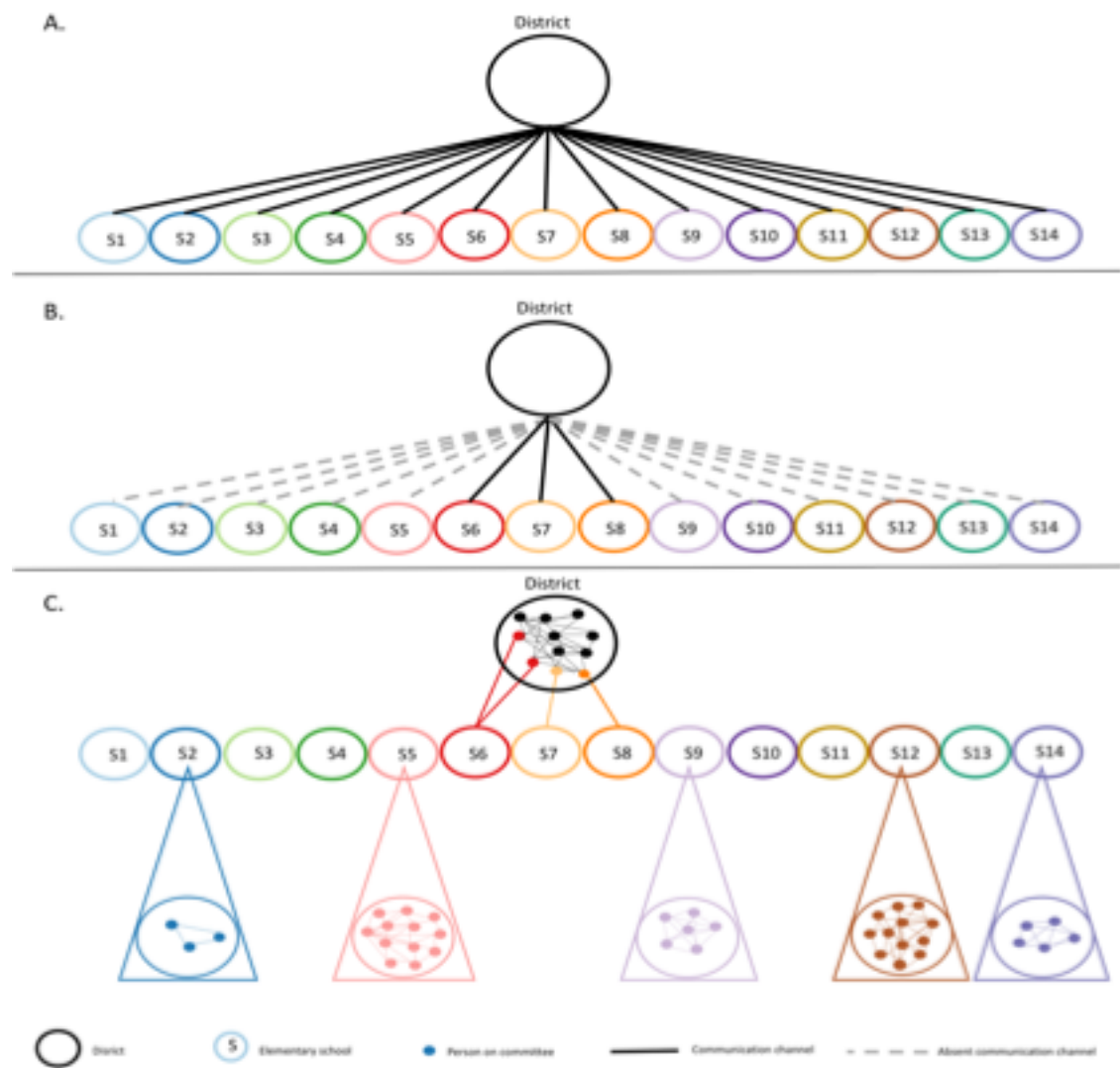
SWITCH TRAINING AND IMPLEMENTATION MODEL

"School Wellness Integration
Targeting Child Health"



Adapted From Dzawaltowski et al. (2010); Dzawaltowski (2014)

Chen, S. (Under Review) Feasibility Study of the SWITCH Implementation Process for Enhancing School Wellness



Chelsey R. Schlechter, MPH; & David A. Dzewaltowski, PhD

Essential Element 3 – Community-Driven Development Process

Fidelity to Iterative Steps (Function Not Form)

Exhibit 10.1

Steps Necessary to Complete the Healthy Youth Places Evaluation

Please follow all of the steps below, and complete the strategy sheets necessary to document activities in your school that target improving your students' fruit and vegetable consumption during school lunch and physical activity participation in the hours after school.

1. Target a place. Record that place.
2. State and document an objective that answers one of the following two questions:
 - How will we develop a healthy place?
 - How will we contact the participants and attract them to a place?Record the start and end dates of the objective.
3. Document the frequency (contact periods per week), duration (length of contact periods), and reach (number of children contacted).
4. Identify and describe the targeted connection, autonomy, skill building, and healthy norms (CASH) processes of the objective. Then, do the following:
 - Describe how the objective affects CASH in the place.
 - Provide a rating of the quality of each of the processes (1 = low; 5 = high).
 - If a particular objective does not target these processes, leave the descriptions blank and record a "0" for the quality of each process.
5. Identify the targeted appeal processes of the objective. Then, do the following:
 - Describe how the objective affects task and social appeal of the place for the students.
 - Provide a rating of the quality of each of the processes (1 = low; 5 = high).
 - If a particular objective does not target these processes, leave the descriptions blank and record a "0" for the quality of each process.

Final Tip: Use the Targeted Process Questions from Steps 4 and 5 to assist you in identifying objectives that will create and draw your students to the healthy place.

Dzewaltowski, D. A., Estabrooks, P.A., Johnston, J.A., & Gyurscik, N. (2002). Promoting physical activity through community development. In J. L. Van Raalte & B. W. Brewer (Eds.), *Exploring Sport and Exercise Psychology* 2nd Edition, Washington, DC: American Psychological Association.

Hawe, P., Shiell, A., & Riley, T. (2004). Complex interventions: how "out of control" can a randomised controlled trial be?. *BMJ: British Medical Journal*, 328(7455), 1561.

Community Driven Development Process

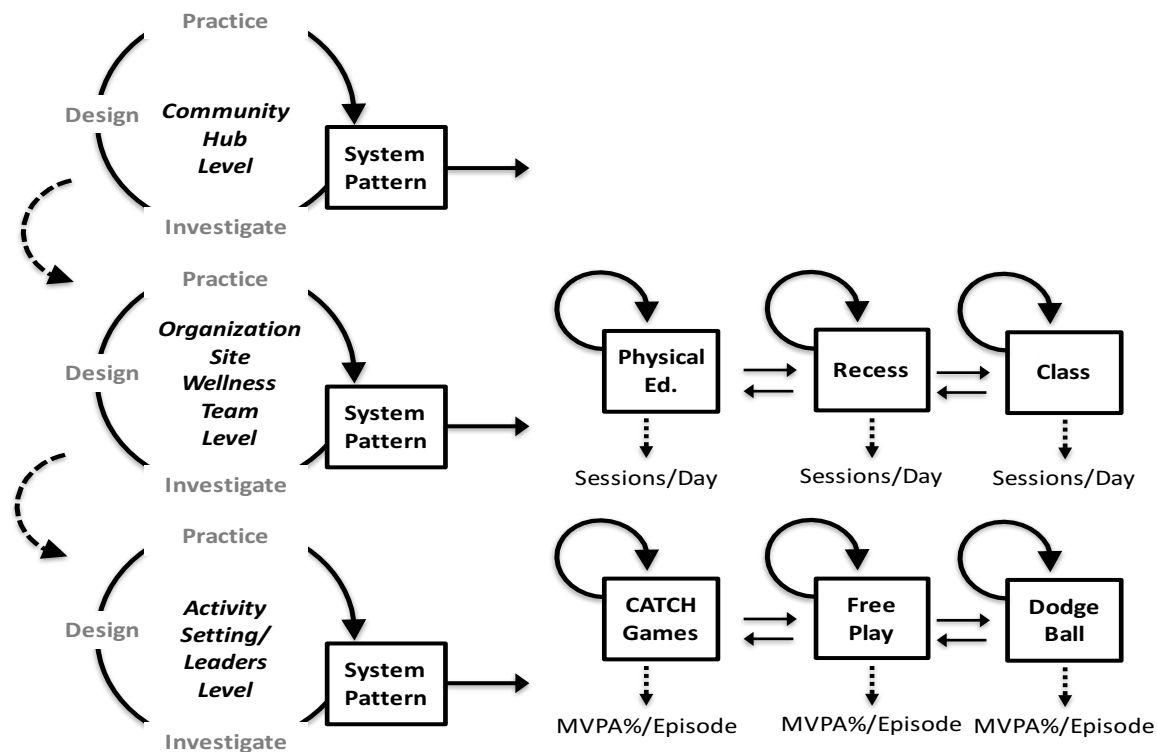


Figure 1 - Wellscapes Multi-Level Intervention

Community-Driven Development Process

- **Year 1**

- **Community Hub Level**

- Workshop 1. Investigate
 - Workshop 2. Design
 - Workshop 3 Practice
 - Workshop 4. Reflect Cycle

- **Year 2**

- **Community Hub Level**

- Workshop 1. Investigate
 - Workshop 2. Design
 - Workshop 3 Practice
 - Workshop 4. Reflect Cycle

- **Year 1**

- **Leader Level**

- Data Collection Training

- **Year 2**

- **Leader Level**

- Data Collection Training
 - Workshop 1 (EBP & I,D,P,R Cycle)

Evidence-Based Practice Change

- **Stacking Time Segmented Episodes of Physical Activity**
 - Inserting event into social ecological systems
- **Community Capitals Framework**
 - Developed by Cornelia and Jan Flora in 2004
 - Based on their research to uncover characteristics of entrepreneurial communities
 - Approach focuses on the interaction among 7 capitals, as well as how investments in one capital can build assets in the other capitals
 - Capitals
 - Resources invested to create new resources over a long time

Specific Aim 1 – Determine the impact of the intervention on multi-level (unit) community system outcomes.

- **H 1:** Intervention communities will have a 10% greater increase in percentage of time of youth in PA during a time segmented episode, compared to standard-practice communities (Primary Outcome).
- **H 2:** Organizations in intervention communities will have a 1-episode greater increase in the number of PA episodes per day, compared to organizations in standard-practice communities (Secondary Outcome).
- **H 3:** Low-income youth, girls, and ethnic minorities will have a greater increase in participation in PA episodes (% reach) in intervention communities, compared to standard-practice communities (Moderation Effect).
- **H 4:** There will be a greater increase in the percentage of children who are meeting physical activity guidelines in intervention communities, compared to standard-practice communities (Population PA Outcome).

Part 2 – Population Health Improvement Science

Studying Community Population Health Improvement

- Design - Hybrid Type 3
 - Testing an implementation intervention/strategy while observing/gathering information on the clinical intervention and related outcomes.
 - Population Health Outcome Variability
 - Implementation Outcome Variability

Unit – The entity of study

- “As depicted in Table 2, key differences exist in terms of unit of analysis (perhaps the most obvious distinction), typical unit of randomization, outcome measures, and the targets of the interventions being tested (Curran, et al 2012, p. 218).”

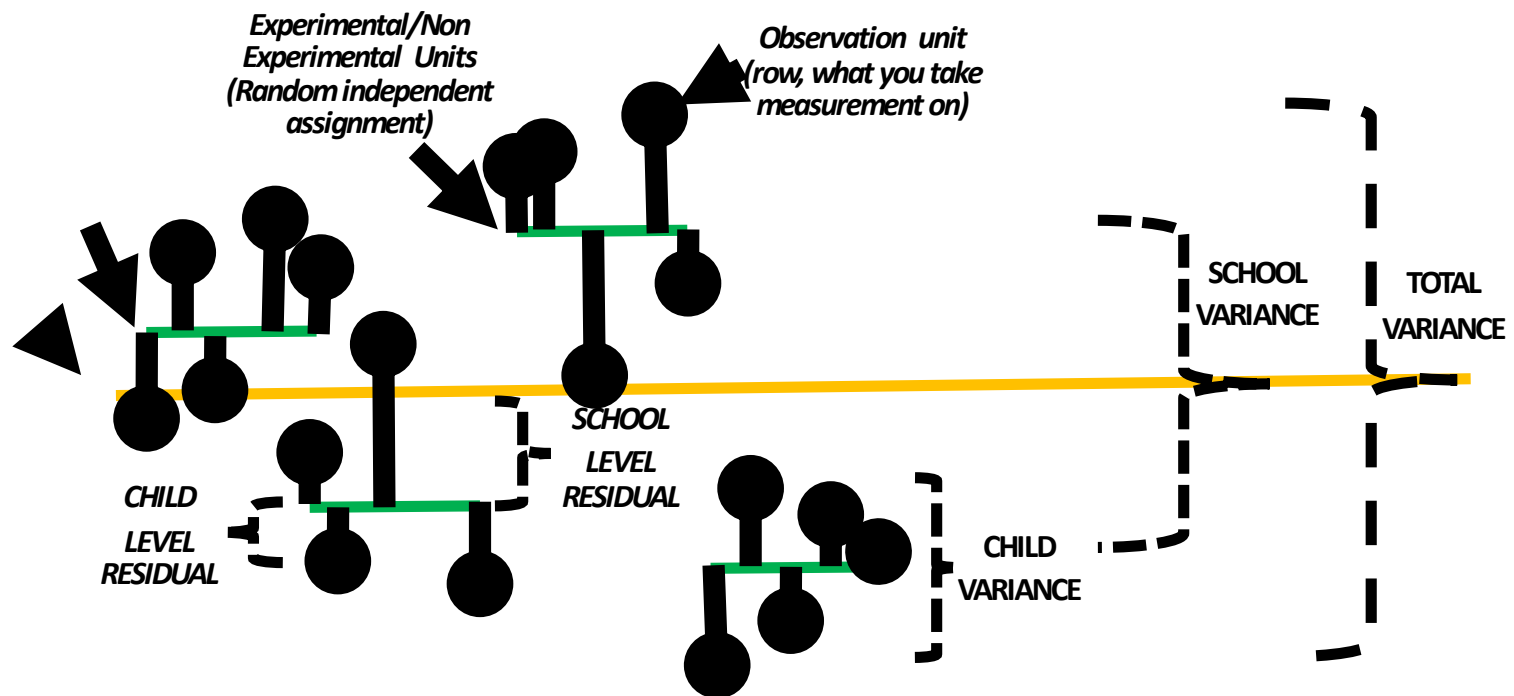
TABLE 2. Design Characteristics of Clinical Effectiveness and Implementation Trials (Ideal Types)

Design Characteristic	Clinical Effectiveness Trial	Implementation Trial
Test	“Clinical” intervention	Implementation intervention or strategy
Typical unit of randomization	Patient, clinical unit	Provider, clinical unit, or system
Typical unit of analysis	Patient	Provider, clinical unit, or system
Summative outcomes	Health outcomes; process/quality measures typically considered intermediate; costs	Adoption/uptake of the “clinical” intervention; process measures/quality measures typically considered outcomes

What are the units of population health effectiveness and implementation?

- Unit
 - Entity
- Observation Unit
 - Unit of measurement
- Experimental Unit
 - Unit of randomization
- Unit of Analysis
 - Unit of statistical analysis

Modeling Variance



Did not include time or classroom.

What is the population in population health?

Population Health

- “the health outcomes of a group of individuals, including the distribution of such outcomes within the group” (Kindig & Stoddard, 2003).”

Kindig DA, Stoddart G. What is population health? *Am J Public Health*. 2003;93(3):380-383.

From: **Academic Health Systems' Third Curve: Population Health Improvement**

Washington et al., JAMA. 2016;315(5):459-460. doi:10.1001/jama.2015.18550

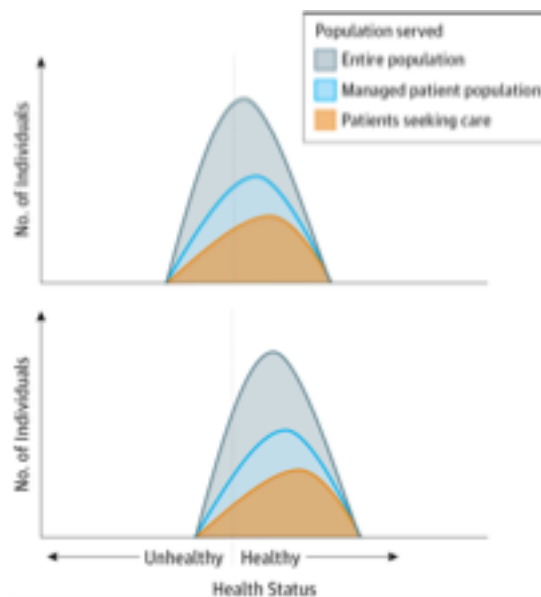


Figure Legend:

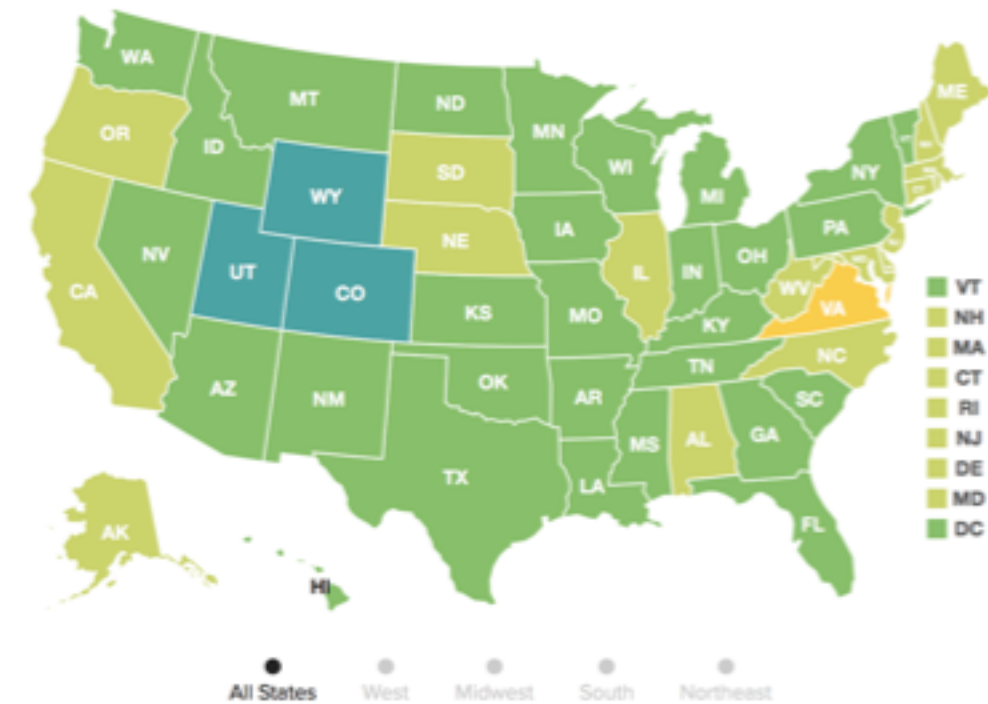
The “3 Curves” of Academic Health Systems. Bottom panel illustrates the potential shift to healthier status for overall population through academic health systems’ augmented focus on the third curve.

Obesity Rate: WIC Participants Ages 2-4, 2014

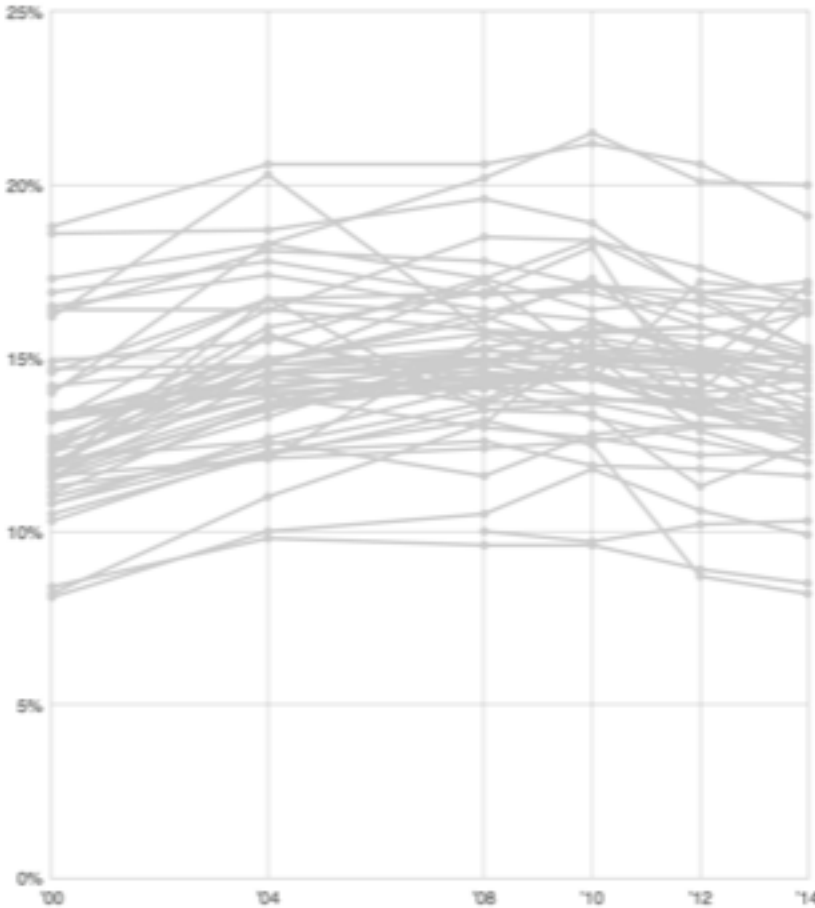
Select years with the slider to see historical data. Hover over states for more information. Click a state to lock the selection. Click again to unlock.

Percent of WIC participants ages 2-4 with obesity

0 - 9.9% 10 - 14.9% 15 - 19.9% 20 - 24.9% 25 - 29.9% 30 - 34.9% 35%+



Obesity Among Participants Ages 2-4, 2000 to 2014



Population Health Group Definition

- **Population health management**
 - Participants in a managed health care patient population
- **Total population health**
 - Participants in a defined a geographic area (Jacobson and Teutsch, 2012).

Jacobson DM, Teutsch S. *An Environmental Scan of Integrated Approaches for Defining and Measuring Total Population Health by the Clinical Care System , the Government Public Health System and Stakeholder Organizations*. Vol Feb.; 2012.

Population Health Group Definition Cont.

- **Community population health**

- The health outcomes of a community population social ecological system, including the distribution of such outcomes within the participants of the system.
 - Complex Adaptive System
 - A set of elements in relations
 - Community social ecological system
 - Elements in a set of relations defined by geographic and social boundaries.

- **Reach**

- Percent of participants in the geographic and socially bounded system.

Community Population Health System

- *Most factors that influence health are embedded in daily life circumstances apart from interactions with the health care system. These factors have to do with social, environmental, and behavioral influences on health that affect everyone in the population. We need to address environmental factors that range from exposure to pathogens, harmful substances, and pollutants to the widely available and aggressively promoted sugary drinks; foods high in salt, fat, and sugar; tobacco; and alcohol products.”*
- (Goldman et al., 2016, Advancing the Health of Communities and Populations, [NAM.edu/Perspectives](https://www.nam.edu/Perspectives))

What are the units of population health improvement studies?

- Population health is community social ecological system outcome
 - If population health is defined as variability in a population of individuals then all study and causality is reduced to individual causes and ultimately blaming the victim.
 - Interventions are events in social systems (Hawe et al, 2009).
 - What is (are) the unit(s) of the social system we need to study?
 - Implementation in a complex social ecological system
 - An event in a social system
 - An effort specifically designed to get best practice findings and related products into routine and sustained use through appropriate change/uptake/adoption interventions. In this study, we are not talking about implementation in the sense of insuring fidelity during a clinical trial, that is, how a medication or behavioral theory is administered by research personnel. (Curran et al., 2012, p. 218).
 - Disturbance
 - A temporary change in environmental conditions that causes a change in the ecosystem.

Hawe, P., Shiell, A., & Riley, T. (2009). Theorizing interventions as events in systems. *American journal of community psychology*, 43(3-4), 267-276.

What are the units of population health improvement studies?

- Units of Study
 - Rural communities (each having nested school, after-school, scouting/4-H club, youth sport organizations) randomly assigned to intervention or standard public health practice.
 - Organizations (school, after-school, club, youth sport)
 - Places/Leaders (teacher, leader, coach)
 - Children
 - Grades 3 through 6th
- Modeling the system as the Data Arise
 - Community by Organization by Place by Children by Time Period (Cluster)

Dissemination and Implementation Design

Milliken & Johnson (2004).

- Often researchers think that only one size of experimental unit is involved in an experiment and fail to recognize situations where more than one size of experimental unit is involved.
- But the important idea involved is that of an independent replication.

• Stroup (2013)

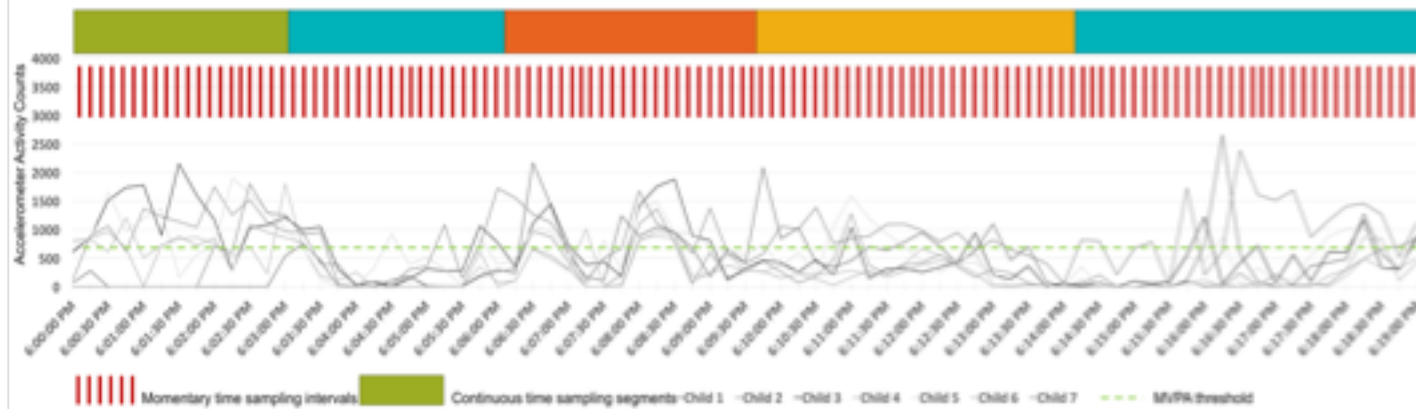
- Most modeling problems are really failure to understand design problems in disguise
- The model needs to adequately accounts for all sources of variation in the “how the data arise” process.

What are measures of implementation in community systems?

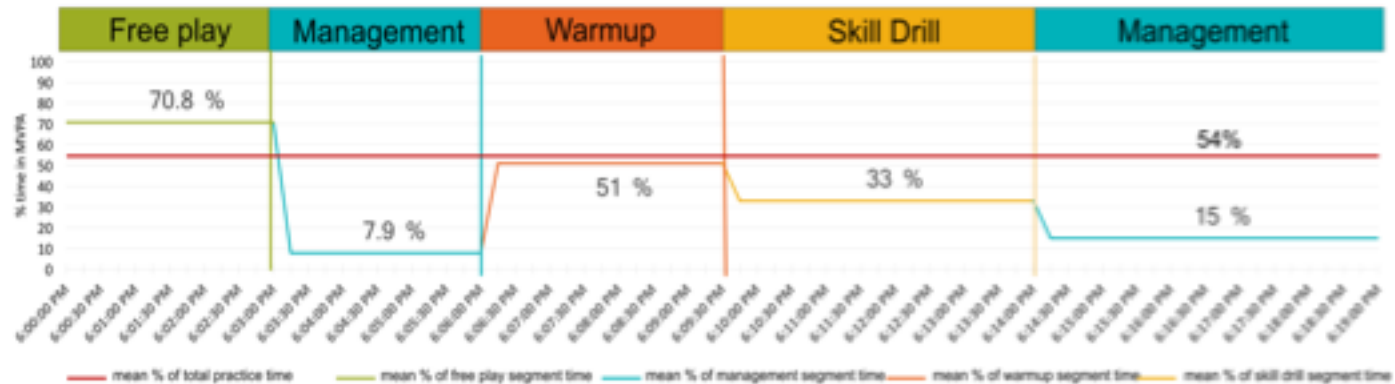
Observing social system



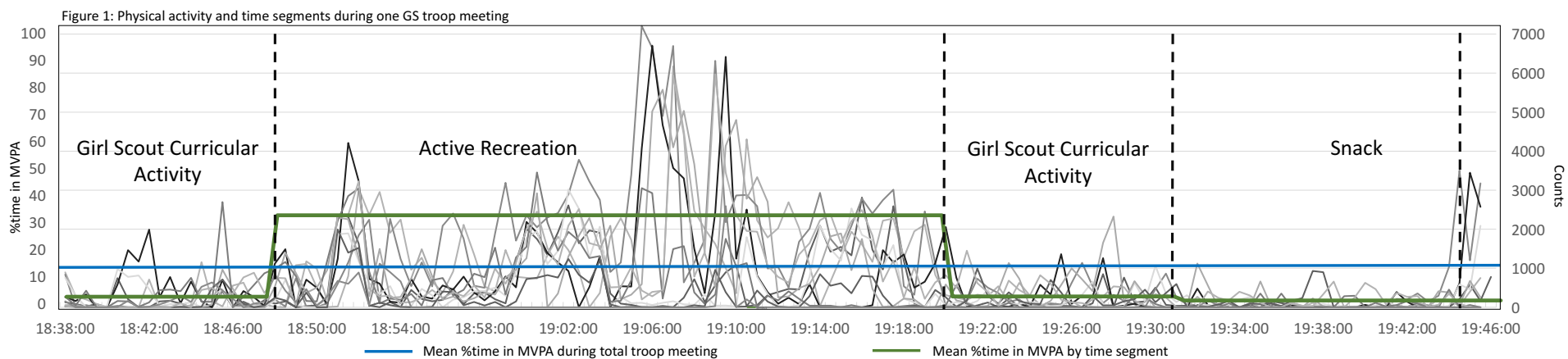
(A) The two observation systems used distinct methods. The System 1 used momentary time sampling to assess PA and context at pre-determined time intervals. System 2 used continuous sampling to divide total practice time into shorter time segments.



(B) The two observation systems resulted in distinct types of data. The System 1 characterized PA across total practice time. The System 2 characterized PA within practice time during time segments defined by continuous 'task' context.



Chelsey R. Schlechter, MPH; Justin M. Guagliano, PhD; Richard R. Rosenkranz, PhD & David A. Dzewaltowski, PhD



Schlechter CR, Guagliano JM, Rosenkranz RR, Dzewaltowski DA. The Impact of troop leader training on the implementation of physical activity opportunities during Girl Scouts troop meetings. (under review). *Translational Behavioral Medicine*.

Observing drivers of PA: Youth Sport



Schlechter, C. R., Guagliano, J. M., Rosenkranz, R. R., Milliken, G. A., & Dzewaltowski, D. A. (2018). Physical activity patterns across time-segmented youth sport flag football practice. *BMC public health*, 18(1), 226.

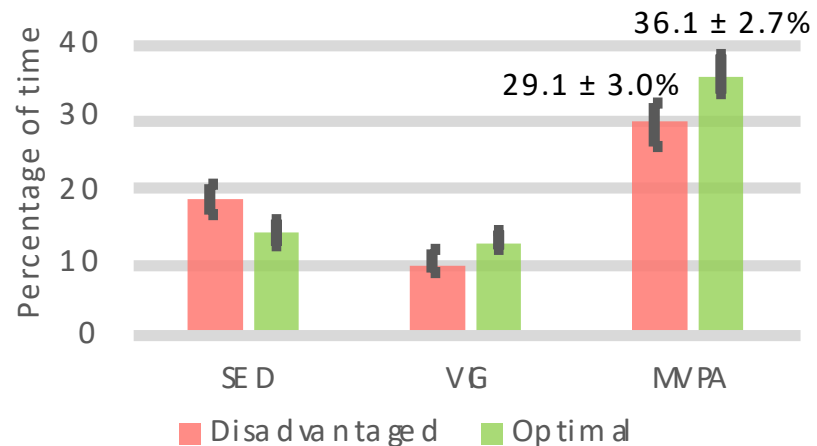
Generalizable EBP Principle – Episode Demand

Optimal

- Equal number of opportunities to participate as children to participate

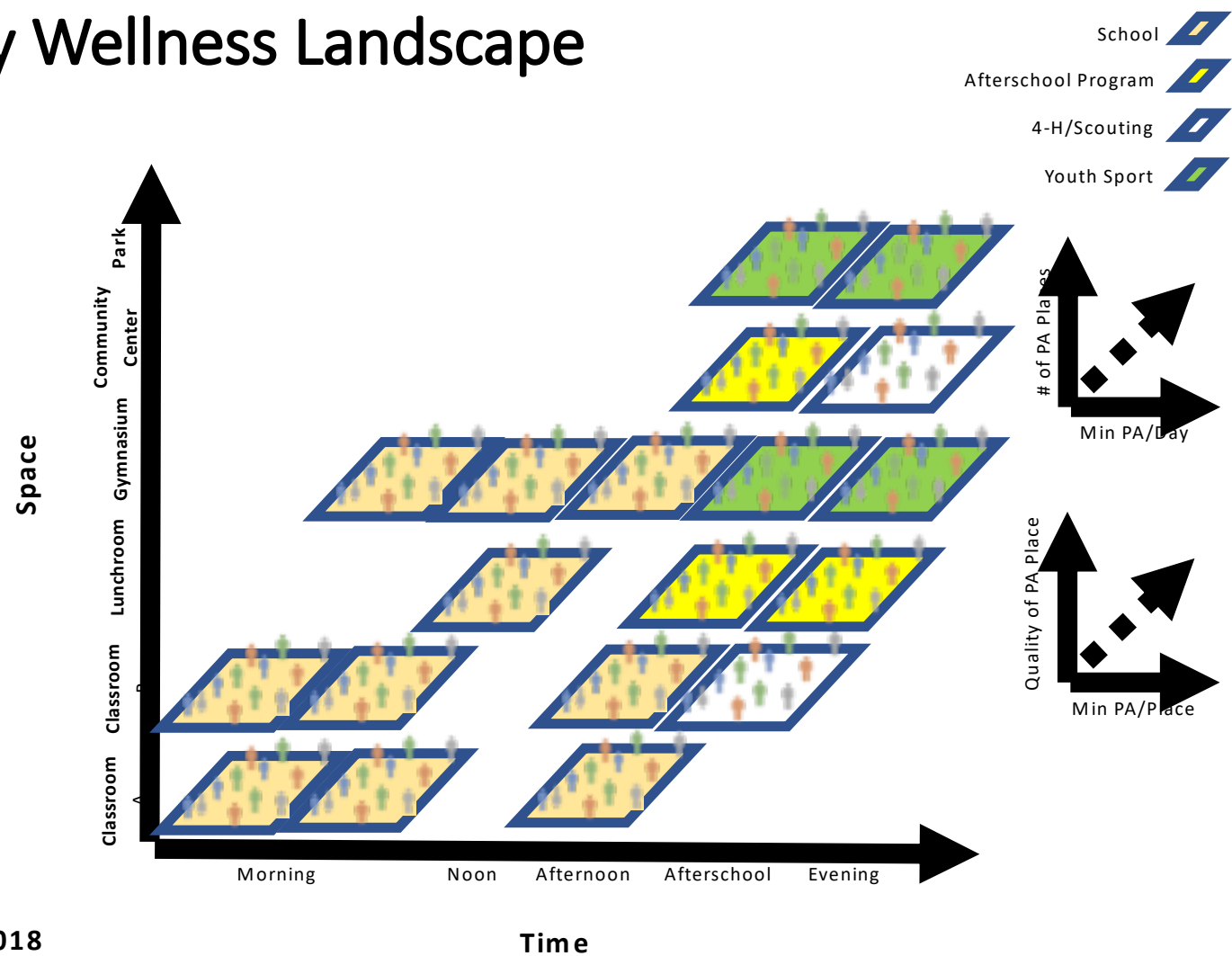
Disadvantaged

- Fewer number of opportunities to participate than children available to participate



Schlechter, C. R., Guagliano, J. M., Rosenkranz, R. R., Milliken, G. A., & Dzewaltowski, D. A. (2018). Physical activity patterns across time-segmented youth sport flag football practice. *BMC public health*, 18(1), 226.

Community Wellness Landscape



Acknowledgments

- Paradigm Change