Systems Thinking in Communities:

Understanding the Causes of Inactivity, Poor Diet/Nutrition, and Childhood Obesity in Lake Worth, Green Acres, Palm Springs, Florida

This community storybook was developed by Transtria LLC.

Support was provided by the Robert Wood Johnson Foundation.

Acknowledgments

Support for this evaluation was provided by a grant from the Robert Wood Johnson Foundation (#67099). Transtria LLC led the evaluation and dissemination activities from April 2009 to March 2014. Representatives from the Palm Beach County Healthy Kids, Healthy Communities partnership actively participated in the evaluation planning, implementation, and dissemination activities.

We are grateful for the collaboration with and support from the Robert Wood Johnson Foundation (Laura Leviton, PhD and Tina Kauh, PhD), the Washington University Institute for Public Health (Ross Brownson, PhD), the Healthy Kids, Healthy Communities (HKHC) National Program Office (Casey Allred; Rich Bell, MCP; Phil Bors, MPH; Mark Dessauer, MA; Fay Gibson, MSW; Joanne Lee, LDN, RD, MPH; Mary Beth Powell, MPH; Tim Schwantes, MPH, MSW; Sarah Strunk, MHA; and Risa Wilkerson, MA), the HKHC Evaluation Advisory Group (Geni Eng, DrPH, MPH; Leah Ersoylu, PhD; Laura Kettel Khan, PhD; Vikki Lassiter, MS; Barbara Leonard, MPH; Amelie Ramirez, DrPH, MPH; James Sallis, PhD; and Mary Story, PhD), the Social System Design Lab at Washington University in St. Louis (Peter Hovmand, PhD), the University of Memphis (Daniel Gentry, PhD), and Innovative Graphic Services (Joseph Karolczak).

Special thanks to the many individuals who have contributed to these efforts from Transtria LLC, including Evaluation Officers (Tammy Behlmann, MPH; Kate Donaldson, MPH; Cheryl Carnoske, MPH; Carl Filler, MSW; Peter Holtgrave, MPH, MA; Christy Hoehner, PhD, MPH; Allison Kemner, MPH; Jessica Stachecki, MSW, MBA), Project Assistants (James Bernhardt; Rebecca Bradley; Ashley Crain, MPH; Emily Herrington, MPH; Ashley Farell, MPH; Amy Krieg; Brandye Mazdra, MPH; Kathy Mora, PhD; Jason Roche, MPH; Carrie Rogers, MPH; Shaina Sowles, MPH; Muniru Sumbeida, MPH, MSW; Caroline Swift, MPH; Gauri Wadhwa, MPH; Jocelyn Wagman, MPH), additional staff (Michele Bildner, MPH, CHES; Daedra Lohr, MS; Melissa Swank, MPH), Interns (Christine Beam, MPH; Skye Buckner-Petty, MPH; Maggie Fairchild, MPH; Mackenzie Ray, MPH; Lauren Spaeth, MS), Transcriptionists (Sheri Joyce; Chad Lyles; Robert Morales; Vanisa Verma, MPH), and Editors (Joanna Bender and Julie Claus, MPH).

Suggested citation:

Brennan L, Sabounchi N, and Behlmann T. Systems Thinking in Communities: Understanding the Causes of Inactivity, Poor Diet/Nutrition, and Childhood Obesity in Lake Worth, Greenacres, Palm Springs, Florida . 2013. http://www.transtria.com/hkhc. Accessed <Date Accessed>.

Introduction

Palm Beach County Healthy Kids, Healthy Communities is one of 49 community partnerships participating in the national *Healthy Kids, Healthy Communities* program of the Robert Wood Johnson Foundation (www.healthykidshealthycommunities.org). The purpose of this *Palm Beach County Healthy Kids, Healthy Communities* project was to introduce systems thinking at the community level by identifying the essential parts of the Palm Beach County Healthy Kids, Healthy Communities system and how the system influences policy and environmental changes to promote healthy eating and active living as well as to prevent childhood obesity. To accomplish this goal, community partners and residents participated in a group model building session and discussions. The group model building exercises were designed by staff from Transtria LLC and the Social System Design Lab at Washington University in St. Louis, Missouri as part of the *Evaluation of Healthy Kids, Healthy Communities* funded by the Robert Wood Johnson Foundation. These exercises actively involved a wide range of participants in modeling complex systems and provided a way for different representatives (e.g., residents, government agencies, community-based organizations, foundations, and schools) to better understand the systems (i.e., dynamics and structures) in the community (see the *Healthy Kids, Healthy Communities Group Model Building Facilitation Handbook*, www.transtria.com/hkhc). Overall, the evaluation was designed to assess policy, system, and environmental changes as a result of the community partnerships' efforts to increase healthy eating and active living in order to reduce childhood obesity.

Lake Worth, Greenacres, Palm Springs, Florida : Background and Local Participation

Palm Beach County is one of the largest counties east of the Mississippi River, with a population of 1,320,134. Residents of the county are mainly white (76.9%) and approximately 20% are Hispanic/Latino. The county is known to have the highest cost of living in the state. The median household income is $52,806 and 14% of persons live below the poverty level.[2] The three target areas (City of Lake Worth, City of Greenacres, Village of Palm Springs) cover 31 square miles from east to west (see Figure 2). The demographic make-up varies across the three cities (see Table 1). The City of Lake Worth, covering seven miles of Palm Beach County, has the highest rate of poverty (28.6%), as well as the highest number of residents that speak a language other than English (52.9%).[2] The city is unique in that it supplies its own services (e.g., electrical plant, water) and has the only school in Palm Beach County with a Haitian principal who speaks Creole. About half (50.9%) of the residents in the Village of Palm Springs are Hispanic/Latino, and 52.2% speak a language other than English. Representing over one-fifth of the county's population, foreign-born residents represent a range of languages, ethnicities, and cultures. Mexicans and Colombians are the most dominant immigrant population in Greenacres, while individuals from Haiti, Mexico, and Guatemala frequently reside in Lake Worth.

The School District of Palm Beach County was the lead agency for Palm Beach County's Healthy Kids, Healthy Communities partnership. The partnership was formed in August 2010 as a result of the HKHC grant funding. Several key partners had an established history of working with the School District before the formation of the HKHC partnership; however through the initiative, they were able to scale-up their participation to the community level. The partnership has grown from a small group of core partners to include a large number of diverse partners from the community, civic organizations, businesses, government, community-based organizations, foundations and elected officials.

Palm Beach County Healthy Kids, Healthy Communities' Priorities and Strategies

The partnership and capacity building strategies of *Palm Beach County Healthy Kids, Healthy Communities* included:

- **School Involvement:** The administrative staff of Palm Beach County School District led the partnership, but principals and teachers were actively engaged in the development and maintenance of school gardens, joint use agreements, and active transportation components.
- **Youth Involvement:** Youth were involved with the development and maintenance of school gardens and the active transportation initiative.

The healthy eating and active living strategies of *Palm Beach County Healthy Kids, Healthy Communities* included:

- **Community and School Gardens:** To increase access to fruits and vegetables, the partnership collaborated with the Palm Beach County Cooperative Extension, local organizations, and community residents to establish 30 school and community gardens.
- **Parks and Play Spaces:** The partnership worked with Palm Beach County Parks and Recreation Department to increase opportunities for healthy eating and active living in parks and play spaces through the development of the Tropical Ridge Fitness Park, improvements to Spillway Park, creation of a park at 5th Avenue, and adoption of a vending machine policy at Palm Beach County Parks.
- **Joint Use:** To increase access to physical activity facilities, the partnership focused on creating a joint use agreement with Berkshire Elementary. As part of the agreement, a walking trail and fence were installed to be used by the students and community.
- **Active Transportation:** The partnership worked to increase opportunities for active transportation in the community by installing a bike rack, purchasing a bike trailer, and supporting the adoption of a Master Comprehensive Bicycle Transportation Plan.

For more information on the partnership, please refer to the Lake Worth, Greenacres, Palm Springs case report (www.transtria.com/hkhc).

Systems Thinking in Communities: Lake Worth, Greenacres, Palm Springs, Florida

"Systems thinking" represents a range of methods, tools, and approaches for observing the behaviors of a system (e.g., family, community, organization) and how these behaviors change over time; changes may occur in the past, present, or future. Figure 1 illustrates a system of policies, environments, local collaborations, and social determinants in Lake Worth, Greenacres, Palm Springs, Florida that influence healthy eating, active living, and, ultimately, childhood obesity. This system and the dynamics within the system are complicated with many different elements interacting.

Models, such as Figure 1, provide a way to visualize all the elements of the system and their interactions, with a focus on causal relationships as opposed to associations. Through the model, specific types of causal relationships, or feedback loops, underlying the behavior of the dynamic system, can be identified to provide insights into what is working or not working in the system to support the intended outcomes (in this case, increases in healthy eating and active living, and decreases in childhood overweight and obesity). In system dynamics, the goal is to identify and understand the system feedback loops, or the cause-effect relationships that form a circuit where the effects "feed back" to influence the causes.

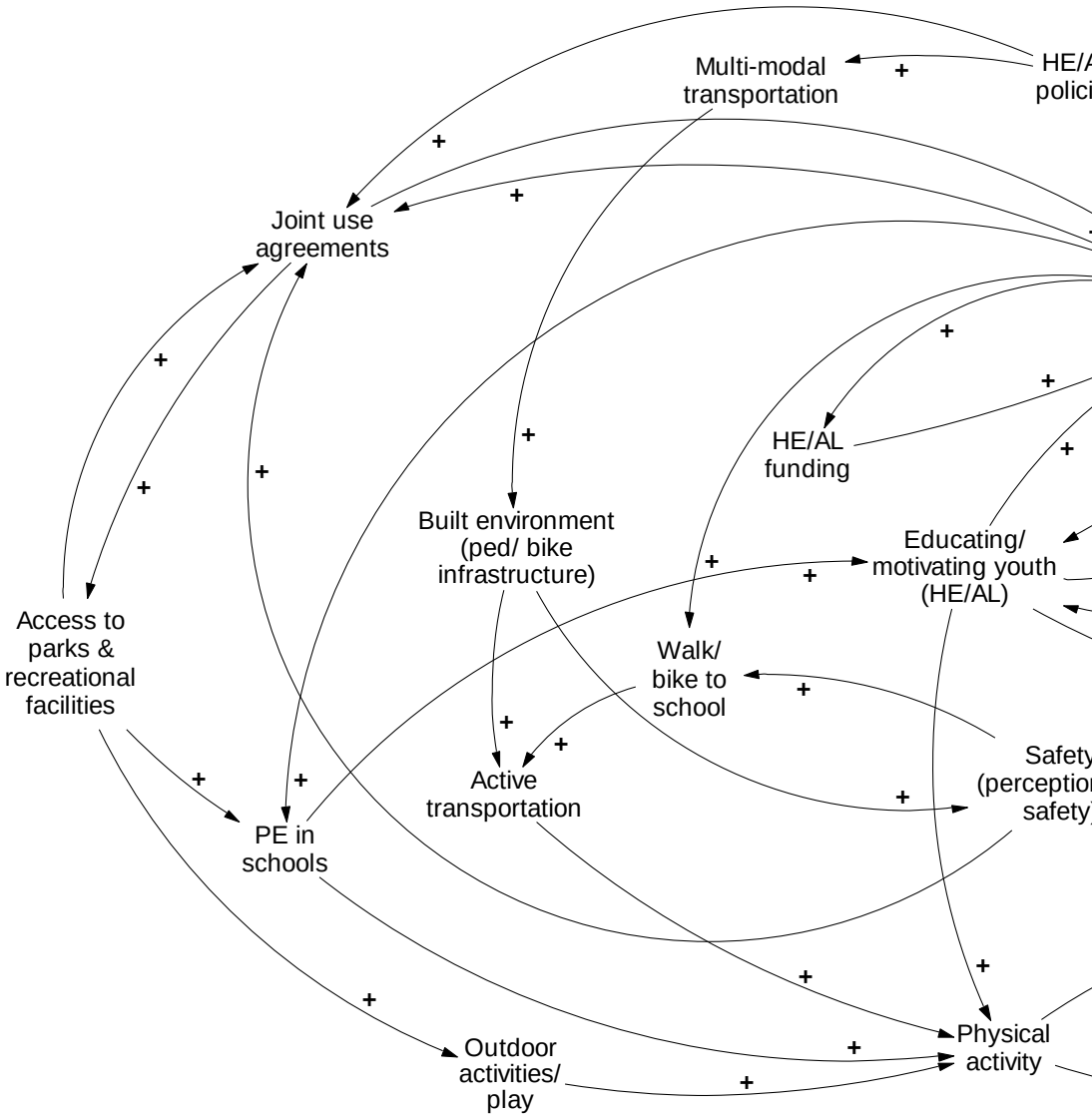
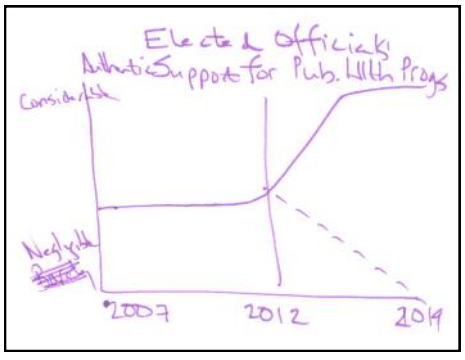


Figure 1: *Palm Beach County Healthy Kids, Healthy Communities* Causal Loop Diagram

Group Model Building

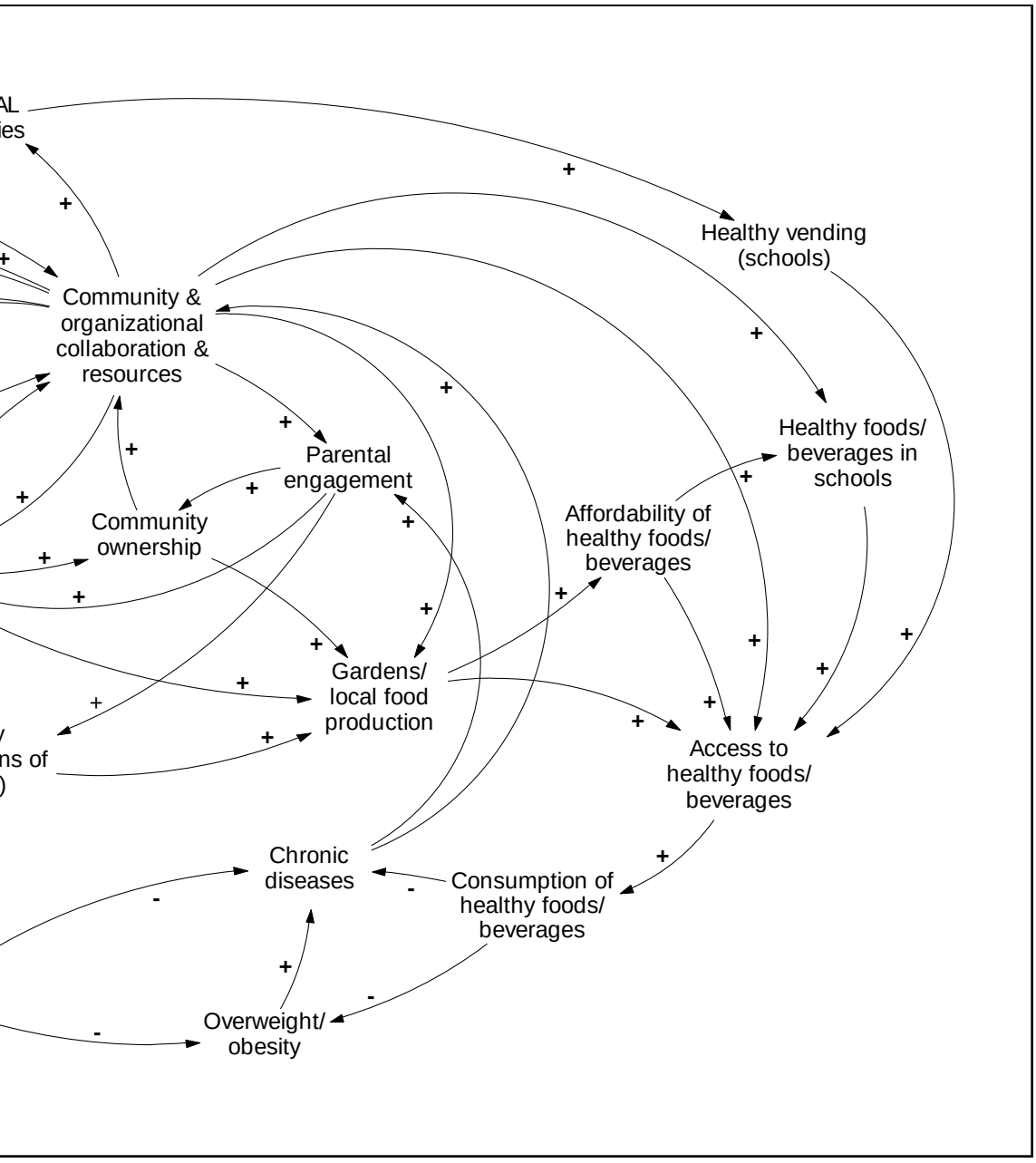
Members of the *Palm Beach County Healthy Kids, Healthy Communities* partnership participated in a group model building session in February, 2012 and generated this system. also referred to as a causal loop diagram (Figure 1). Participants in the group model building session included residents and representatives from government agencies, community-based organizations, foundations, and schools. The group model building session had two primary activities: 1) a Behavior Over Time Graph exercise; and 2) a Causal Loop Diagram (or structural elicitation) exercise.



Behavior Over Time Graphs

To identify the range of things that affect or are affected by policy, system, and environmental changes in Lake Worth, Greenacres, Palm Springs related to healthy eating, active living, and childhood obesity, participants designed graphs to name the influences and to illustrate how the influences

have changed over time (past, present, and future). In this illustration for elected officials' authentic support for public health programs, the amount of support has remained low and stable since 2007 and the participant hopes that this stable trend will increase substantively into the future. Each graph is a tool to increase the use of common, specific language to describe *what* is changing in the community as well as *when*, *where*, and *how* it is changing. The graphs capture participants' perceptions of the influence, or variable, and through the graph, the participant tells their story. These perceptions are based on actual data or evidence, or they are part of the participants' lived experience.



Causal Loop Diagram

To examine the relationships among the variables from the behavior over time graphs, participants worked together and with facilitators to develop a causal loop diagram. In Figure 1, the words represent variables of quantities that can increase and decrease over time (i.e., the behavior over time graphs). These variables are influenced by other variables as indicated by the lines with arrows. The lines with arrows represent causal relationships - this is what is known about the system and how it behaves.

One feedback loop is: community and organizational collaboration and resources → parental engagement → community ownership → community and organizational collaboration and resources.

What is important to notice is that there are other feedback loops interacting simultaneously to influence or to be influenced by community and organizational collaboration and resources. Some variables may increase community and organizational collaboration and resources while other variables limit it. Determining the feedback loop or loops that dominate the system's behavior at any given time is a more challenging problem to figure out, and ultimately, requires the use of computer simulations.

Based on this preliminary work by the *Palm Beach County Healthy Kids, Healthy Communities* partnership, this "storybook" ties together the behavior over time graphs, the participants' stories and dialogue, and feedback loops from the causal loop diagram to understand the behavior of the system affecting health in Lake Worth, Greenacres, Palm Springs, Florida and to stimulate greater conversation related to Lake Worth, Greenacres, Palm Springs 's theory of change, including places to intervene in the system and opportunities to reinforce what is working. Each section builds on the previous sections by introducing concepts and notation from systems science.

Causal Loop Diagram for the Childhood Obesity System

The causal loop diagram (CLD) represents a holistic system and several subsystems interacting in Lake Worth, Greenacres, Palm Springs, Florida. In order to digest the depth and complexity of the diagram, it is helpful to examine the CLD in terms of the subsystems of influence. Because of this project's focus on healthy eating, active living, and childhood obesity, this system draws attention to a number of corresponding subsystems, including: healthy eating policies and environments (red), active living policies and environments (blue), health and health behaviors (orange), partnership and community capacity (purple), and social determinants (green).

From the group model building exercises, several variables and causal relationships illustrated in Figure 2 were identified within and across subsystems. This section describes the subsystems in the CLD.

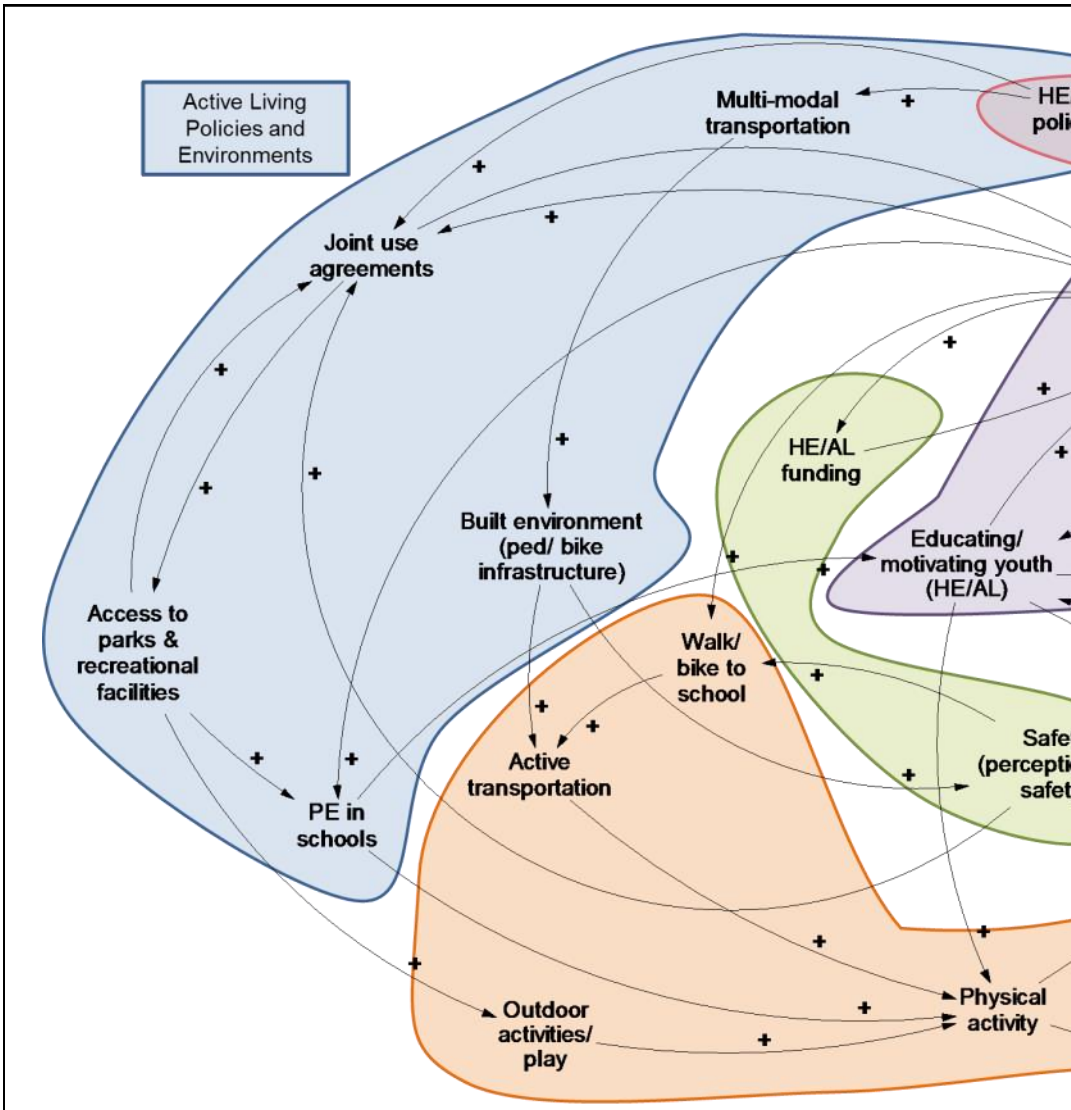


Figure 2: Subsystems in the *Palm Beach County Healthy Kids, Healthy Communities* Causal Loop Diagram

<u>Healthy Eating Policies and Environments (Red)</u>

The healthy eating policy and environmental subsystem includes food production, food distribution and procurement, and food retail. During the behavior over time graphs exercise, the participants generated nine graphs related to policy or environmental strategies (e.g., gardens and local food production) or contexts (e.g., healthy foods and beverages in schools) that affected or were affected by the work of *Palm Beach County Healthy Kids, Healthy Communities*. The variables represent participants' conversations from the behavior over time graph and causal loop diagram exercises.

<u>Active Living Policies and Environments (Blue)</u>

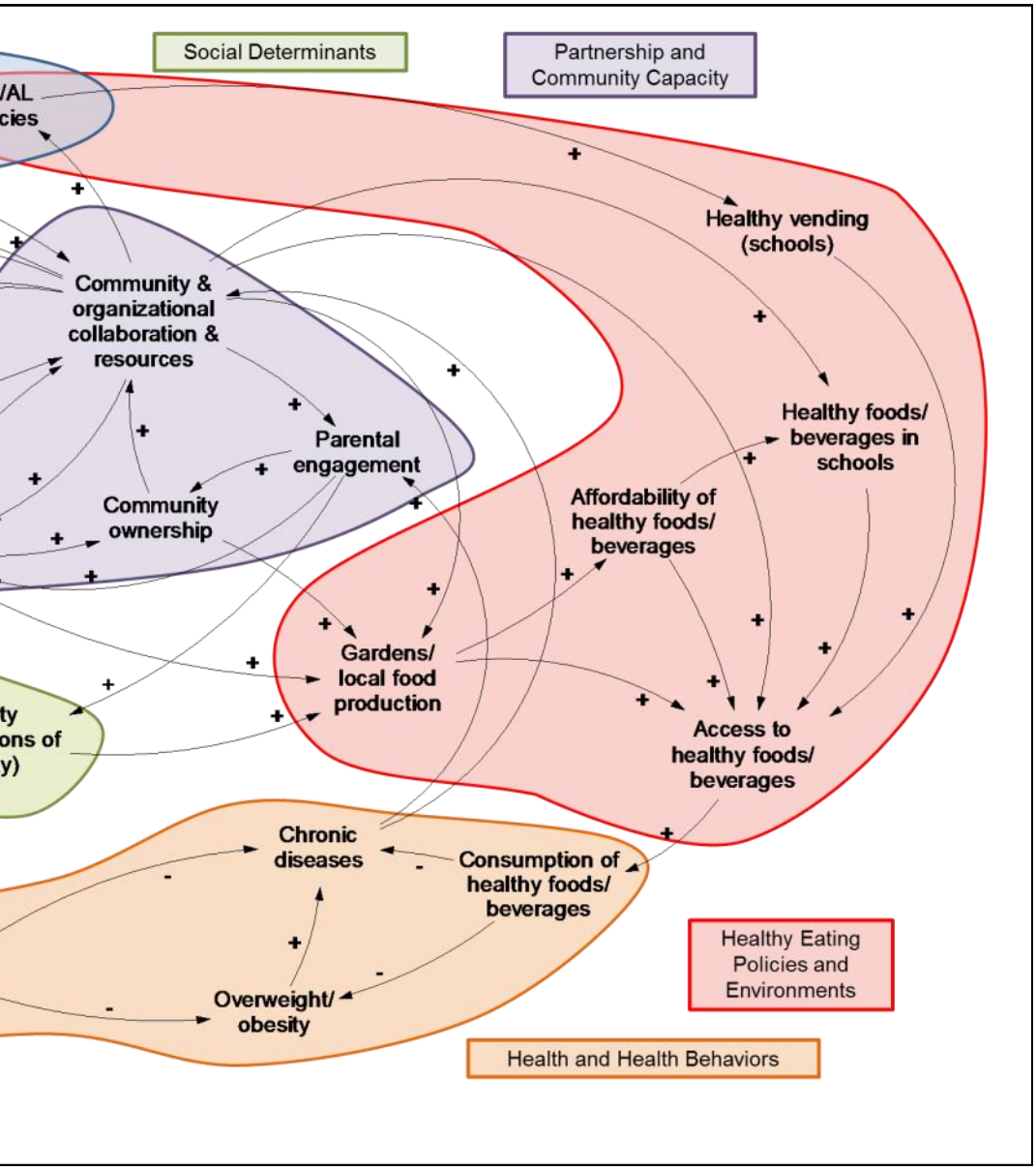
The active living policy and environmental subsystem includes design, planning, construction, and enforcement or maintenance related to access to opportunities for active transportation and recreation. For this topic, the group model building participants developed three graphs related to policy or environmental strategies (e.g., physical education in schools) or contexts (e.g., access to parks and recreational facilities) that affected or were affected by the partnership's work.

<u>Health and Health Behaviors (Orange)</u>

The subsystem for health and health behaviors includes health outcomes (e.g., obesity), health behaviors (e.g., healthy eating, physical activity), and behavioral proxies or context-specific behaviors (e.g., walk or bike to school, outdoor activities/play).

Partnership and Community Capacity

The partnership and community capacity subsystem refers to the ways communities organized and rallied for changes to the healthy eating and active living subsystems. For instance, *Palm Beach County Healthy Kids, Healthy Communities* educated youth and motivated them to work collaboratively on healthy eating and active living in the community. This subsystem also includes community factors outside the partnership that may influence or be influenced by their efforts, such as community ownership.



Social Determinants

Finally, the social determinants subsystem denotes societal conditions (e.g., funding for healthy eating and active living) and psychosocial influences (e.g., perceptions of safety) in the community that impact health beyond the healthy eating and active living subsystems. In order to achieve health equity, populations and subgroups within the community must have equitable access to these resources and services.

Each one of these subsystems has many more variables, causal relationships (arrows), and feedback loops that can be explored in greater depth by the *Palm Beach County Healthy Kids, Healthy Communities* partners or by other representatives in Lake Worth, Greenacres, Palm Springs, Florida . Using this CLD as a starting place, community conversations about different theories of change within subsystems may continue to take place.

The next sections begin to examine the feedback loops central to the work of *Palm Beach County Healthy Kids, Healthy Communities*. In these sections, causal relationships and notations (i.e., arrows, “+” signs, “-” signs) from Figure 2 will be described to increase understanding about how systems thinking and modeling tools can work in communities to increase understanding of complex problems that are continuously changing over time, such as childhood obesity. At the end of this CLD storybook, references to other resources will be provided for those interested in more advanced systems science methods and analytic approaches.

Parks and Play Spaces Feedback Loop

To simplify the discussion about feedback loops, several loops drawn from the Palm Beach County Healthy Kids, Healthy Communities CLD (see Figures 1 and 2) are shown in Figure 3. While the CLD provides a theory of change for the childhood obesity prevention movement in Lake Worth, Greenacres, and Palm Springs, Florida, each feedback loop tells a story about a more specific change process.

Causal Story for Feedback Loop

Story A: In this case , the story is about parks and play spaces (orange highlighted loop in Figure 3). Lake Worth, Greenacres, and Palm Springs, Florida partners increased opportunities for active living in parks and play spaces through development of the Tropical Ridge Fitness Park, improvements to Spillway Park, and creation of a park at 5th Avenue. Participants described how joint use agreements increase access to parks and recreational facilities, enhancing opportunities for outdoor play that increase physical activity and reduce chronic disease morbidity and mortality. In turn, with lower rates of chronic diseases, fewer community and organizational partners and resources will be required to develop joint use agreements in order to address these health problems.

Story B: While the preceding story reflected a positive scenario for Lake Worth, Greenacres, Palm Springs, Florida , the same feedback loop also tells the opposite story. A lack of joint use agreements limits access to parks and recreational facilities in the area, and, consequently, reduces outdoor play and physical activity. Less activity increases chronic diseases and this burden translates into the need for community and organizational partners and resources to be channeled into efforts to increase active living, such as the development of joint use agreements.

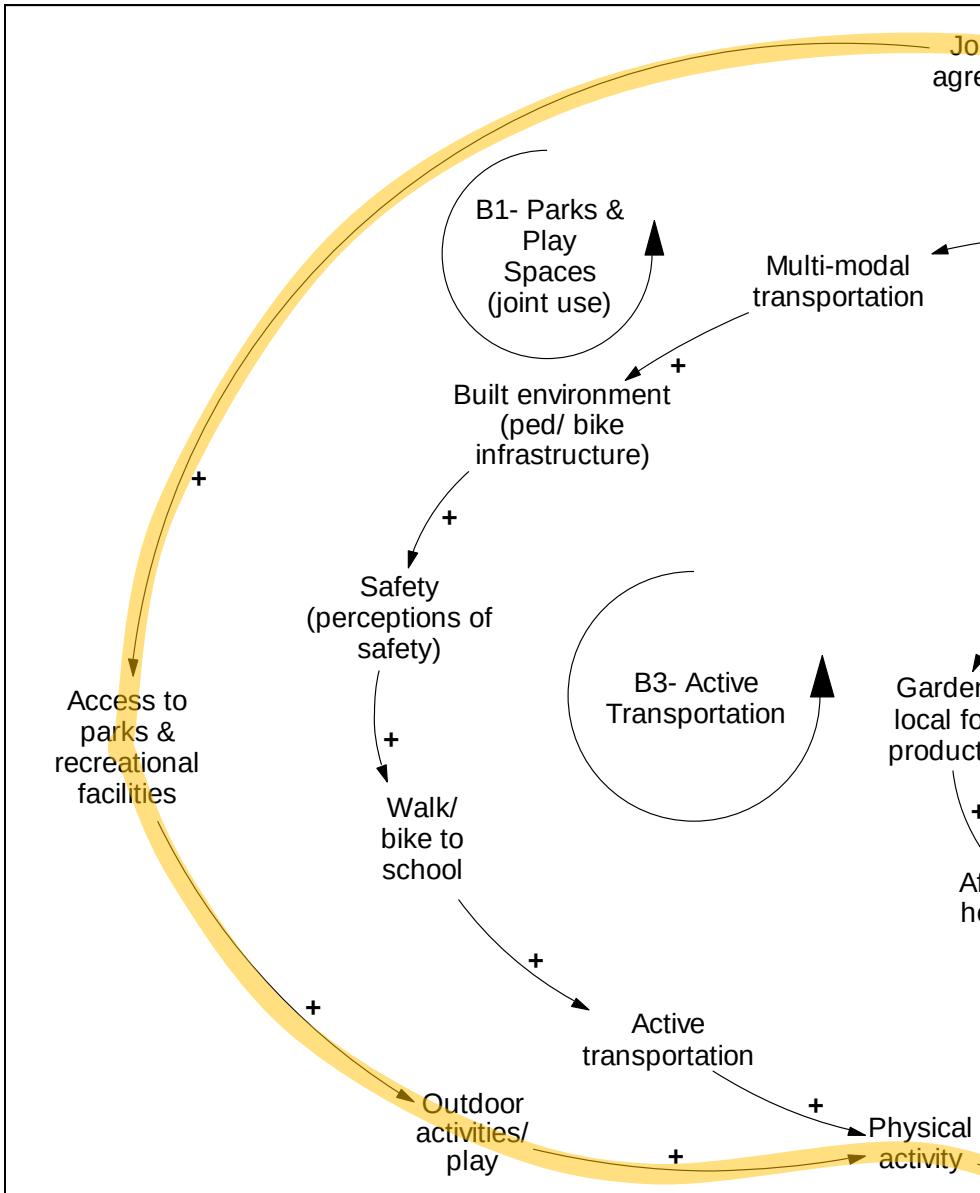


Figure 3: Parks and Play Spaces Feedback Loop

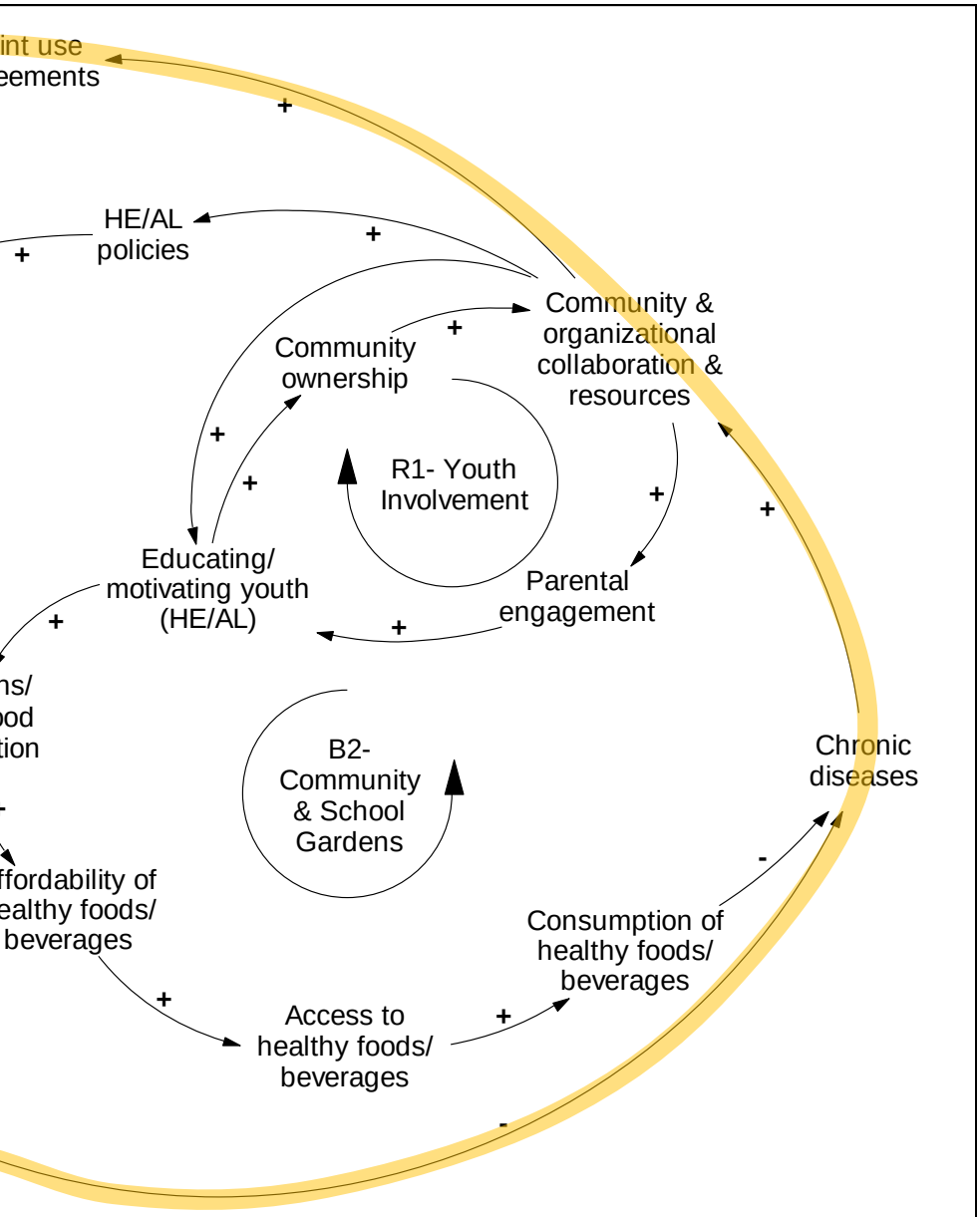
Balancing Loop and Notation

These stories represent a balancing loop, and the notation in the feedback loop identifies it as a balancing loop (see "B1 — Parks and Play Spaces (joint use)" and orange highlighted loop in Figure 3). The words represent variables of quantities that increase and decrease as illustrated in the stories above. These

"From what we understand from the chief of police in the school district, in the late '90s to 2000, schools were open pretty readily to the community. Then, about 2000 to now, they kind of shut everything down because of liabilities, insurance, and costs. What we're trying to do is actually create one local joint-use agreement between the community school district and the municipalities, the parks and recreation, to show that it can be on open on weekends or nights easily." (Participant)

variables change over time and are influenced by other variables as indicated by the arrows. Each arrow represents a causal relationship, and the plus and minus signs on the arrows indicate whether or not the influence of one variable on another variable (1) increases/adds to (plus or "+" sign), or (2) decreases/removes from the other variable (minus or "-" sign). These signs are referred to as polarities.

In a balancing loop, the effect of the variables tend to create more



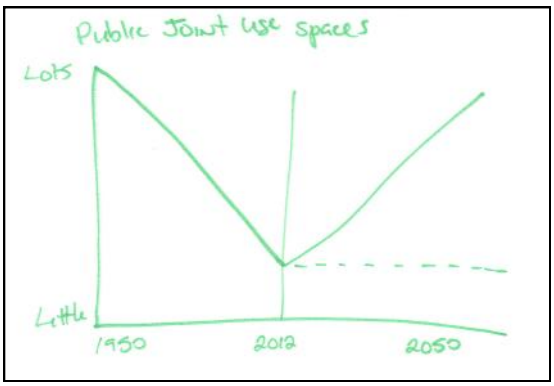
of a stable trend over time, as opposed to one that is continually increasing or decreasing. This effect continues through the cycle and returns a stabilizing influence to the original variable, respectively.

Looking specifically at the "+" or "-" notation, a feedback loop that has an odd number of "-" signs, or polarities in the loop, is considered a balancing loop. Reinforcing loops, with zero or an even number of "-" signs, are another type of feedback loop.

In isolation, this balancing loop represents the influence of access to parks and recreation facilities on physical activity and chronic diseases. To understand other influences on these variables, it is important to remember that this balancing loop is only one part of the larger CLD (see Figures 1 and 2), and the other loops and causal relationships can have an impact on the variables in this loop.

<u>System Insights for *Palm Beach County Healthy Kids, Healthy Communities*</u>

From 1950 to 2012, participants identified a substantial decline in public joint use spaces and the proportion of children engaging in self-directed, outdoor play in Lake Worth, Greenacres, and Palm



Springs, Florida (see behavior over time graph).

From the systems thinking exercises, several insights can inform the partners' parks and play spaces strategy. For instance, partners' can collaborate to reclaim public spaces for parks and recreation facilities through joint use and zoning policies.

In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including assessing factors that contributed to the decline in public recreation spaces.

Opportunities for Systems Thinking in Lake Worth, Greenacres, Palm Springs, Florida

This storybook provided an introduction to some basic concepts and methods for systems thinking at the community level, including: causal loop diagrams, variables, causal relationships and polarities, reinforcing feedback loops, and balancing feedback loops, among others. For the *Palm Beach County Healthy Kids, Healthy Communities* partners, this storybook also summarized the healthy eating, active living, partnership and community capacity, social determinants, and health and health behaviors subsystems in the Lake Worth, Greenacres, and Palm Springs causal loop diagram as well as an example feedback loop corresponding to the partnership's primary strategies.

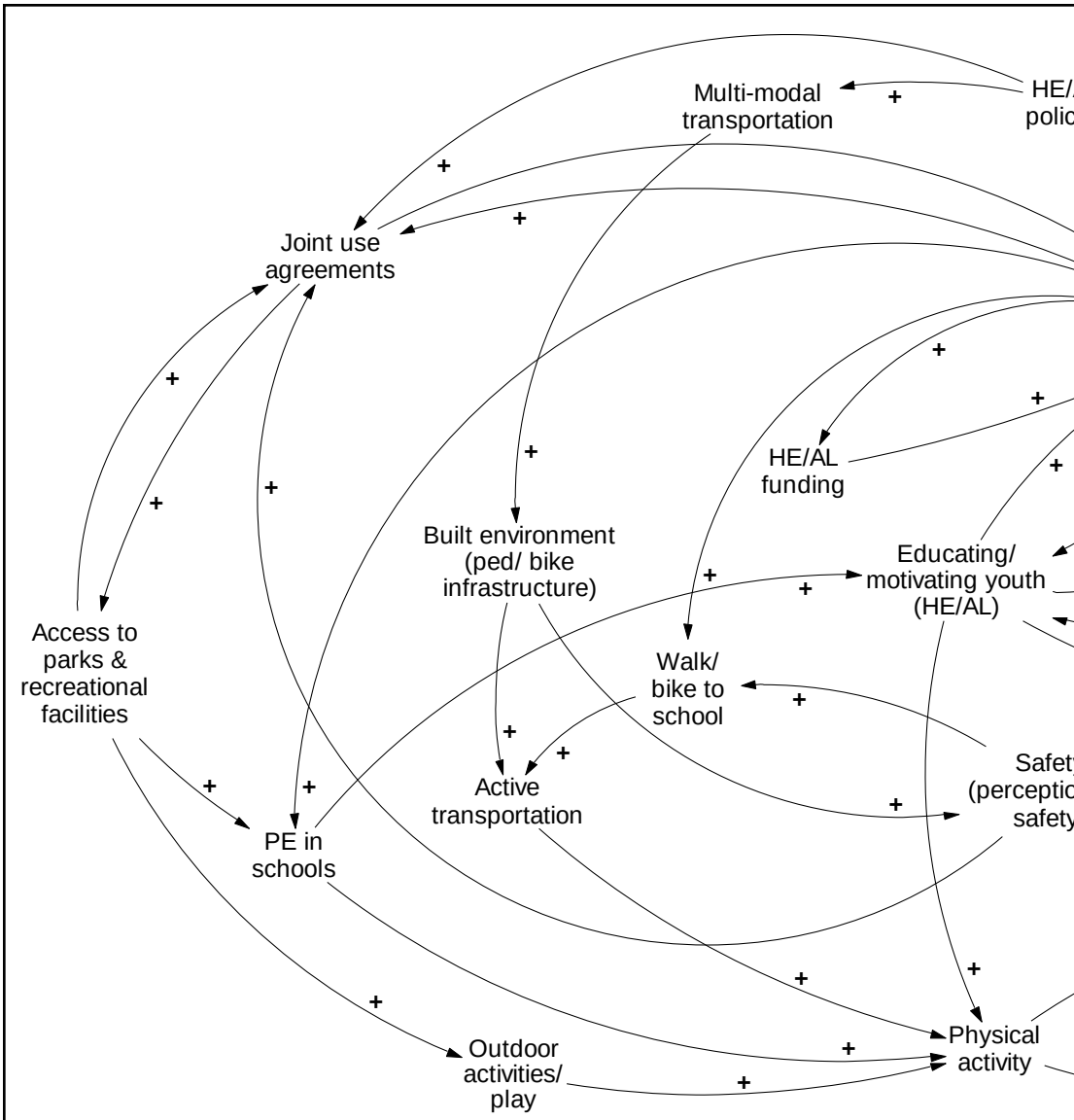


Figure 4: *Palm Beach County Healthy Kids, Healthy Communities* Causal Loop Diagram

This causal loop diagram reflects a series of conversations among partners and residents from 2011 to 2013. Some discussions probed more deeply into different variables through the behavior over time graphs exercise, or causal relationships through the causal loop diagram exercise.

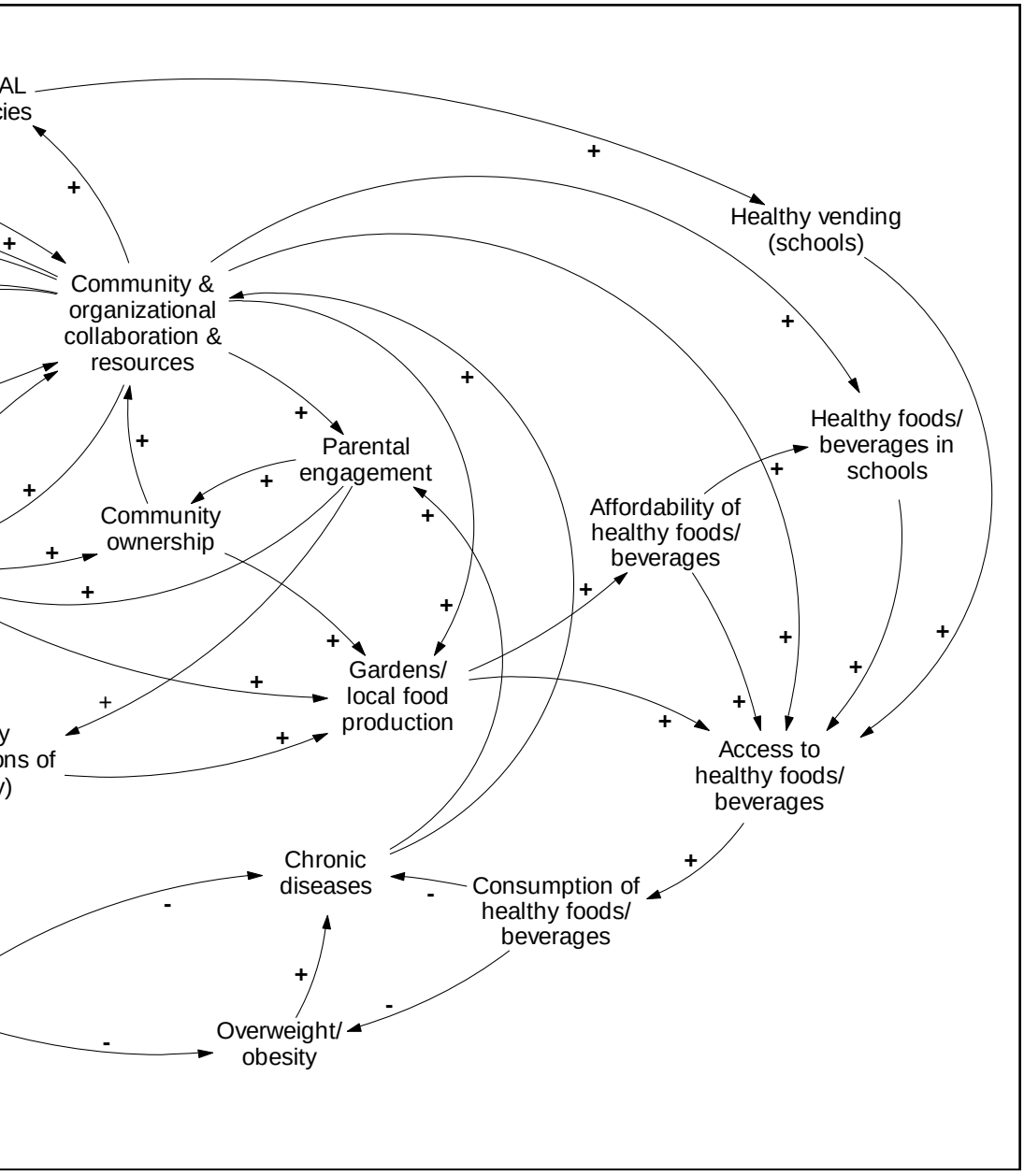
This represented a first attempt to collectively examine the range of things that affect or are affected by policy, system, and environmental changes in Lake Worth, Greenacres, and Palm Springs, Florida to promote healthy eating and active living as well as preventing childhood overweight and obesity.

Yet, there are several limitations to this storybook, including:

- the participants represent a sample of the *Palm Beach County Healthy Kids, Healthy Communities* partners (organizations and residents) as opposed to a representative snapshot of government agencies, community organizations, businesses, and community residents;
- the behavior over time graphs and the causal loop diagram represent perceptions of the participants in these exercises (similar to a survey or an interview representing perceptions of the respondents);
- the exercises and associated dialogue took place in brief one- to two-hour sessions, compromising the group's capacity to spend too much time on any one variable, relationship, or feedback loop; and
- the responses represent a moment in time so the underlying structure of the diagram and the types of feedback represented may reflect "hot button" issues of the time.

Much work is yet to be done to ensure that this causal loop diagram is accurate and comprehensive, for example:

- having conversations to discuss existing feedback loops to ensure that the appropriate variables and relationships are represented accurately;
- reviewing the behavior over time graphs (see also Appendix D) to confirm that the trends reflect common perceptions among residents and compare these trends to actual data;



- revisiting variables removed because they were not part of feedback loops, including: crime, employment, academic achievement, convenience stores, fast food restaurants, healthy and unhealthy food/ beverage marketing/advertising, awareness of obesity/ overweight, poverty/ homelessness, farmers' markets, local economy, policy-maker support for HE/AL, champions, liability insurance, media, consumption of unhealthy, convenience foods,. corporate food industry; and
- starting new conversations about other variables (behavior over time graphs exercise) or relationships (causal loop diagram exercise) to add to this diagram.

In addition, different subgroups in Lake Worth, Greenacres, Palm Springs may use this causal loop diagram to delve in deeper into some of the subsectors (e.g., healthy eating, active living) or feedback loops, creating new, more focused causal loop diagrams with more specific variables and causal relationships.

Use of more advanced systems science methods and analytic approaches to create computer simulation models is another way to take this early work to the next level. The references section includes citations for resources on these methods and analytic approaches, and it is necessary to engage professional systems scientists in these activities.

Please refer to the Appendices for more information, including:

- Appendix A: Behavior over time graphs generated during site visit
- Appendix B: Original translation of the causal loop diagram into Vensim PLE
- Appendix C: Transcript translation of the causal loop diagram into Vensim PLE
- Appendix D: Behavior over time graphs not represented in the storybook

References for Systems Thinking in Communities:

Group model building handbook:
Hovmand, P., Brennan L., & Kemner, A. (2013). Healthy Kids, Healthy Communities Group Model Building Facilitation Handbook. Retrieved from http://www.transtria.com/hkhc.

Vensim PLE software for causal loop diagram creation and modification:
Ventana Systems. (2010). Vensim Personal Learning Edition (Version 5.11A) [Software]. Available from http://vensim.com/vensim-personal-learning-edition/

System dynamics modeling resources and support:
Andersen, D. F. and G. P. Richardson (1997). "Scripts for group model building." System Dynamics Review 13(2): 107-129.

Hovmand, P. (2013). Community Based System Dynamics. New York, NY: Springer.

Hovmand, P. S., et al. (2012). "Group model building "scripts" as a collaborative tool." Systems Research and Behavioral Science 29: 179-193.

Institute of Medicine (2012). An integrated framework for assessing the value of community-based prevention. Washington, DC, The National Academies Press.

Meadows, D. (1999). Leverage points: places to intervene in a system. Retrieved from http://www.donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/

Richardson, G. P. (2011). "Reflections on the foundations of system dynamics." System Dynamics Review 27 (3): 219-243.

Rouwette, E., et al. (2006). "Group model building effectiveness: A review of assessment studies." System Dynamics Review 18(1): 5-45.

Sterman, J. D. (2000). Business dynamics: Systems thinking and modeling for a complex world. New York, NY: Irwin McGraw-Hill.

System Dynamics in Education Project. (1994). Road maps: A guide to learning system dynamics. Retrieved from http://www.clexchange.org/curriculum/roadmaps/

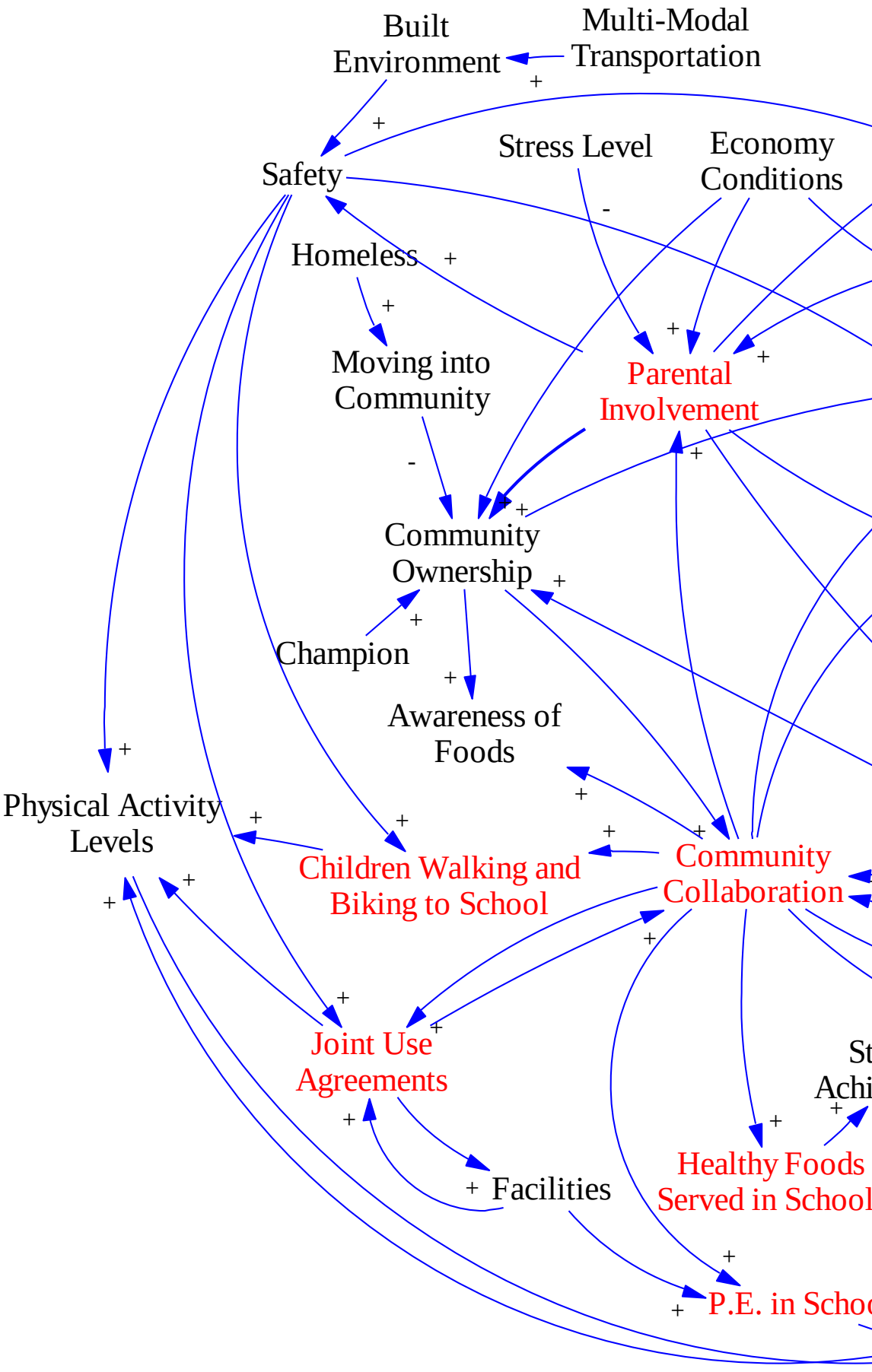
Vennix, J. (1996). Group model building. New York, John Wiley & Sons.

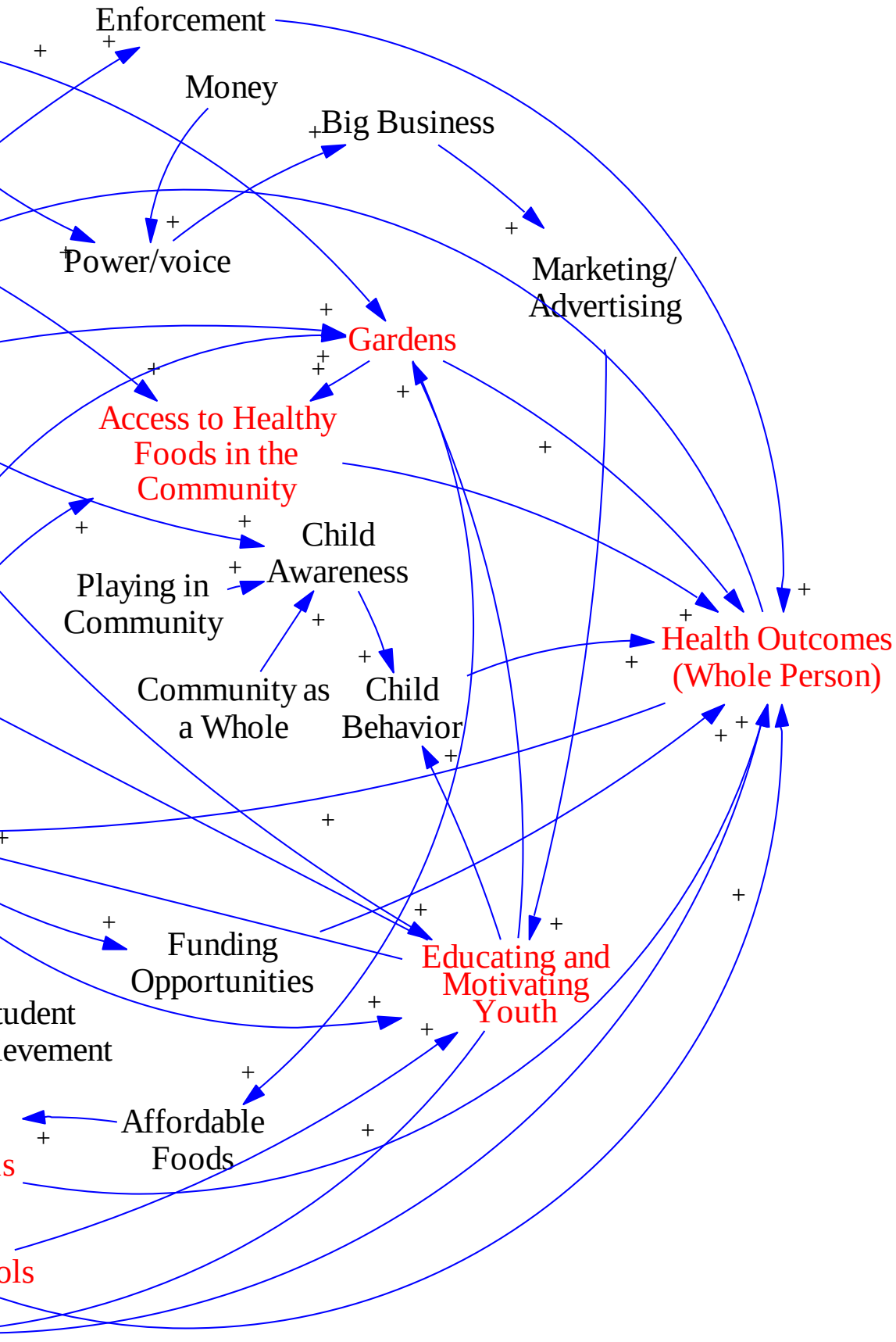
Zagonel, A. and J. Rohrbaugh (2008). Using group model building to inform public policy making and implementation. Complex Decision Making. H. Qudart-Ullah, J. M. Spector and P. I. Davidsen, Springer-Verlag: 113-138.

Appendix A: Behavior Over Time Graphs Generated during Site Visit

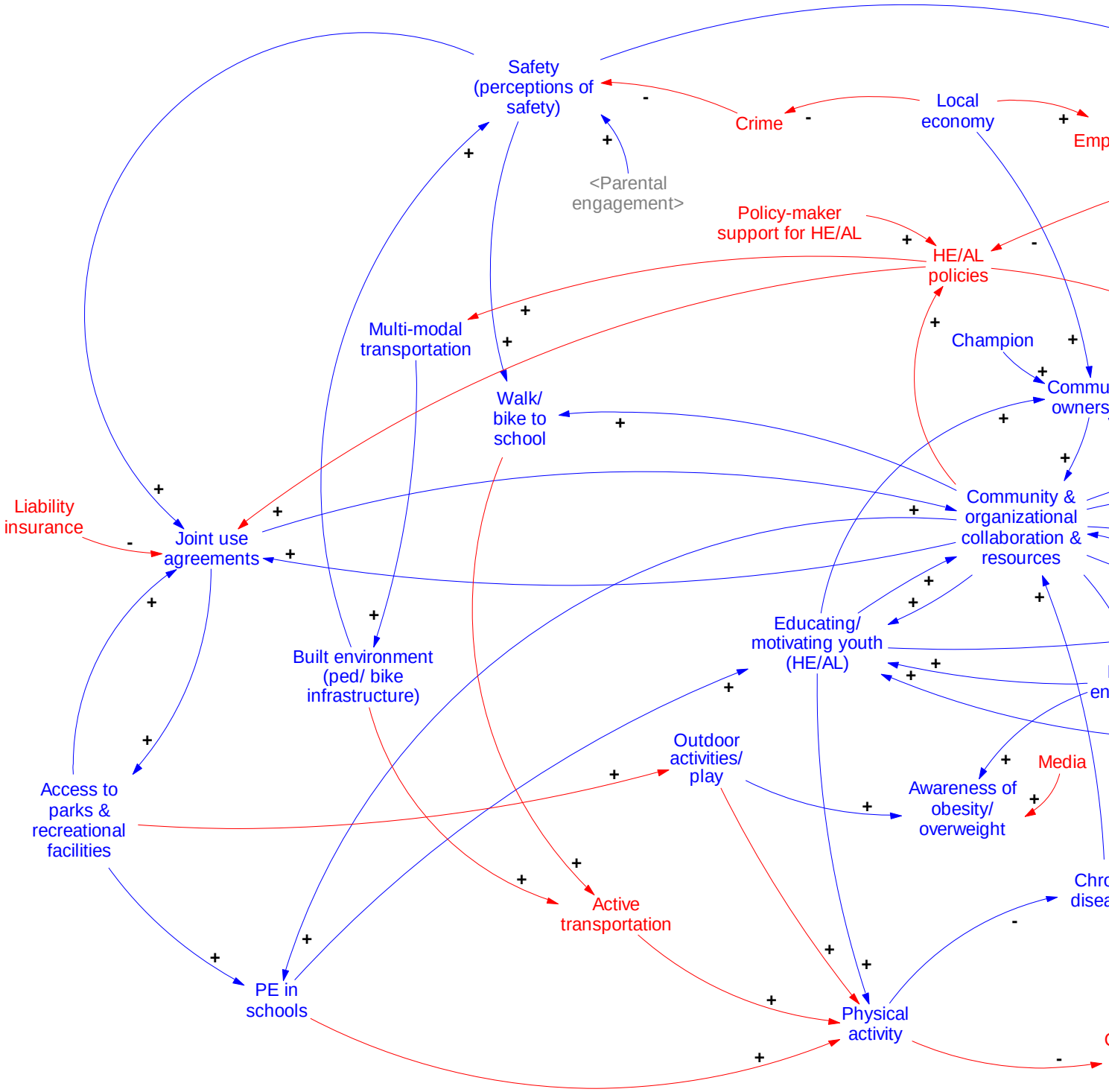
Lake Worth, Greenacres, Palm Springs, Florida: *Palm Beach County Healthy Kids, Healthy Communities*	
Categories	**Number of Graphs**
Active Living Behavior	3
Active Living Environments	0
Funding	0
Healthy Eating Behavior	0
Healthy Eating Environments	9
Marketing and Media Coverage	2
Obesity and Long Term Outcomes	2
Partnership & Community Capacity	2
Policies	3
Programs & Promotions (Education and Awareness)	4
Social Determinants of Health	4
Total Graphs	**29**

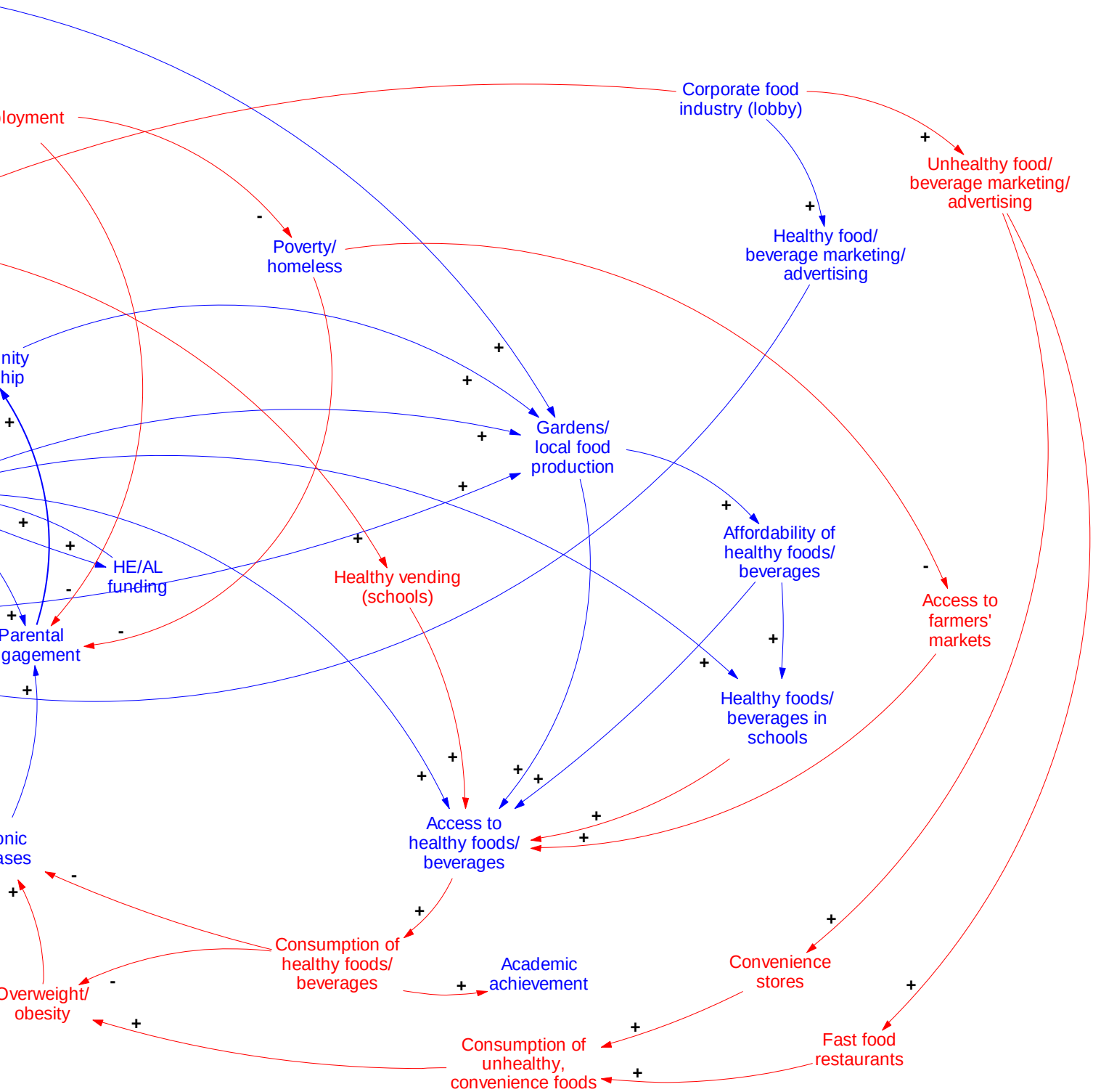
Appendix B: Original Translation of the Causal Loop Diagram into Vensim PLE



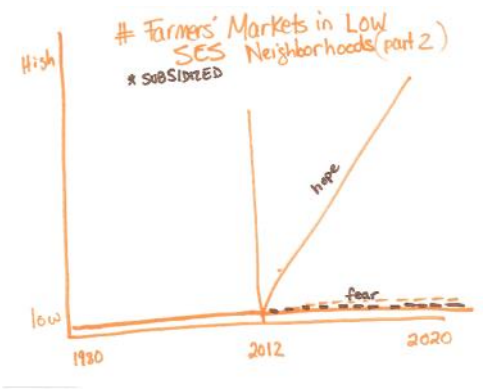

Enforcement
Money
Big Business
Power/voice
Marketing/
Advertising
Gardens
Access to Healthy
Foods in the
Community
Child
Awareness
Playing in
Community
Community as
a Whole
Child
Behavior
Health Outcomes
(Whole Person)
Funding
Opportunities
Educating and
Motivating
Youth
Affordable
Foods

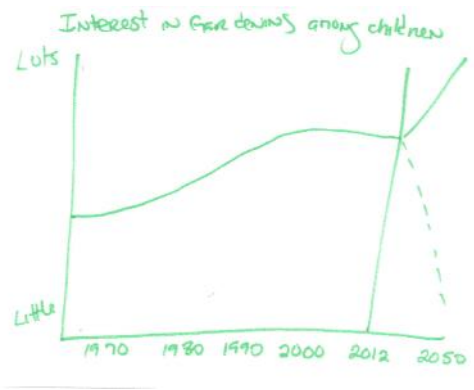
Appendix C: Transcript Translation of the Causal Loop Diagram into Vensim PLE

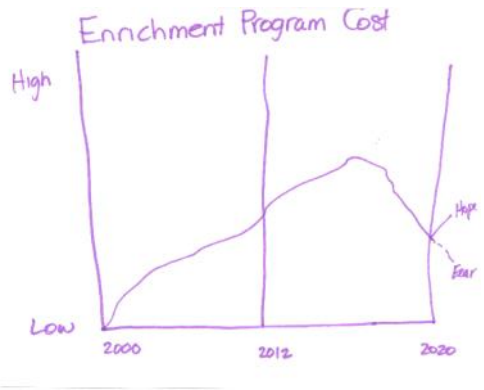


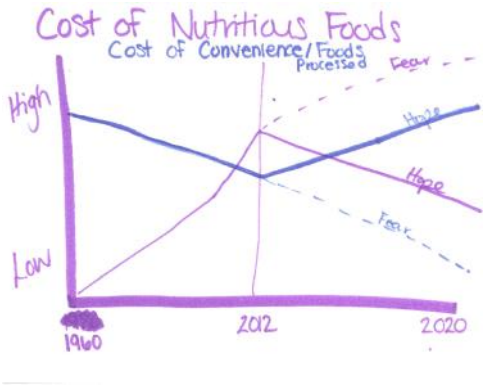

loyment
Corporate food industry (lobby)
Unhealthy food/ beverage marketing/ advertising
Poverty/ homeless
Healthy food/ beverage marketing/ advertising
nity hip
Gardens/ local food production
HE/AL funding
Healthy vending (schools)
Affordability of healthy foods/ beverages
Access to farmers' markets
Parental gagement
Healthy foods/ beverages in schools
onic ases
Access to healthy foods/ beverages
Consumption of healthy foods/ beverages
Academic achievement
Convenience stores
Overweight/ obesity
Consumption of unhealthy, convenience foods
Fast food restaurants

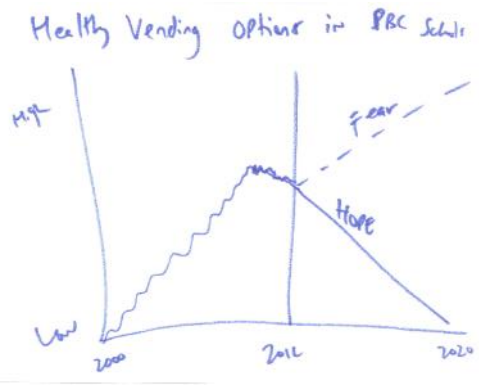
Appendix D: Behavior Over Time Graphs not Represented in the Storybook

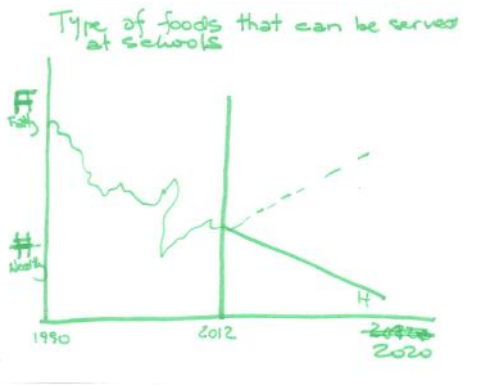


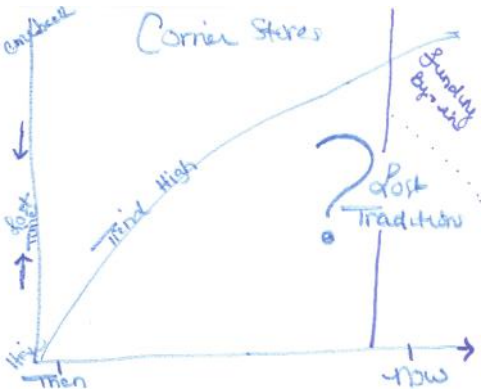


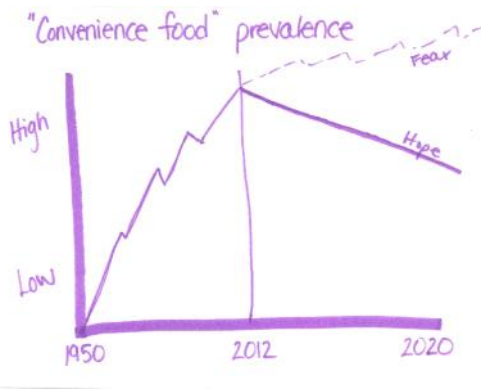


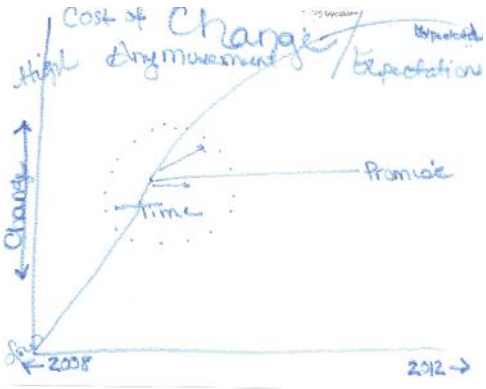


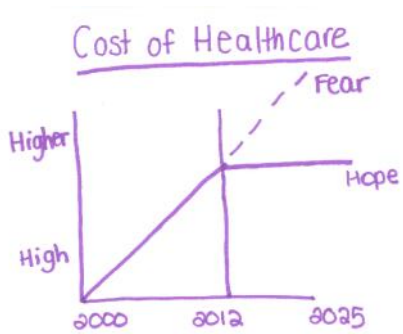


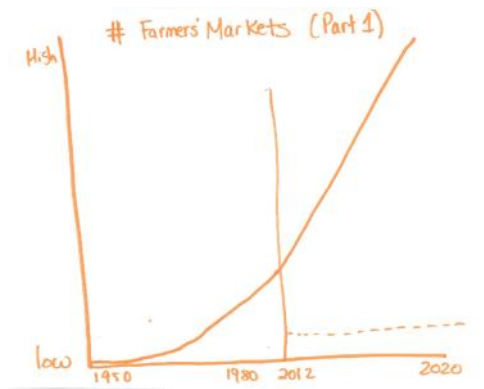


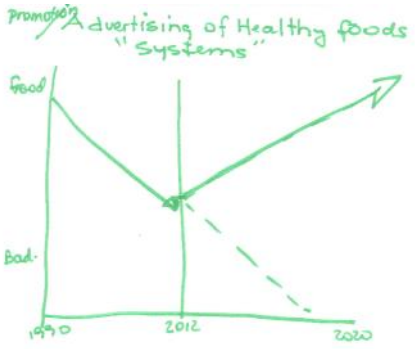


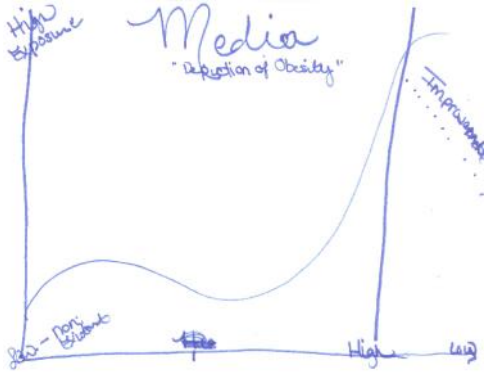


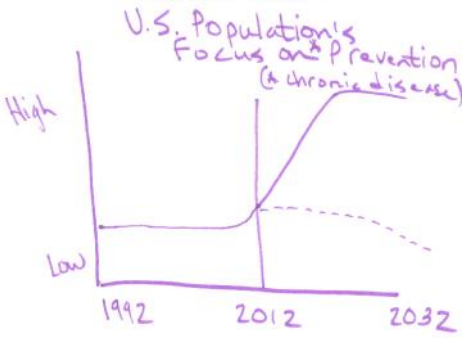


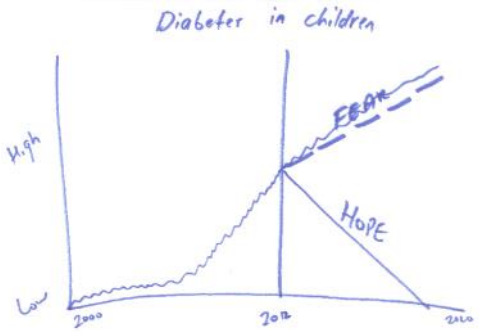


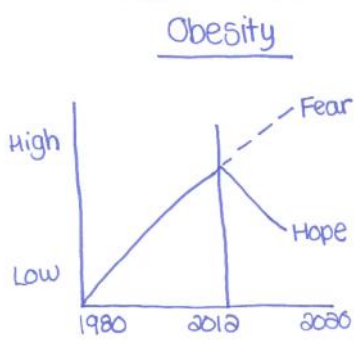


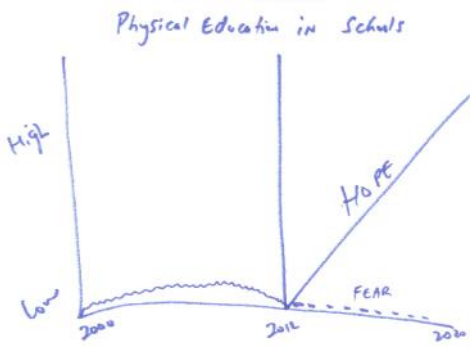

Promotion
Advertising of Healthy foods
"Systems"
Good
Bad
1990
2012
2020

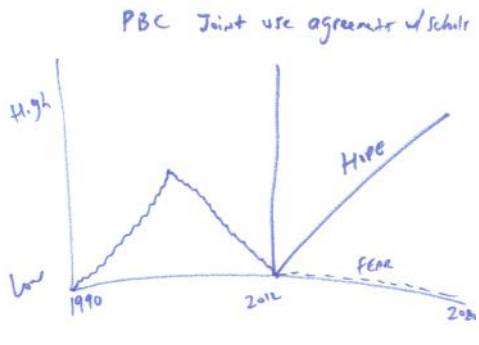

High Exposure
Media
"Depiction of Obesity"
Improvement
Low
High

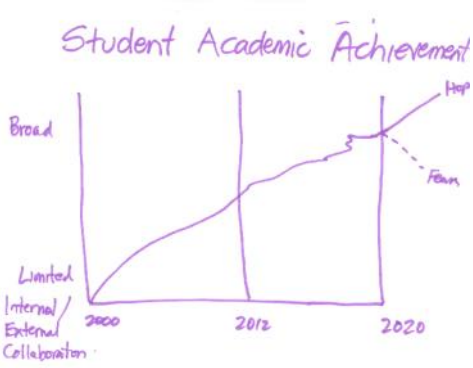

U.S. Population's Focus on Prevention
(& chronic disease)
High
Low
1992
2012
2032

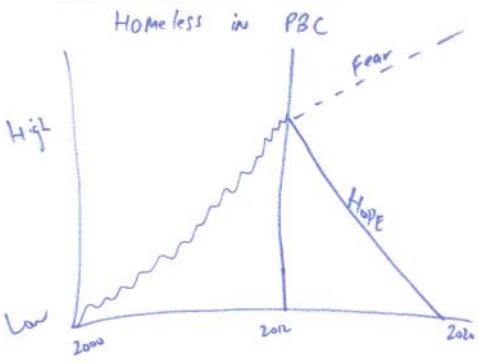

Diabetes in children
High
Low
Fear
Hope
2000
2012
2020


Obesity
High
Low
Fear
Hope
1980
2012
2050


Physical Education in Schools
High
Low
Hope
FEAR
2000
2012
2020


PBC Joint use agreements w/ Schools
High
Low
Hope
FEAR
1990
2012
2020


Student Academic Achievement
Broad
Limited
Internal/
External
Collaboration
Hope
Fear
2000
2012
2020


Homeless in PBC
High
Low
Fear
Hope
2000
2012
2020