Systems Thinking in Communities:

Understanding the Causes of Inactivity, Poor Diet/Nutrition, and Childhood Obesity in Jackson, Mississippi

This community storybook was developed by Transtria LLC.

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Acknowledgments

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Introduction

Jump Start Jackson 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 *Jump Start Jackson* project was to introduce systems thinking at the community level by identifying the essential parts of the Jackson, Mississippi 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 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., government agencies, community-based organizations, businesses) 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.

Jackson, Mississippi: Background and Local Participation

Jackson, with a population of 173,514, is the largest city in Mississippi. The city is considered the southern border of the Mississippi Delta and consists of three areas – north, south, and west. Jackson's population is 79.4% black, 18.4% white, and 1.6% Hispanic. The median income is $34,567 and about 27.5% of the population is below the poverty level. North Jackson's residents are mainly white and higher income, while South and West Jackson are predominantly African American and lower income.

The lead agency was My Brother's Keeper that was established in 1999. The mission of My Brother's Keeper is "to reduce health disparities among vulnerable populations through community based approaches, partnerships, and collaborations." The organization began by advocating for HIV prevention among African Americans and has expanded to include chronic diseases. The community partnership, Jump Start Jackson, was created as the result of Healthy Kids, Healthy Communities (HKHC) funding to increase healthy food options and access to opportunities for physical activity.

Jump Start Jackson was created as the result of HKHC funding to increase healthy food options and access to opportunities for physical activity. At the beginning of HKHC, Jump Start Jackson created an Agents of Change Coalition as part of the Mississippi Racial and Ethnic Health Disparities Action Institute (MS REHDAI). The coalition consisted of community stakeholders and key informants with a goal to "increase the capacity of local communities to impact health disparities."[11] More than 45 members from the community and 7 local and state organizations and universities were involved. Members felt there was not a clear purpose or structure and recommended that the coalition be restructured.

After the restructure, stakeholders and partners met frequently in small groups and had one-on-one meetings to work on specific strategies. Jackson Inner-City Gardeners, Washington Addition Neighborhood Association, and Mid-Town Partners were engaged in various components of the community garden initiative. The City of Jackson's Department of Parks and Recreation collaborated to make changes to Battlefield Park. Several other organizations were involved in HKHC, including government entities, universities, and non-profit organizations.

Jump Start Jackson's Priorities and Strategies

The partnership and capacity building strategies of *Jump Start Jackson* included:

- **Community Involvement:** Jump Start Jackson engaged community members through partnership meetings, events, town meetings, and assessment activities.
- **Agents of Change Coalition:** Jump Start Jackson created an Agents of Change Coalition as part of the Mississippi Racial and Ethnic Health Disparities Action Institute (MS REHDAI) to increase the capacity of local communities. The coalition consisted of community stakeholders and key informants.

The healthy eating and active living strategies of *Jump Start Jackson* included:

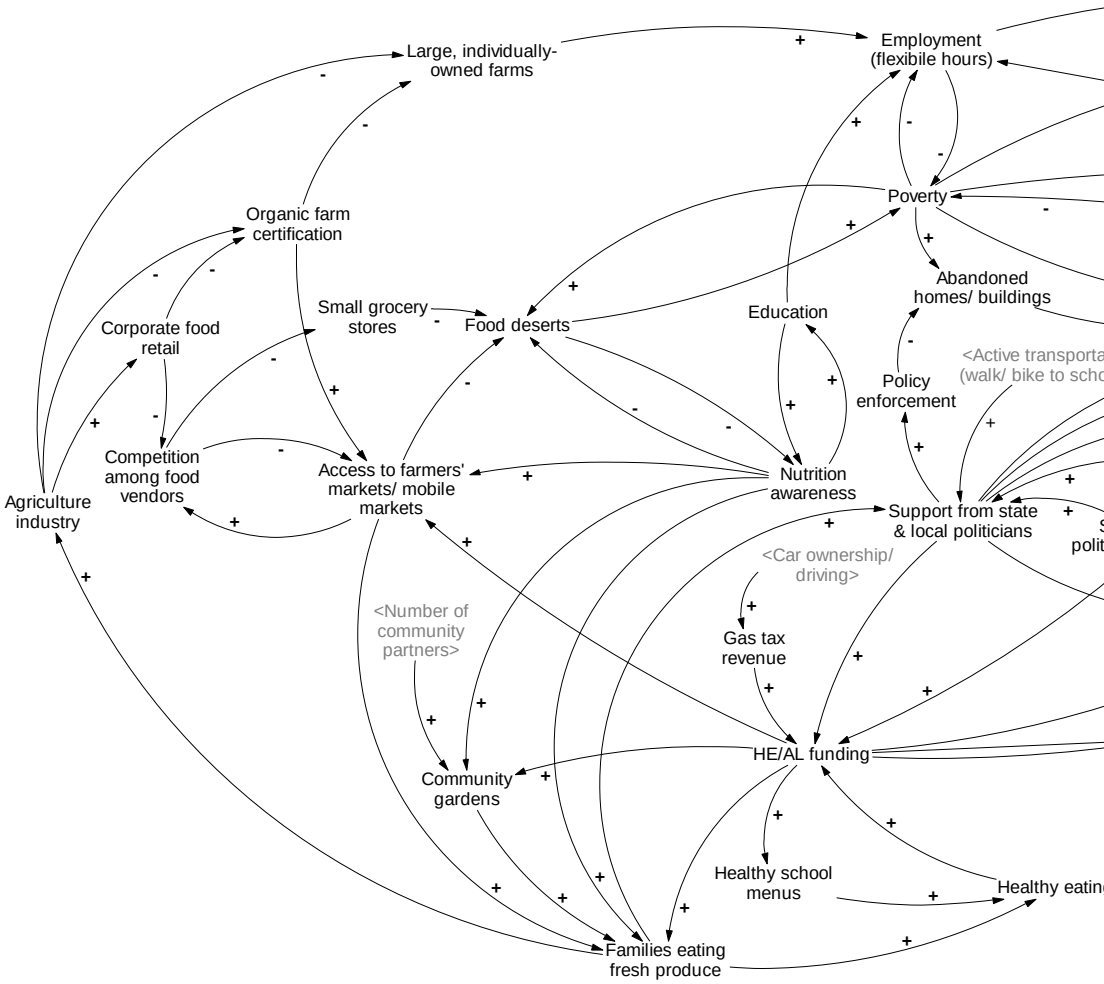
- **Farmers' Markets:** To increase access to affordable and healthy foods, Jump Start Jackson collaborated with the Mississippi Association of Cooperatives and the City of Jackson Department of Parks and Recreation to develop market guidelines; to identify, recruit, and certify farmers; and to establish Jump Start Jackson's Farmers' Market.
- **Community Gardens:** Jump Start Jackson collaborated with the Washington Addition Neighborhood Association and other local organizations to support, develop, and maintain community gardens in low-income neighborhoods.
- **Parks and Play Spaces:** In partnership with the City of Jackson Department of Parks and Recreation, a Green Space Policy was drafted and submitted for review. Plans were created and funds were received for the development of a walking trail in Battlefield Park.
- **Safe Routes to School:** Jump Start Jackson collaborated with Jackson Public Schools, Mississippi Department of Transportation, and the Mississippi State Department of Health's Safe Routes to School Program to increase awareness of and implement Safe Routes to School initiatives in Jackson Public Schools.

For more information on the partnership, please refer to the Jackson case report (www.transtria.com/hkhc).

Systems Thinking in Communities: Jackson, Mississippi

"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 Jackson, Mississippi 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.

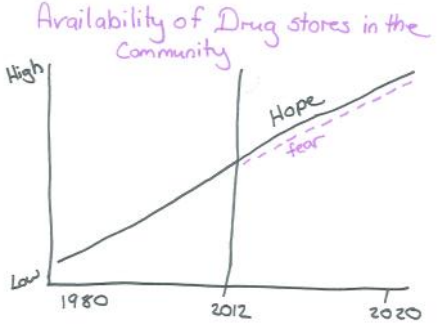
Figure 1: *Jump Start Jackson* Causal Loop Diagram



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.

Group Model Building

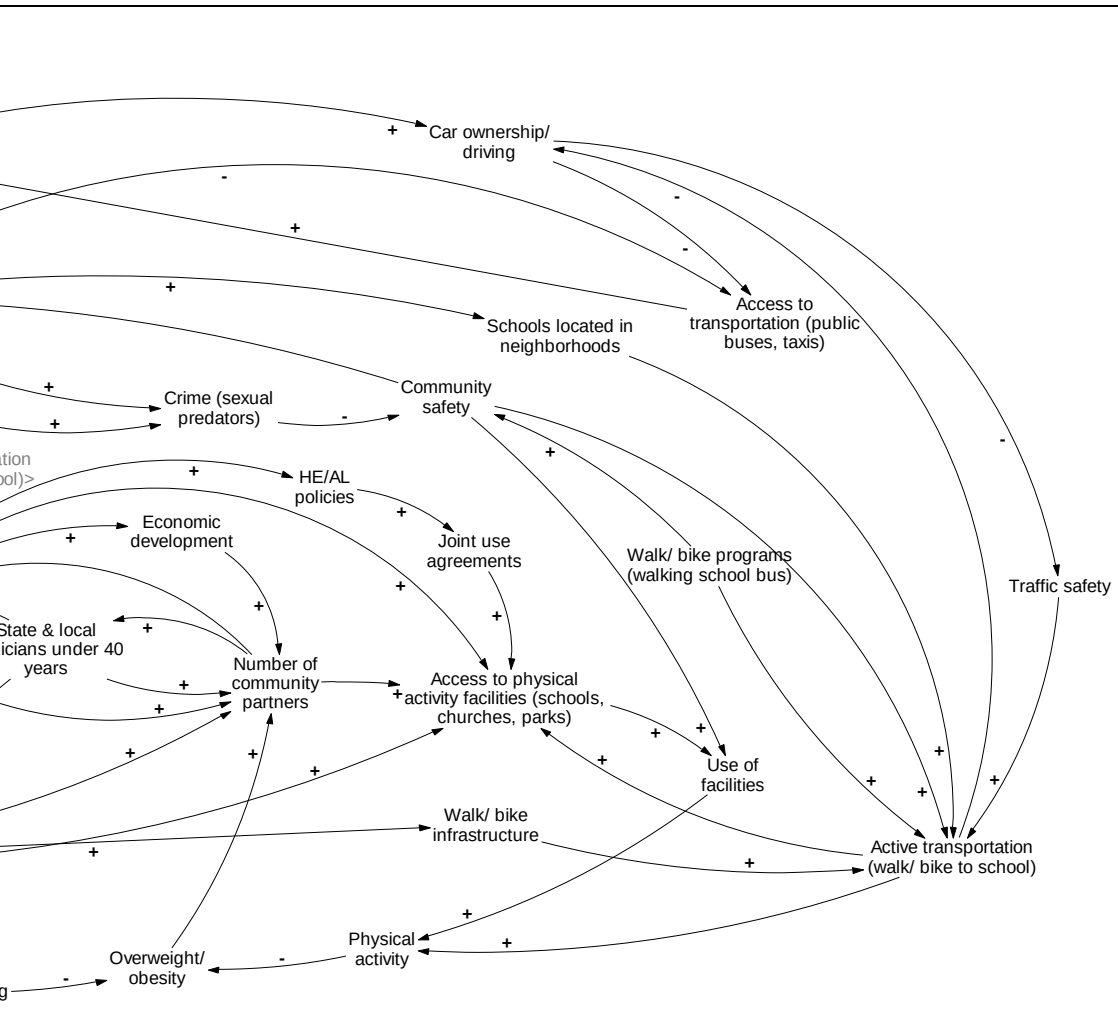
Members of the *Jump Start Jackson* partnership participated in a group model building session in July, 2012 and generated this system, also referred to as a causal loop diagram (Figure 1). Participants in the group model building session included representatives from government agencies, community-based organizations, businesses. 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 Jackson 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 the availability of drug stores in the community, the number

of drug stores has steadily increased since 1980 and the participant hopes that this increase will continue 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: support from state and local politicians → economic development → number of community partners → support from state and local politicians.

What is important to notice is that there are other feedback loops interacting simultaneously to influence or to be influenced by support from state and local politicians. Some variables may increase support from state and local politicians 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 *Jump Start Jackson* 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 Jackson, Mississippi and to stimulate greater conversation related to Jackson'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 Jackson, Mississippi. 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.

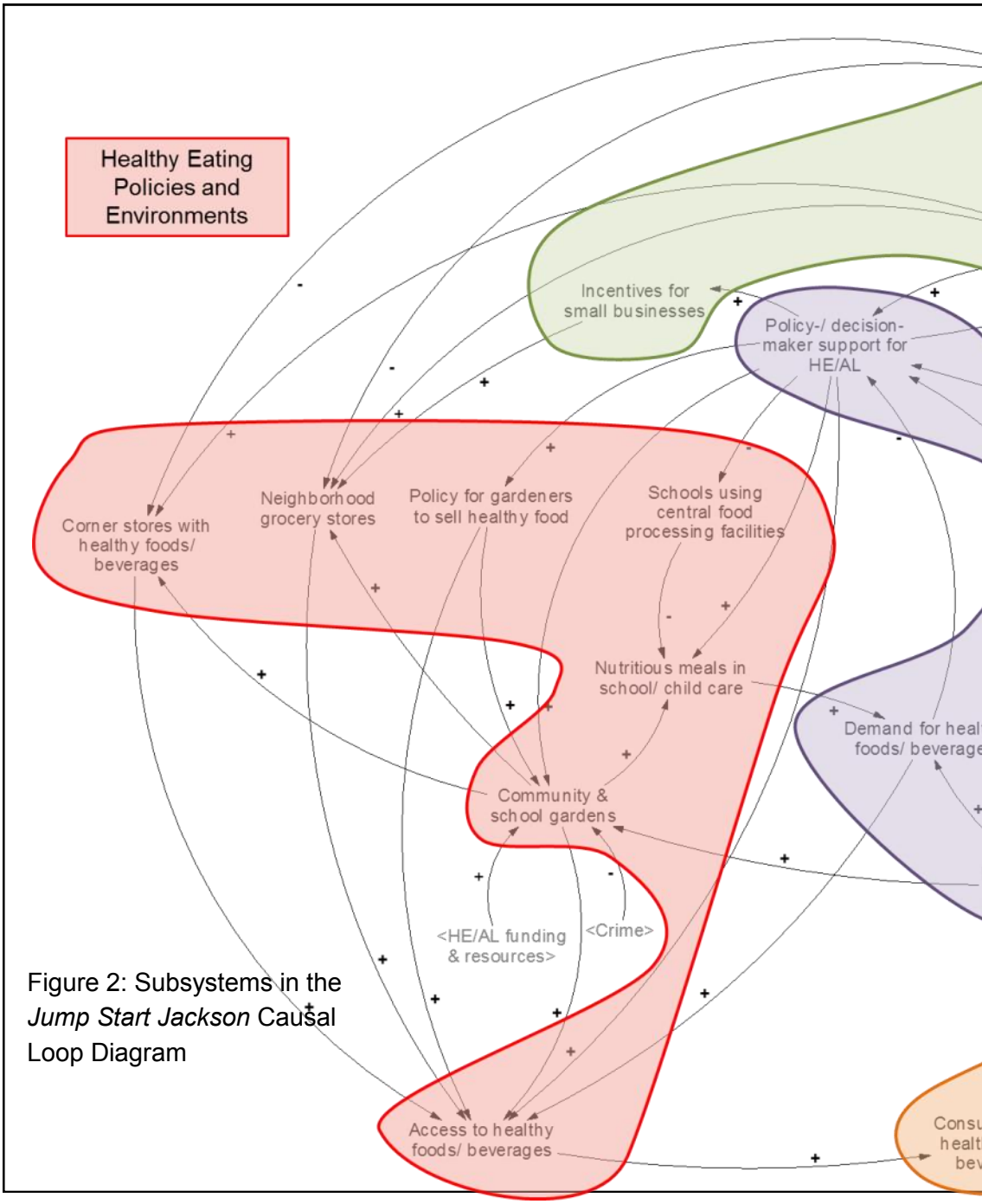


Figure 2: Subsystems in the *Jump Start Jackson* Causal Loop Diagram

Healthy Eating Policies and Environments (Red)

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 four graphs related to policy or environmental strategies (e.g., community gardens) or contexts (e.g., agriculture industry) that affected or were affected by the work of *Jump Start Jackson*. The variables represent participants' conversations from the behavior over time graph and causal loop diagram exercises.

Active Living Policies and Environments (Blue)

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 four graphs related to policy or environmental strategies (e.g., joint use agreements) or contexts (e.g., traffic safety) that affected or were affected by the partnership's work.

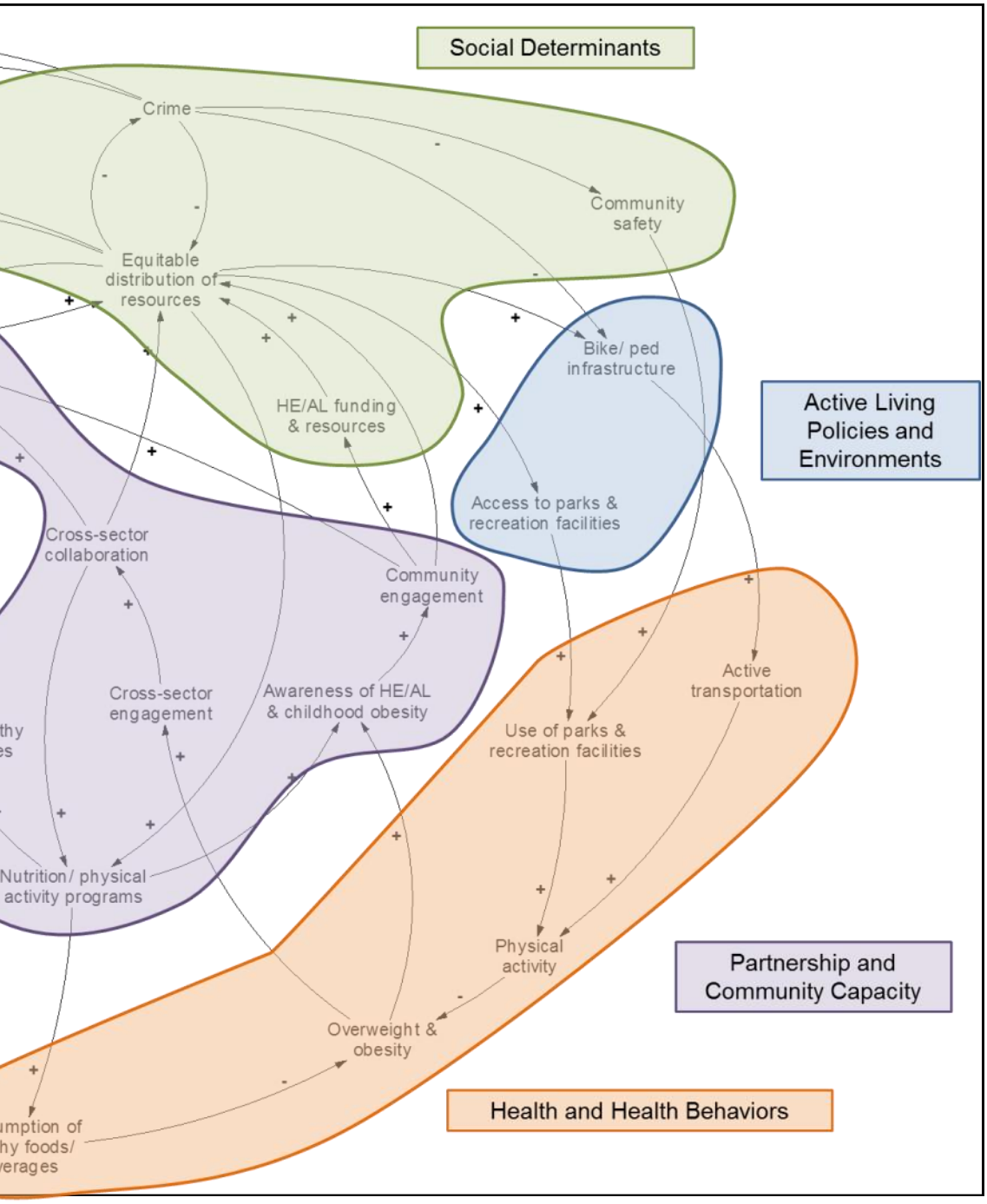
Health and Health Behaviors (Orange)

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., families eating fresh produce, active transportation).

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, *Jump Start Jackson* worked to increase the number of community partners. This subsystem also includes community factors outside the partnership that may influence or be influenced by their efforts, such as the number of state and local politicians under 40 years of age.



Social Determinants

Finally, the social determinants subsystem denotes societal conditions (e.g., poverty) and psychosocial influences (e.g., perceptions of community 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.

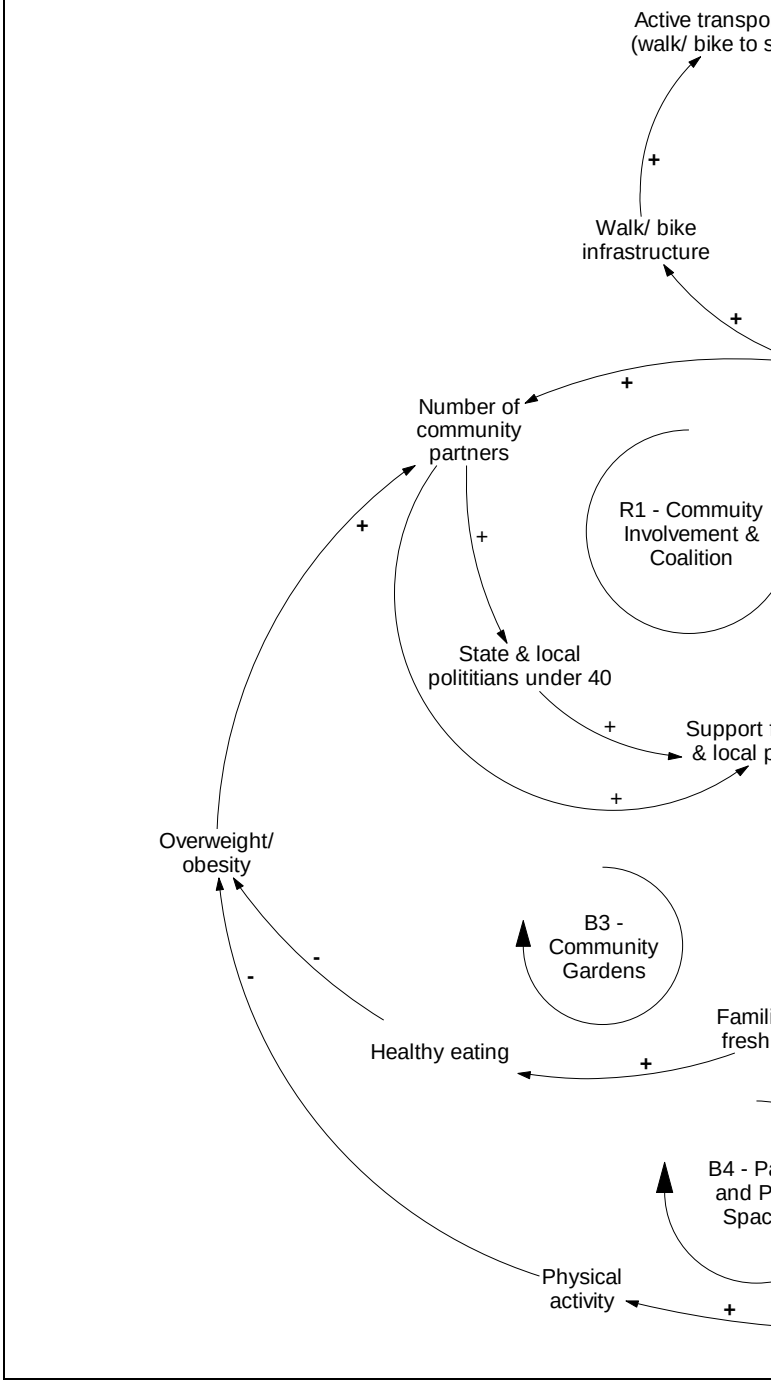
Each one of these subsystems has many more variables, causal relationships (arrows), and feedback loops that can be explored in greater depth by the *Jump Start Jackson* partners or by other representatives in Jackson, Mississippi. Using this CLD as a starting place, community conversations about different theories of change within subsystems may continue to take place.

The next sections begin to examine the feedback loops central to the work of *Jump Start Jackson*. 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.

Farmers' Markets Feedback Loop

To simplify the discussion about feedback loops, several loops drawn from the Jump Start Jackson CLD (see Figures 1 and 2) are highlighted in Figure 3. While the CLD provides a theory of change for the childhood obesity prevention movement in Jackson, Mississippi, each feedback loop tells a story about a more specific change process.

Figure 3: Farmers' Markets Feedback Loop



Causal Story for Feedback Loop

Story A: In this case , the story is about farmers' markets (orange highlighted loop in Figure 3). Jackson, Mississippi developed market guidelines to identify, recruit, and certify farmers as well as to establish Jump Start Jackson's Farmers' Market. Participants described how organic farm certification increases access to farmers' markets and mobile markets, thus increasing the number of families eating fresh produce. In turn, this demand for fresh produce can stimulate the agriculture industry to boost production of fresh fruits and vegetables, thereby increasing sales of these products in corporate retail settings. At some point, this movement leads to an abundance of farms growing fresh produce and reduces the need for organic farm certification as this is now driven by consumer demand.

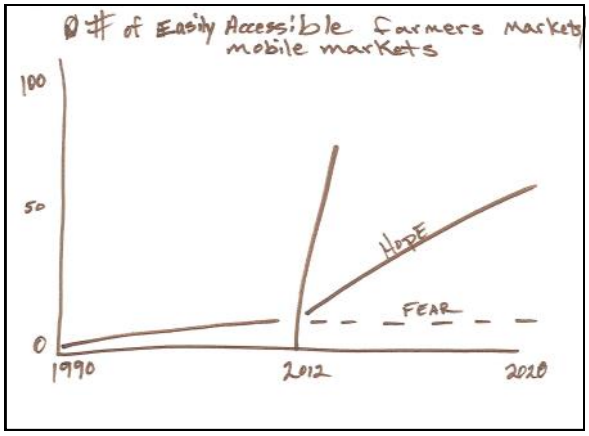
Story B: While the preceding story reflected a positive scenario for Jackson, Mississippi, the same feedback loop also tells the opposite story. Without organic farm certification, access to farmers' markets and mobile markets may be diminished, limiting the number of families eating fresh produce. In turn, the agriculture industry and corporate food retail will not likely boost availability and sales of these products.

Balancing Loop and Notation

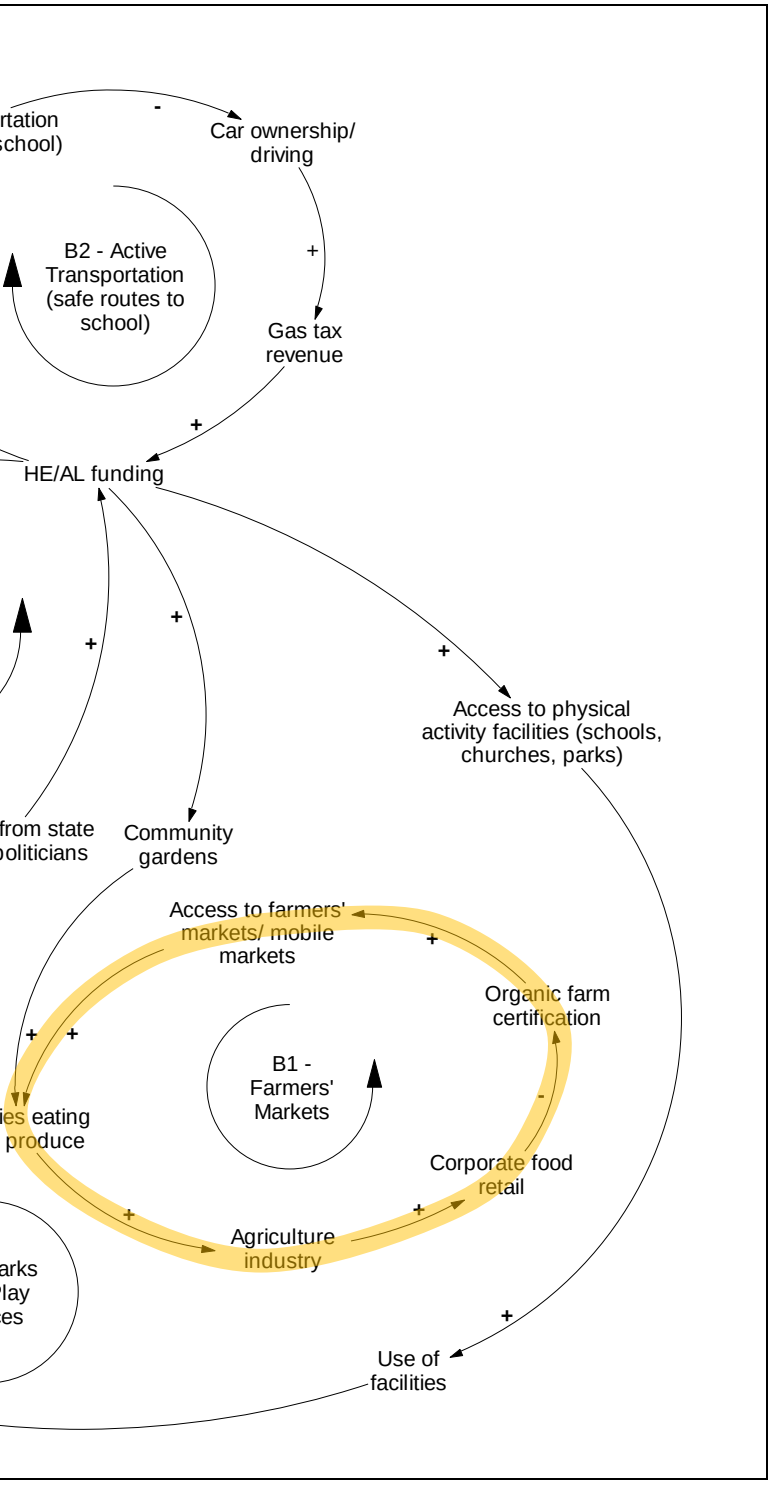
These stories represent a balancing loop, and the notation in the feedback loop identifies it as a balancing loop (see "B1 — Farmers' Markets" and orange highlighted loop in Figure 3). The words represent variables of quantities that increase and decrease as illustrated in the stories above. These variables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

"The few markets that are in the particular communities, they try to keep it small so they don't overdo themselves or overextend themselves to where they're spending out more than they're bringing in because it still has to be sustainable [as a business]. And I think that because of all the health talk, you have a lot more fast food restaurants that are switching their menus to be more health conscious. We're still in a microwave society where people want to get it now and go, even for their children; we still prefer fast food." (Participant)

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.



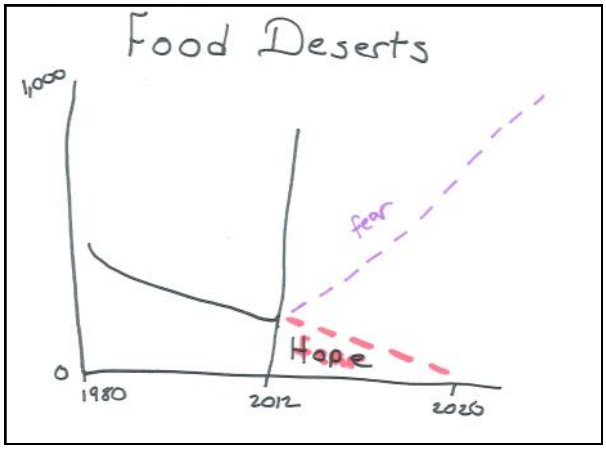
In isolation, this balancing loop represents the influence of farmers' markets and mobile markets on consumption of fresh produce and the response of the food industry to this demand. To understand other influences on these variables, it is important to remember that this balancing loop is only one part 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 *Jump Start Jackson*</u>

Participants identified a slight increase in the number of easily accessible farmers' markets and mobile markets in Jackson, Mississippi, despite this overall number remaining extremely low (see above behavior over time graph). Similarly, there has been a decline in the number of food deserts, but partners want to see this number drop off (see below behavior over time graph).

From the systems thinking exercises, several insights can inform partners' farmers' markets and mobile markets strategy. For instance, sustaining the markets in the face of competition from the agriculture industry and corporate food retail requires planning with the community to determine how to retain the consumer base.

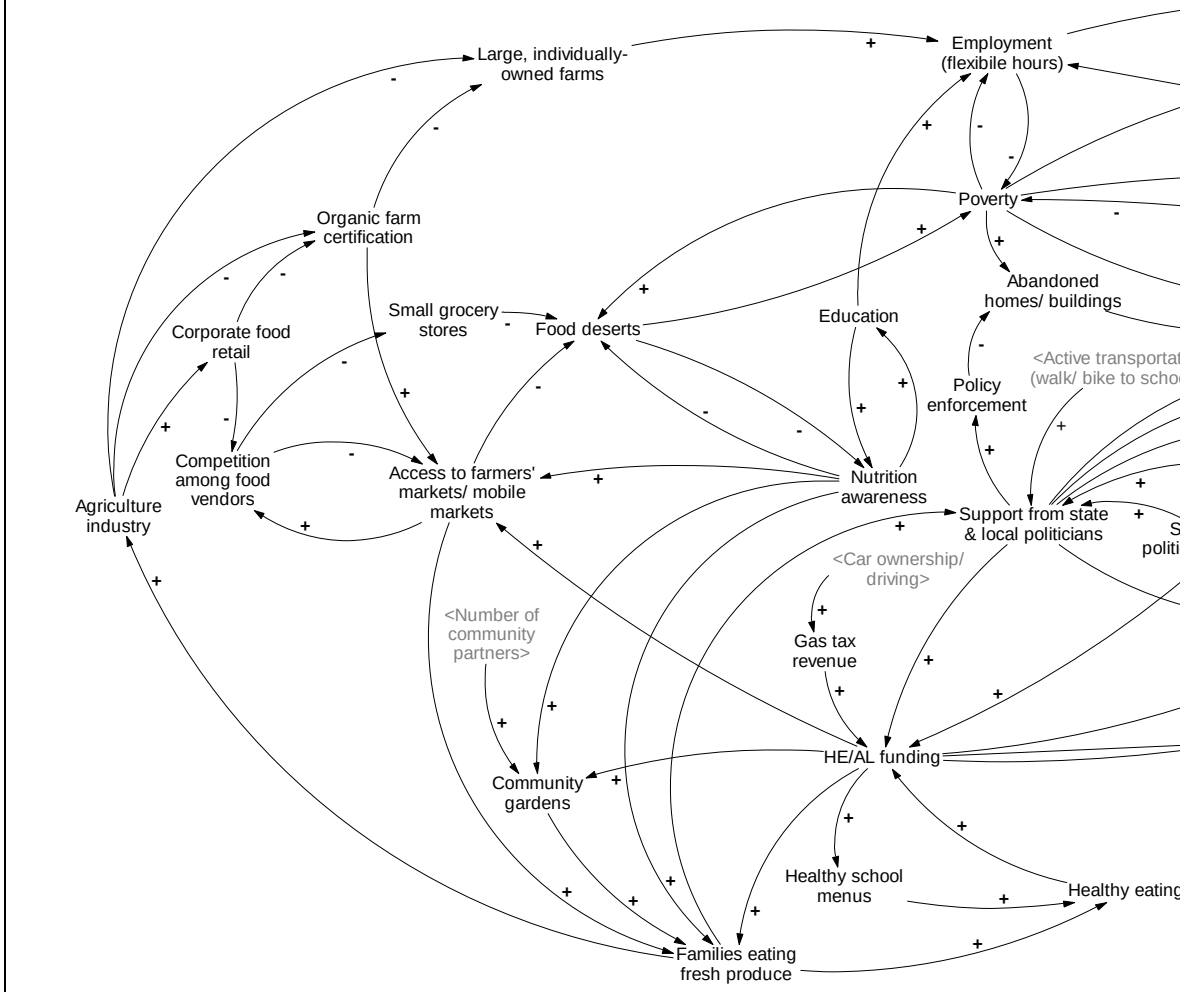
In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including methods and measures to conduct an economic evaluation of the feasibility of sustaining the farmers' markets and mobile markets in the face of increased competition from the agriculture industry and corporate food retail.



Opportunities for Systems Thinking in Jackson, Mississippi

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 *Jump Start Jackson* partners, this storybook also summarized the healthy eating, active living, partnership and community capacity, social determinants, and health and health behaviors subsystems in the Jackson causal loop diagram as well as an example feedback loop corresponding to the partnership's primary strategies.

Figure 4: *Jump Start Jackson* 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 Jackson, Mississippi to promote healthy eating and active living as well as preventing childhood overweight and obesity.

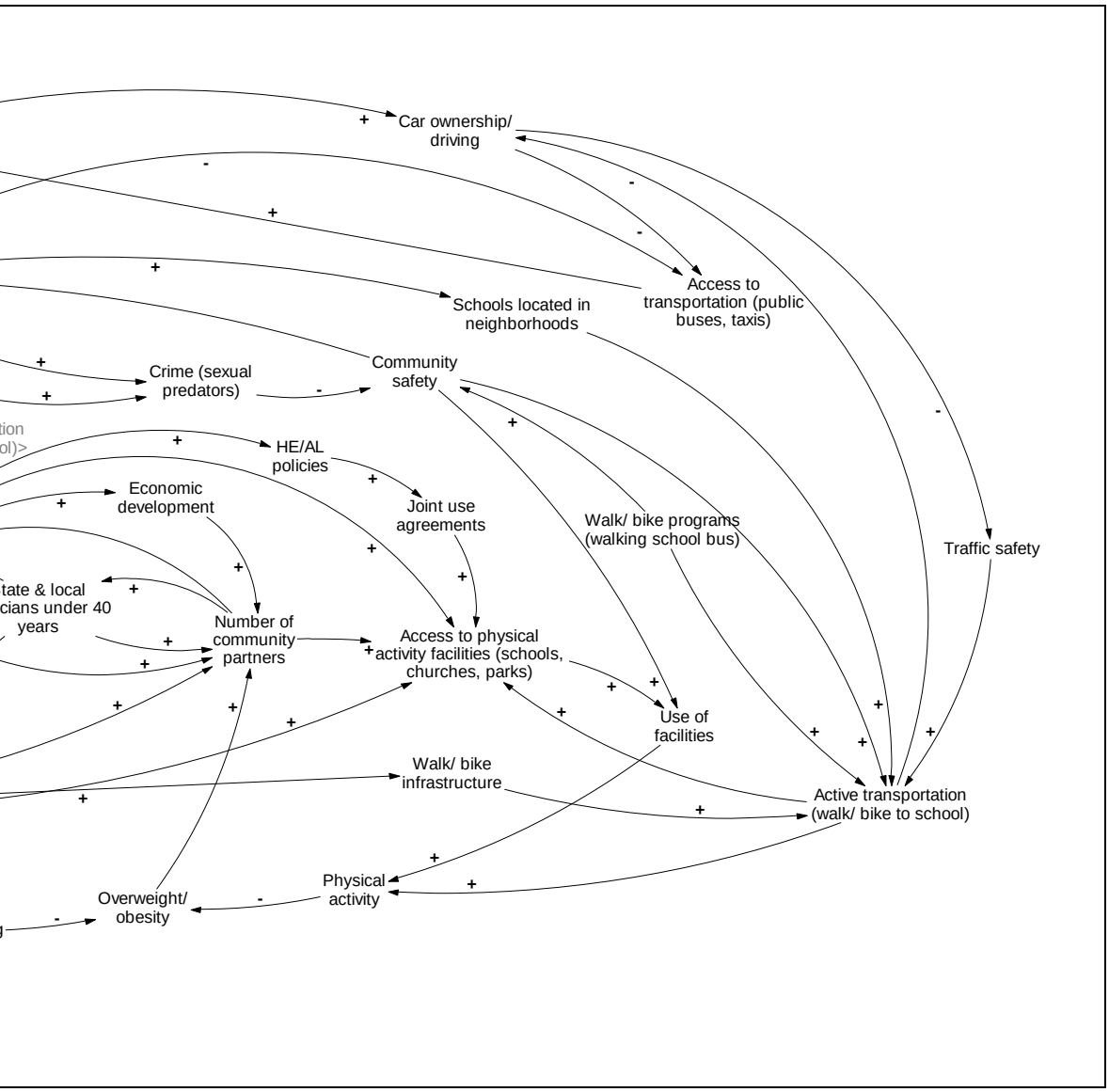
Yet, there are several limitations to this storybook, including:

- the participants represent a sample of the *Jump Start Jackson* 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 E) 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 complete street policies, mental health, availability and use of drug stores, chronic diseases, convenience stores, fast food restaurants, purchase/ consumption of unhealthy, processed foods/ beverages, suburban sprawl, social media, youth engagement, high impact clinical services, advocacy, liability (facilities), smoke free policies, cigarette tax revenue, cost of market insurance; 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 Jackson 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: Photograph of the original version of the *Jump Start Jackson* Causal Loop Diagram
- Appendix C: Original translation of the causal loop diagram into Vensim PLE
- Appendix D: Transcript translation of the causal loop diagram into Vensim PLE
- Appendix E: 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.

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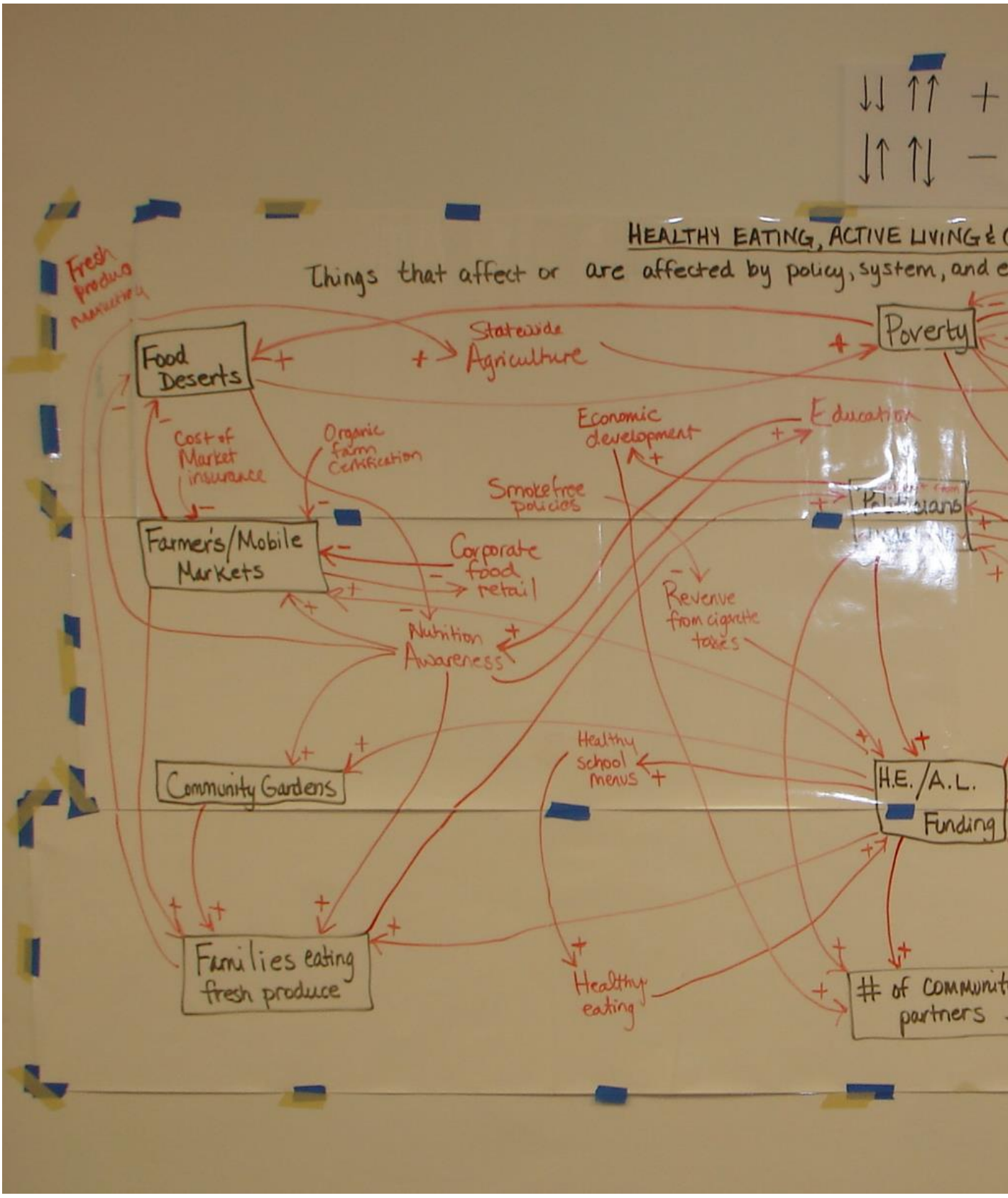
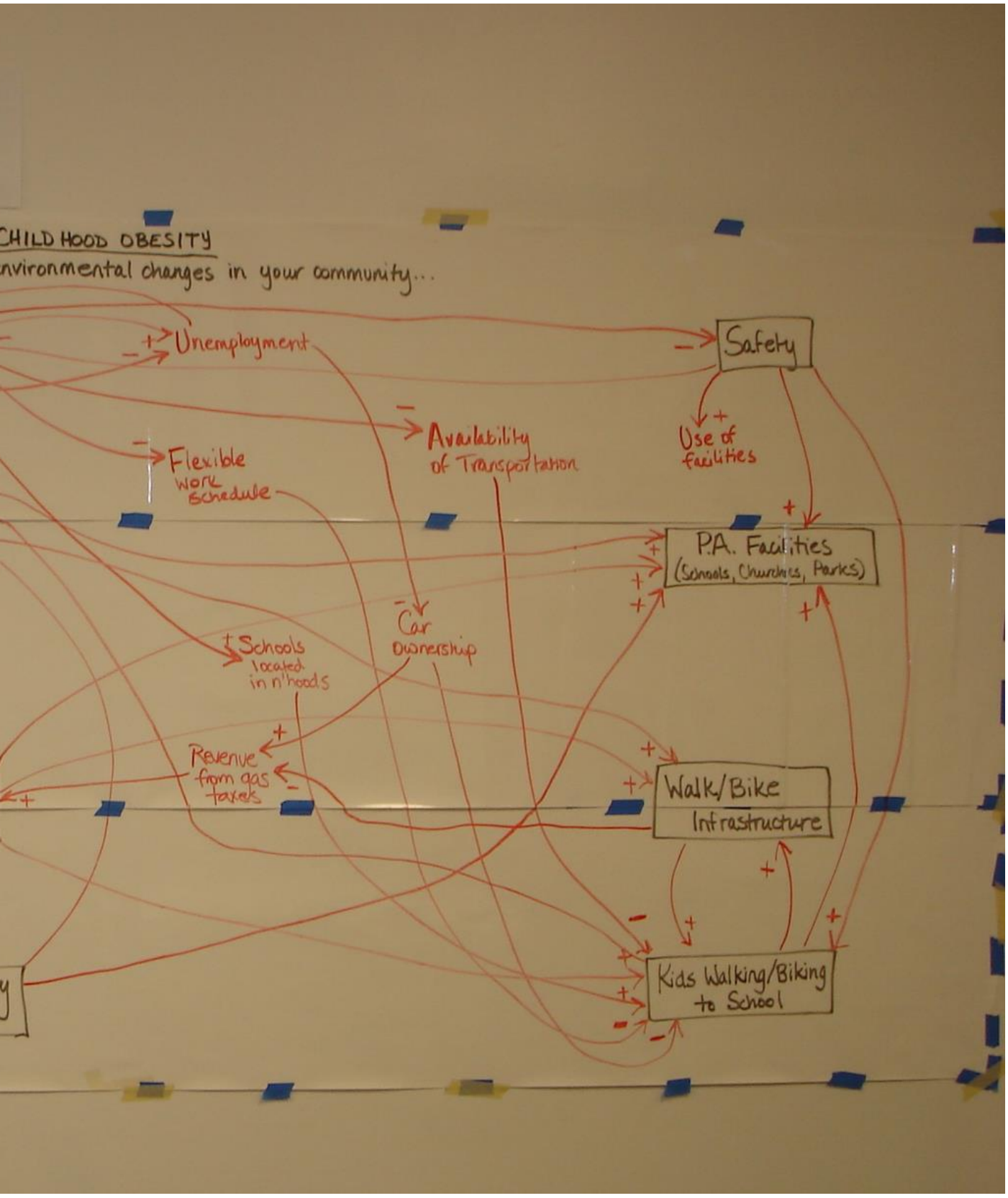
Zagonel, A. and J. Rohrbaugh (2008). Using group model building to inform public policy making and implementation. Complex Decision Making. H. Qudart-Ullah, J. M. Spector and P. I. Davidsen, Springer-Verlag: 113-138.

Appendix A: Behavior Over Time Graphs Generated during Site Visit

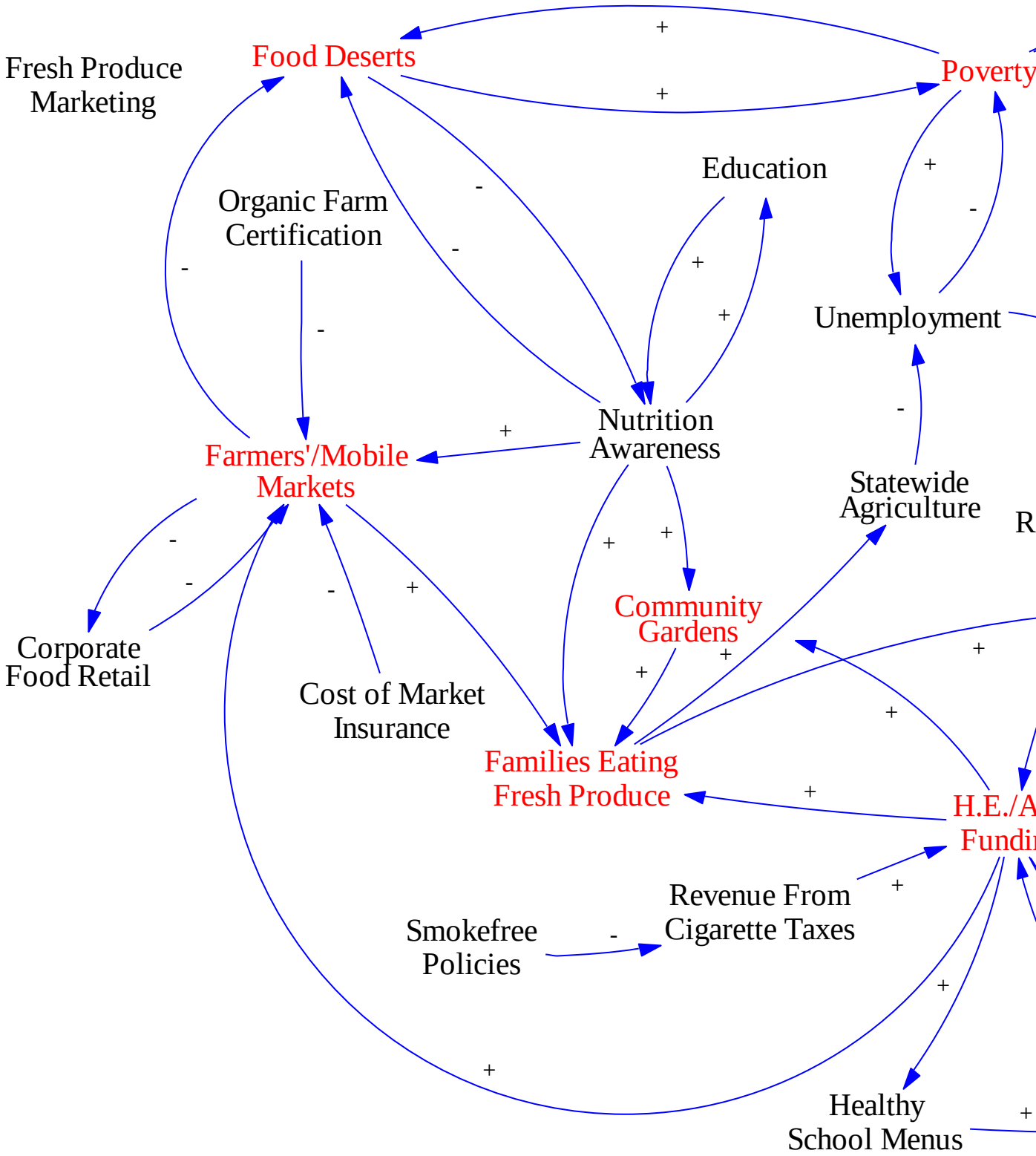
Community: *Jump Start Jackson*	
Categories	**Number of Graphs**
Active Living Behavior	3
Active Living Environments	1
Funding	1
Healthy Eating Behavior	0
Healthy Eating Environments	4
Marketing and Media Coverage	0
Obesity and Long Term Outcomes	2
Partnership & Community Capacity	2
Policies	4
Programs & Promotions (Education and Awareness)	3
Social Determinants of Health	2
Total Graphs	**22**

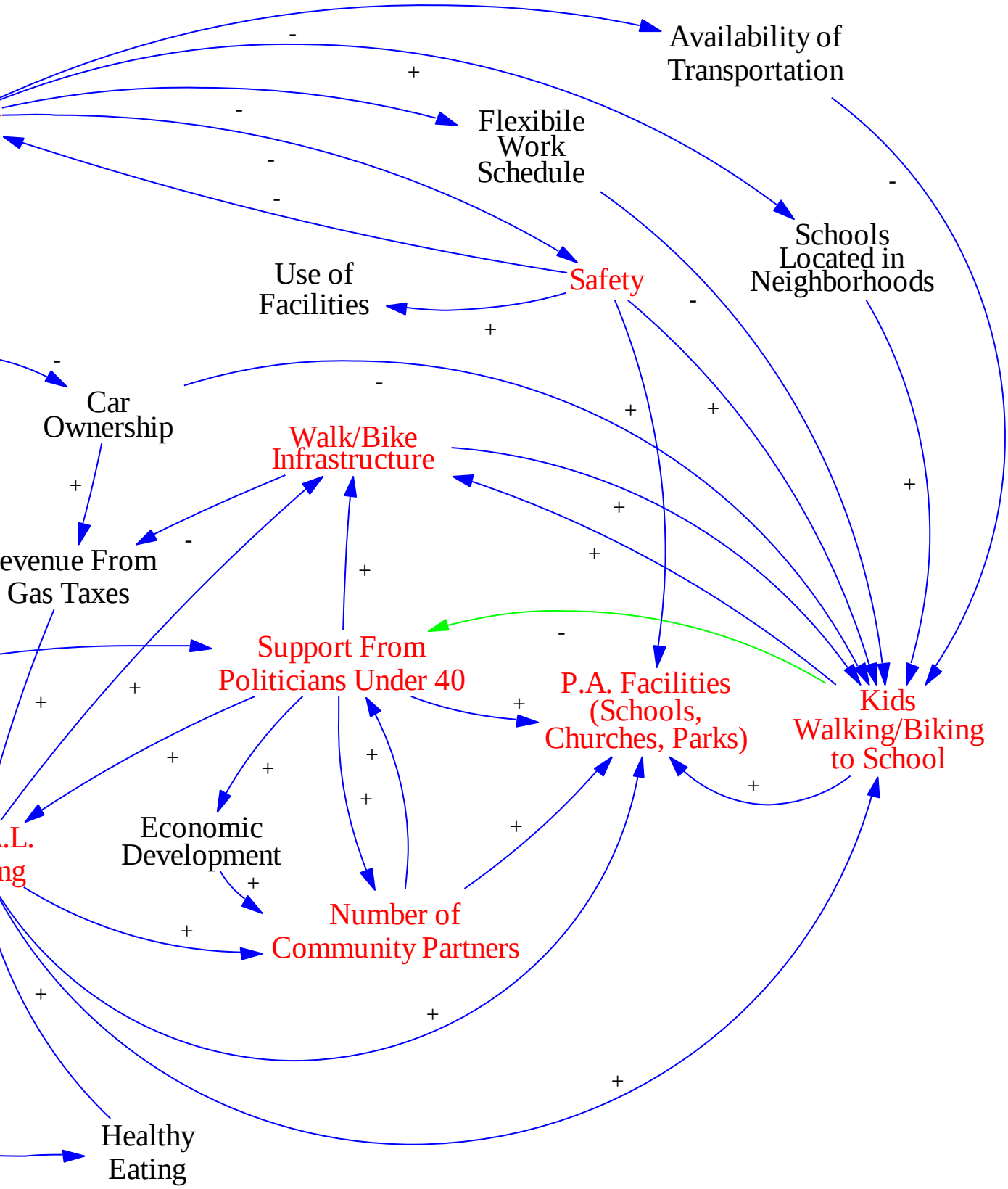
Appendix B: Photograph of the Original Version of the *Jump Start Jackson* Causal Loop Diagram



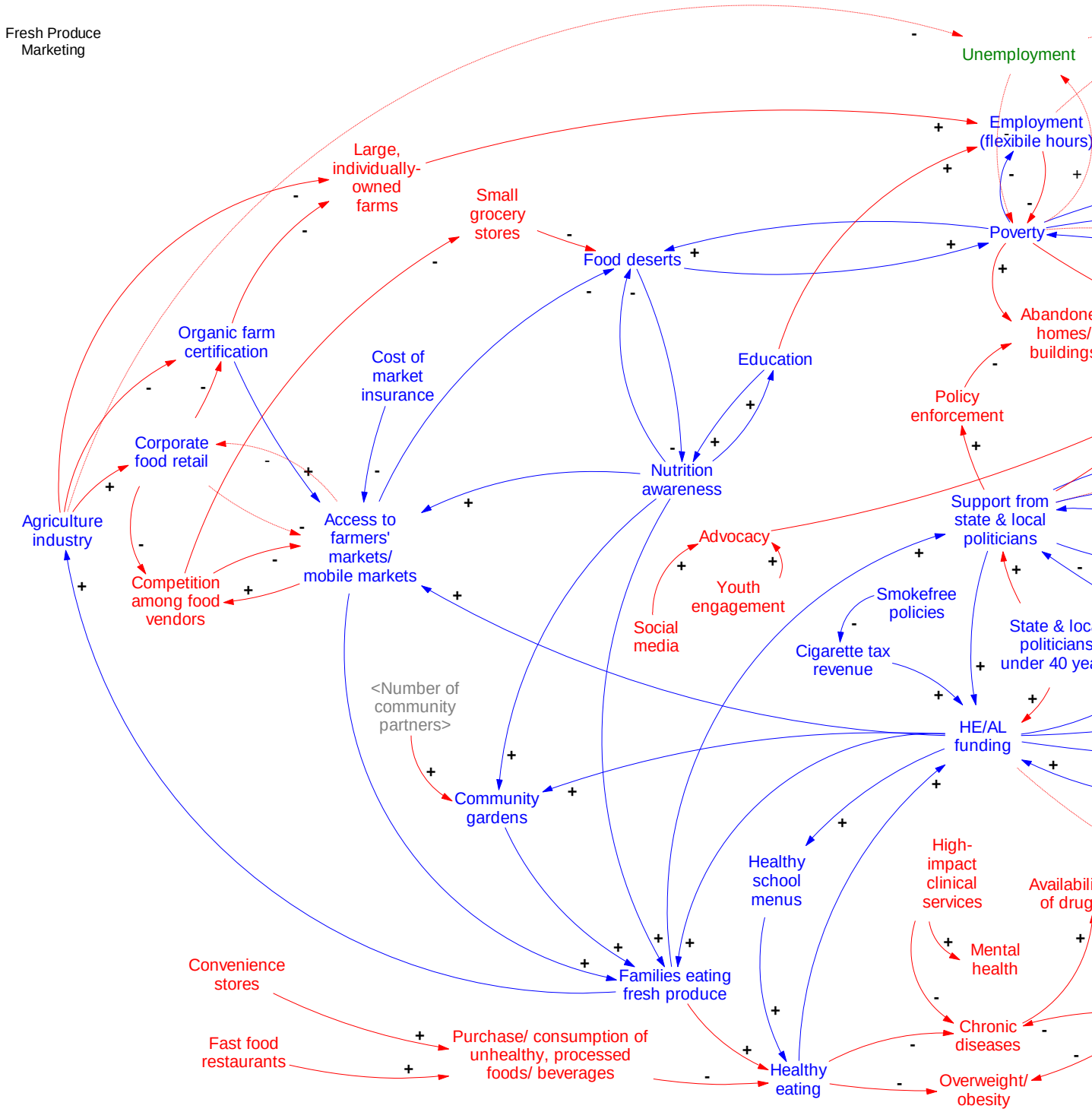

CHILD HOOD OBESITY
nvironmental changes in your community...
Unemployment
Safety
Availability of Transportation
Use of facilities
Flexible work schedule
P.A. Facilities (Schools, Churches, Parks)
Car ownership
Schools located in n'hoods
Revenue from gas taxes
Walk/Bike Infrastructure
Kids Walking/Biking to School

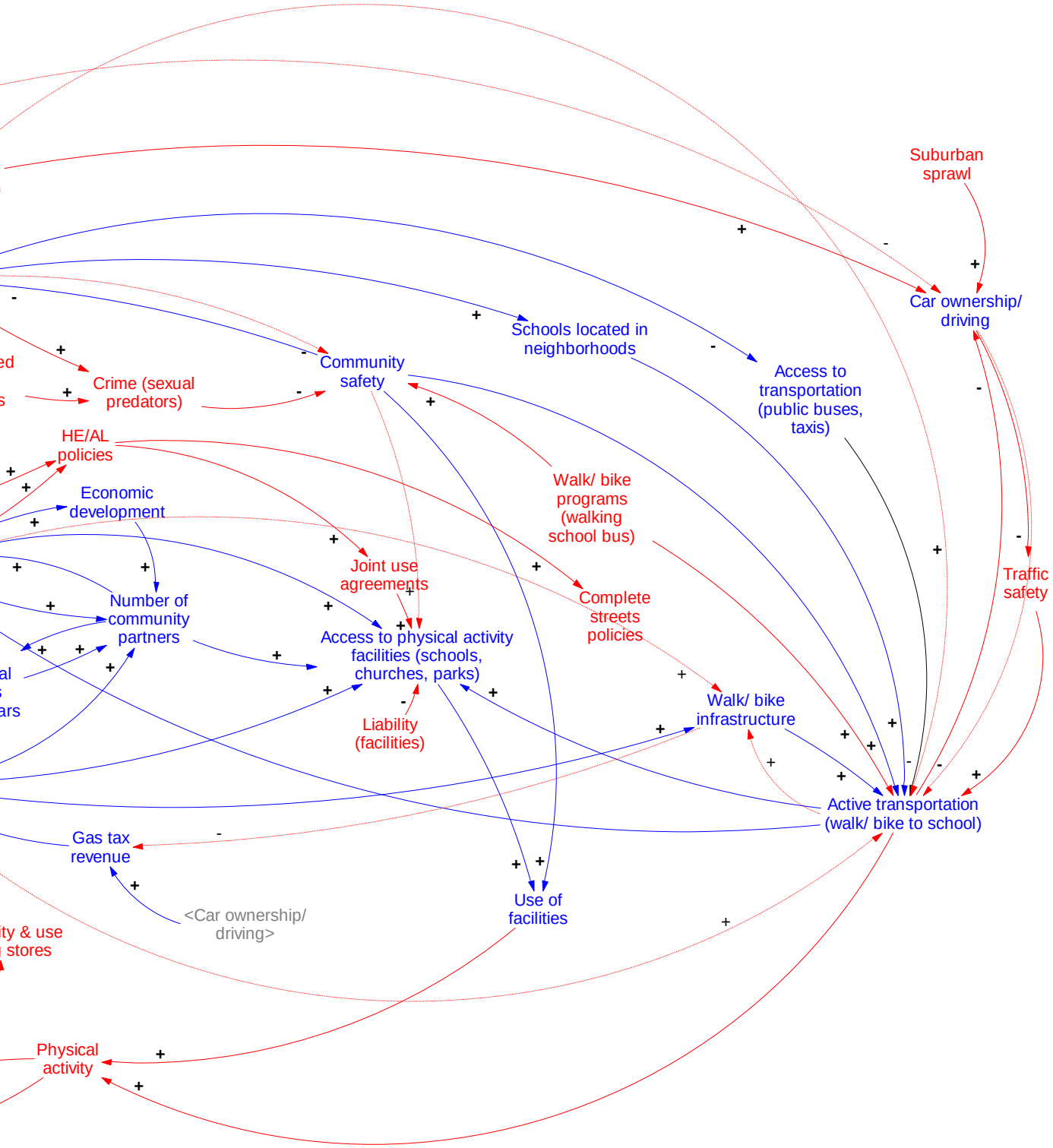
Appendix C: Original Translation of the Causal Loop Diagram into Vensim PLE



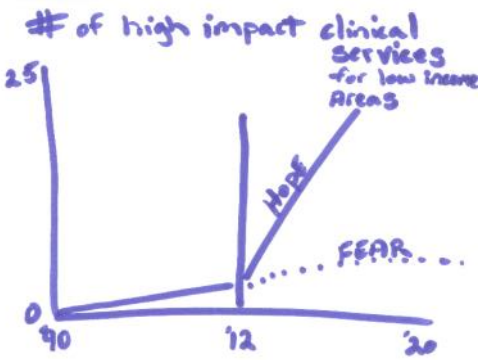

Availability of Transportation
Flexibile Work Schedule
Schools Located in Neighborhoods
Use of Facilities
Safety
Car Ownership
Walk/Bike Infrastructure
evenue From Gas Taxes
Support From Politicians Under 40
P.A. Facilities (Schools, Churches, Parks)
Kids Walking/Biking to School
.L. ng
Economic Development
Number of Community Partners
Healthy Eating

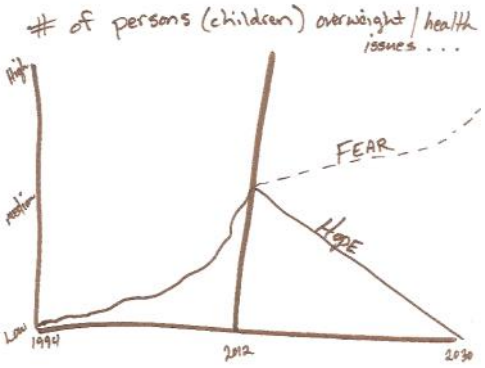
Appendix D: Transcript Translation of the Causal Loop Diagram into Vensim PLE

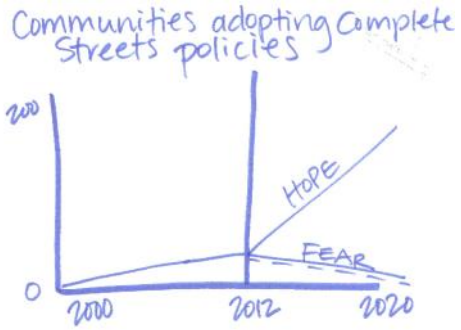


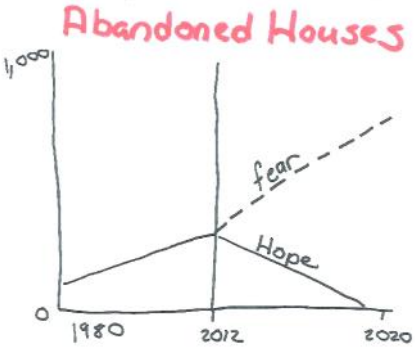

Suburban sprawl
Car ownership/ driving
Schools located in neighborhoods
Community safety
Crime (sexual predators)
Access to transportation (public buses, taxis)
HE/AL policies
Economic development
Walk/ bike programs (walking school bus)
Joint use agreements
Traffic safety
Number of community partners
Complete streets policies
Access to physical activity facilities (schools, churches, parks)
Walk/ bike infrastructure
Liability (facilities)
Active transportation (walk/ bike to school)
Gas tax revenue
<Car ownership/ driving>
Use of facilities
Physical activity

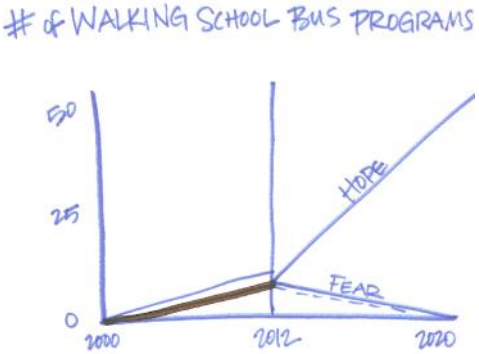
Appendix E: Behavior Over Time Graphs not Represented in the Storybook

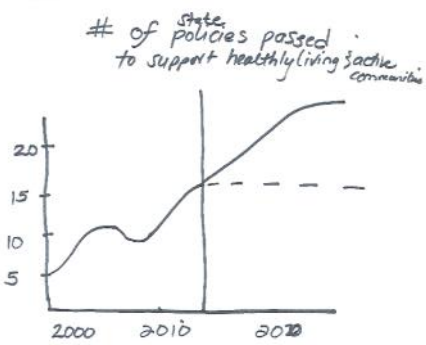


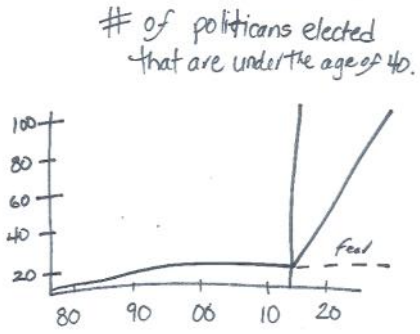


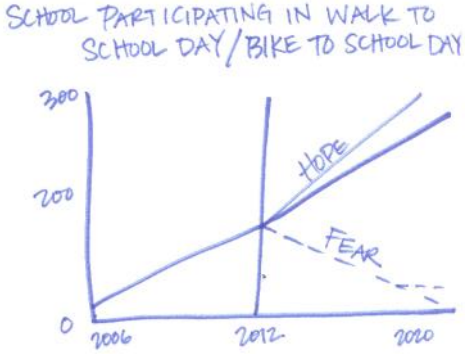


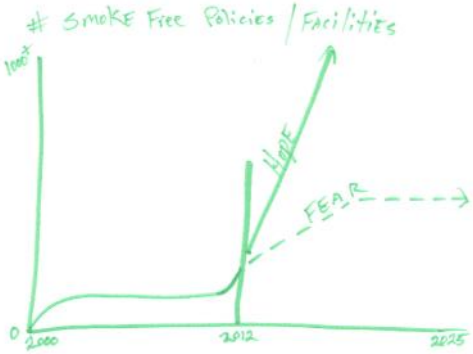


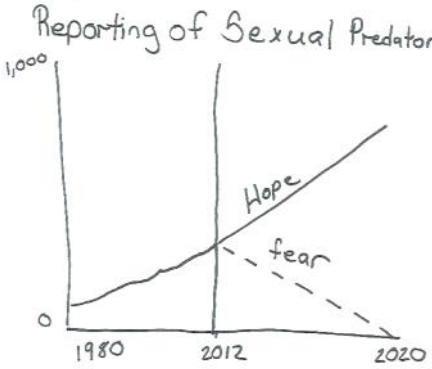


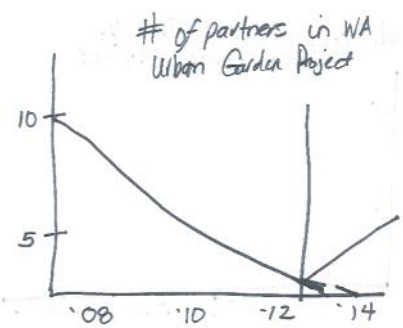


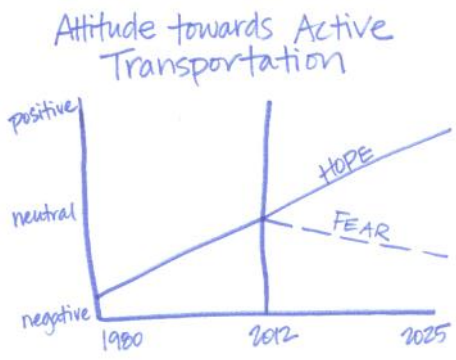


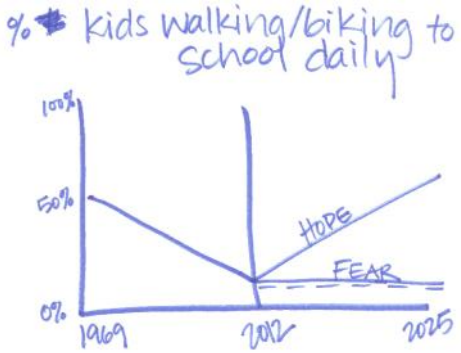











% kids walking/biking to school daily
100%
50%
0%
1969
2012
2025
HOPE
FEAR