Systems Thinking in Communities:

Understanding the Causes of Inactivity, Poor Diet/Nutrition, and Childhood Obesity in San Antonio, Texas

This community storybook was developed by Transtria LLC.

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Acknowledgments

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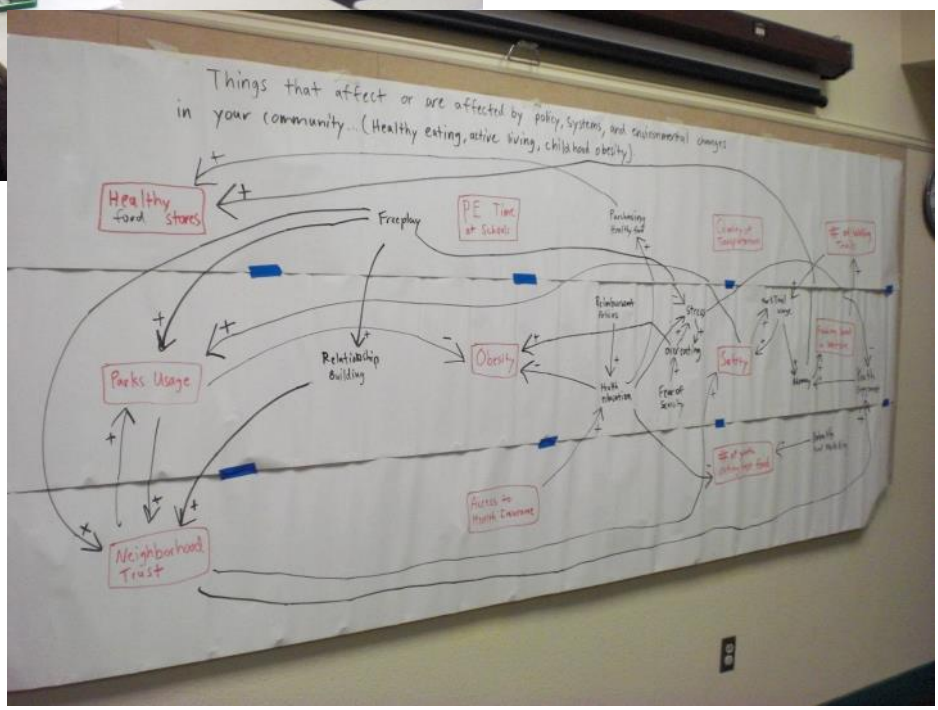

Things that affect or are affected by policy, systems, and environmental changes
in your community... (Healthy eating, active living, childhood obesity)
Healthy food stores
Freeplay
PE Time at Schools
Parks Usage
Relationship Building
Obesity
Safety
Neighborhood Trust
Access to Health Insurance

Introduction

HKHC San Antonio 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 *HKHC San Antonio* project was to introduce systems thinking at the community level by identifying the essential parts of the San Antonio 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, schools, community-based organizations, businesses, policy/advocacy organizations, government agencies) 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.

San Antonio, Texas : Background and Local Participation

San Antonio is the second largest city in Texas and the seventh largest in the United States. The Healthy Kids, Healthy Communities San Antonio partnership focused its efforts in San Antonio's Westside neighborhood. The Westside is home to 107,497 residents. Over 96% of the residents are Hispanic. The partnership focused many of its efforts in the Collins Garden and Avenida Guadalupe neighborhood associations within the Westside neighborhood.

San Antonio Metropolitan Health District, in partnership with the Westside Development Corporation, Health Collaborative, University of Texas Health Science Center School of Nursing, and the San Antonio Planning Department, formed the HKHC San Antonio partnership in 2008-2009 in response to the HKHC proposal. San Antonio Metropolitan Health District (Metro Health) was the lead agency for the Healthy Kids, Healthy Communities (HKHC) San Antonio partnership. Metro Health experienced significant turnover of administrative staff (i.e., new Director and new Assistant Directors) during the project. The transition presented some challenges to the partnership staff but it did not negatively influence the work of HKHC San Antonio. The new Metro Health leadership was very supportive of HKHC San Antonio.

The partnership operated under an informal structure and organized under strategy-specific workgroups: Complete Streets, Green Space, and Healthy Restaurants. The partnership did not hold full membership meetings, but the workgroups met regularly to advance their efforts (see Appendix C for a list of all partners). The Complete Streets and Green Space workgroups disbanded after meeting their deliverables. The Healthy Restaurants workgroup continued to meet semi-annually after the HKHC project.

As a result of the HKHC project, Metro Health established relationships with the City of San Antonio Planning, Economic, and Parks departments. Partnership staff viewed the HKHC collaborative approach as transformational for the health department in terms of how it approached projects and initiatives. Metro Health established plans to ensure the departments continued to collaborate in the future. Partnership staff were confident that the relationships with other city departments, community organizations, and businesses established through HKHC would continue beyond the grant.

HKHC San Antonio's Priorities and Strategies

The partnership and capacity building strategies of HKHC San Antonio included:

- **Healthy Hubs:** The partnership created Healthy Hubs community planning to approach healthy eating and active living policy and environmental changes in a concentrated geographical area. A Healthy Hub needed to have at minimum one healthy eating resource and one physical activity resource, walkability and bikeability, and strong community engagement. The Healthy Hub concept was piloted in the Collins Garden neighborhood with Communities Putting Prevention to Work (CPPW) funds. Key stakeholders and community residents contributed to the planning and implementation of the Collins Garden Healthy Hub.

The healthy eating and active living strategies of HKHC San Antonio included:

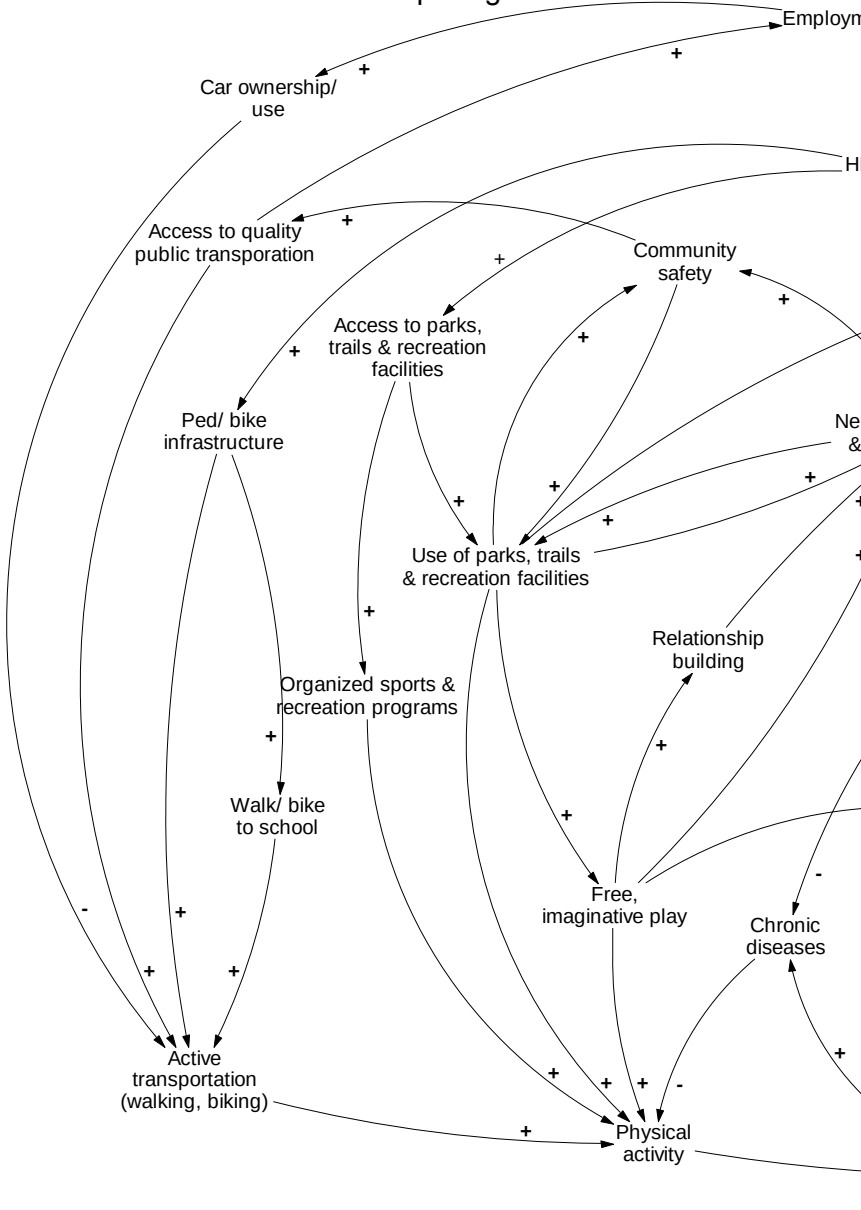
- **Parks and Play Spaces:** HKHC San Antonio and San Antonio Metro Health collaborated with the Edgewood Independent School District, San Antonio Independent School District, and Northeast Independent School District to develop and implement shared use agreements. The shared use agreements permitted community access to playgrounds, school yards, and green space and implemented environmental changes at multiple schools. HKHC San Antonio implemented environmental changes and increased physical activity programming in Collins Garden Park as part of the Healthy Hub pilot project.
- **Active Transportation:** San Antonio's Complete Streets policy was adopted, and a street and infrastructure bond was passed to fund elements of the Complete Streets policy. HKHC San Antonio and partners provided training and input regarding street design protocols and Complete Streets concepts. The partnership also implemented environmental changes in Collins Garden as part of the Healthy Hub pilot project.
- **Access to Healthy Food:** HKHC San Antonio implemented practice and environmental changes at food service establishments and corner stores throughout San Antonio with the creation of its ¡Por Vida! and Tiendita ¡Por Vida! programs.

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

Systems Thinking in Communities: San Antonio, Texas

"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 San Antonio, Texas 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: *HKHC San Antonio* Causal Loop Diagram



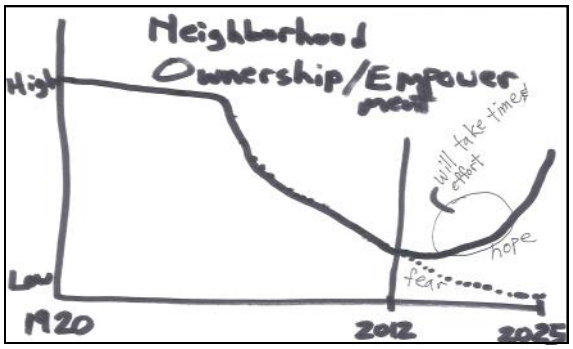
Models, such as Figure 1, provide a way to visualize all the elements of the system and their interactions, with a focus on causal relationships as opposed to associations. Through the model, specific types of causal relationships, or feedback loops, underlying the behavior of the dynamic system, can 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

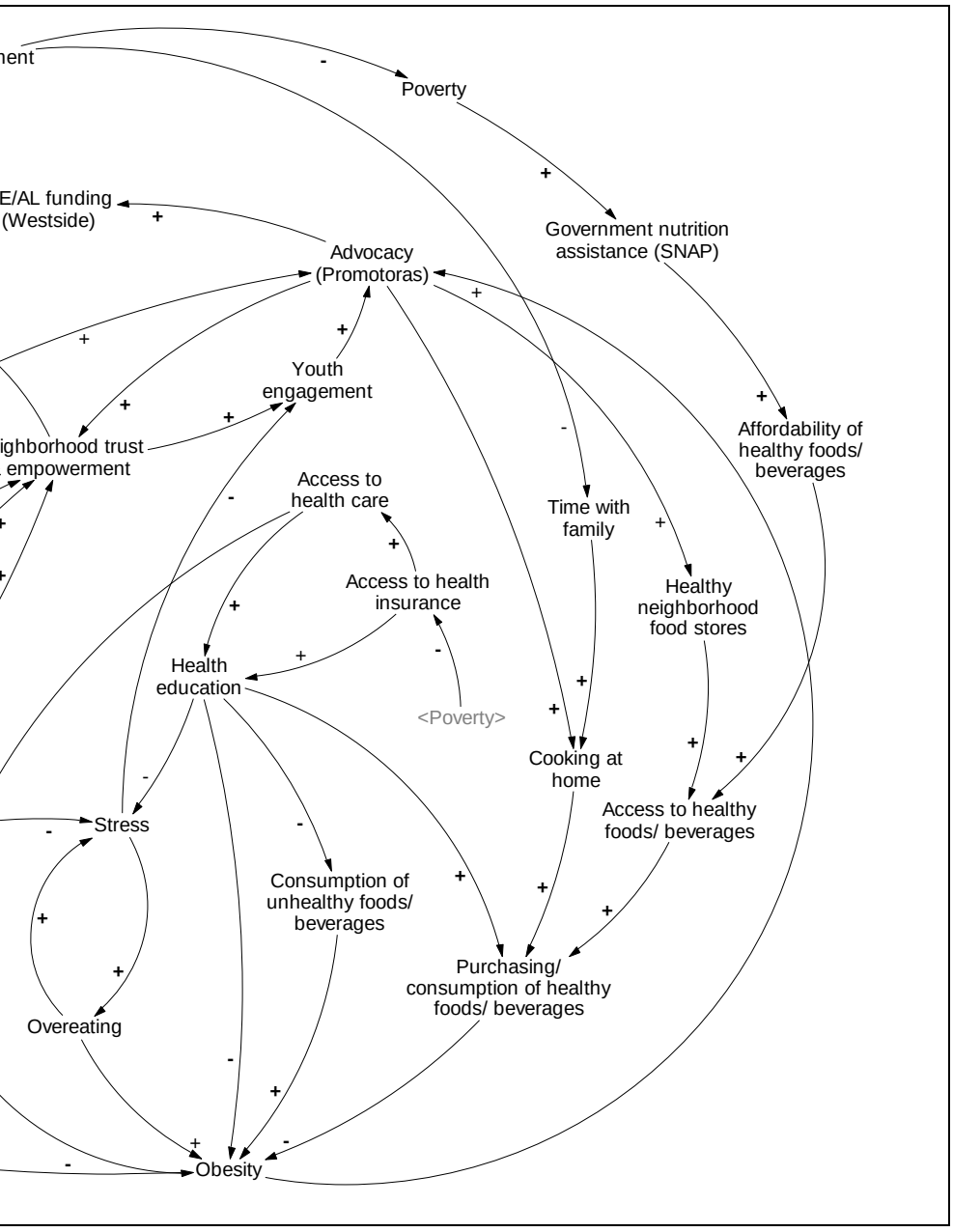
Members of the *HKHC San Antonio* partnership participated in a group model building session in October, 2012 and generated this system. also referred to as a causal loop diagram (Figure 1). Participants in the group model building session included residents and representatives from schools, community-based organizations, businesses, policy/advocacy organizations, and government agencies. 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.

<u>Behavior Over Time Graphs</u>

To identify the range of things that affect or are affected by policy, system, and environmental changes in San Antonio 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 neighborhood ownership/ empowerment, the amount of ownership and empowerment has declined substantially since 1920 and this participant



hopes that this decline will reverse 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: neighborhood trust and empowerment → youth engagement → advocacy → neighborhood trust and empowerment.

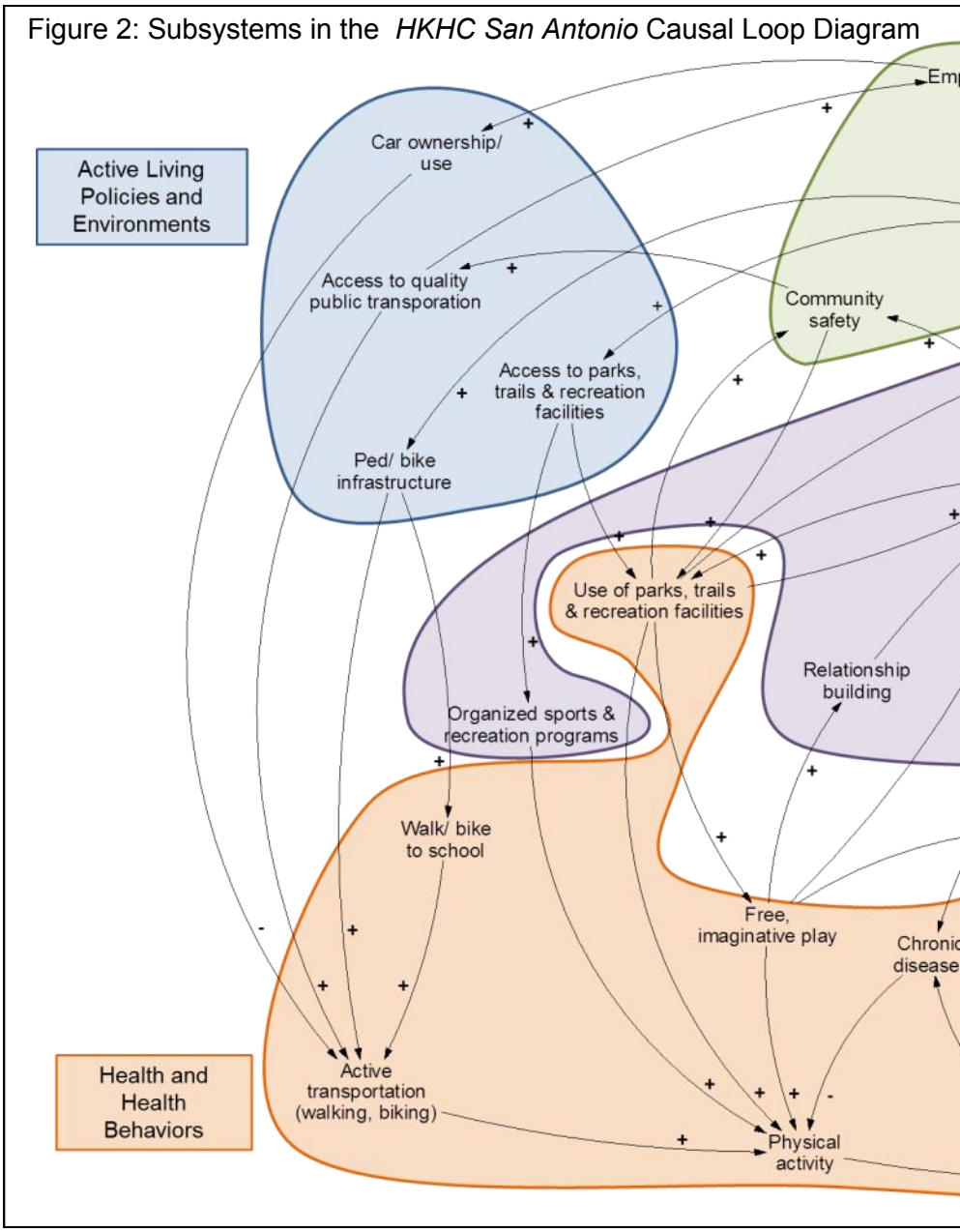
What is important to notice is that there are other feedback loops interacting simultaneously to influence or to be influenced by neighborhood trust and empowerment. Some variables may increase neighborhood trust and empowerment while other variables limit it. Determining the feedback loop or loops that 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 *HKHC San Antonio* 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 San Antonio, Texas and to stimulate greater conversation related to San Antonio '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 San Antonio, Texas. 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).

Figure 2: Subsystems in the *HKHC San Antonio* Causal Loop Diagram



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.

<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 eleven graphs related to policy or environmental strategies (e.g., healthy neighborhood food stores) or contexts (e.g., government nutrition assistance) that affected or were affected by the work of *HKHC San Antonio*. The variables represent participants' conversations from the behavior over time graph and causal loop diagram exercises.

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

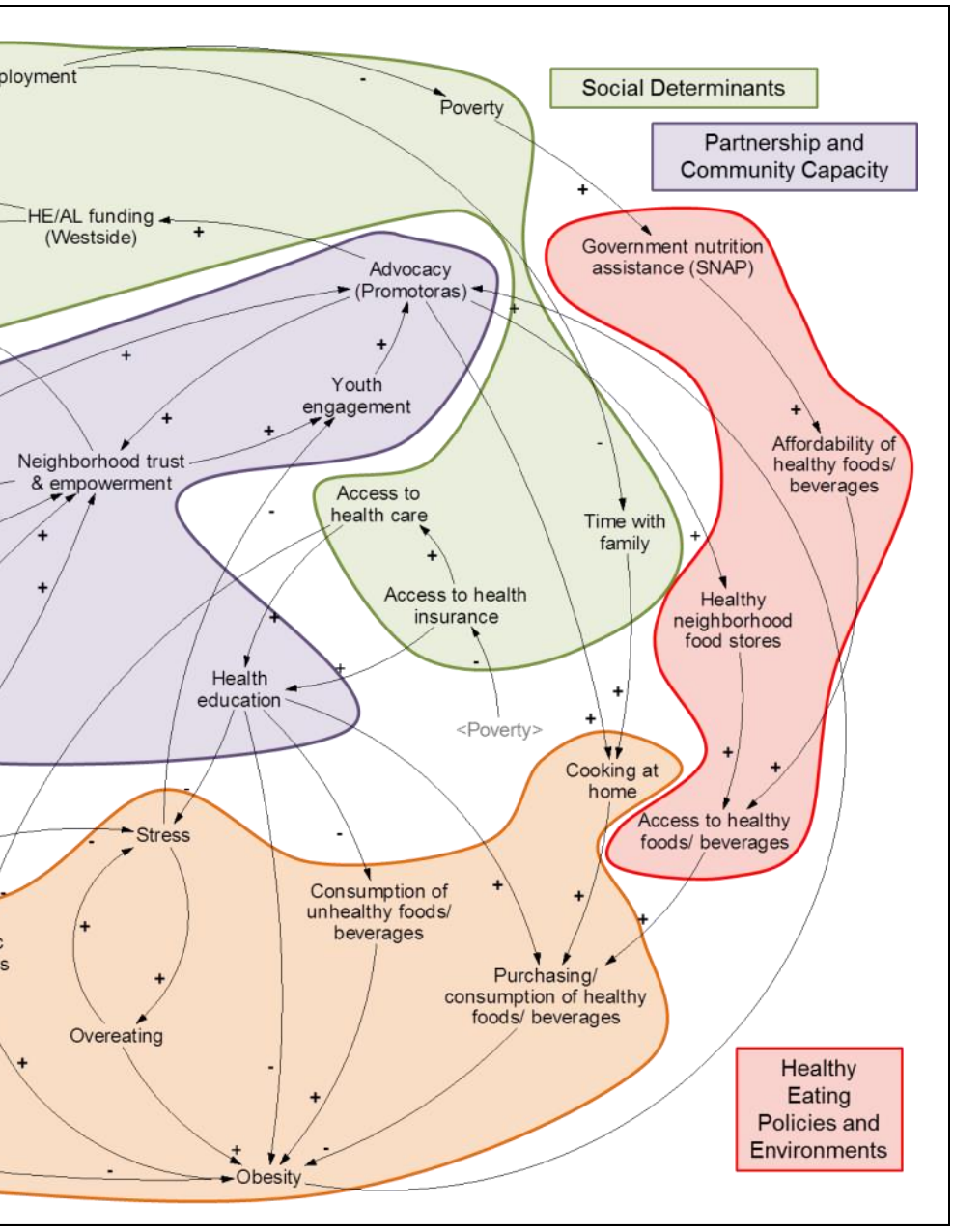
The active living policy and environmental subsystem includes design, planning, construction, and enforcement or maintenance related to access to opportunities for active transportation and recreation. For this topic, the group model building participants developed seven graphs related to policy or environmental strategies (e.g., pedestrian and bike infrastructure) or contexts (e.g., car ownership and use) 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., cooking at home, active transportation, free, imaginative 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, *HKHC San Antonio* worked to increase neighborhood trust and empowerment through Healthy Hubs. This subsystem also includes community factors outside the partnership that may influence or be influenced by their efforts.



Social Determinants

Finally, the social determinants subsystem denotes societal conditions (e.g., poverty, community safety) and psychosocial influences (e.g., time with family) 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.

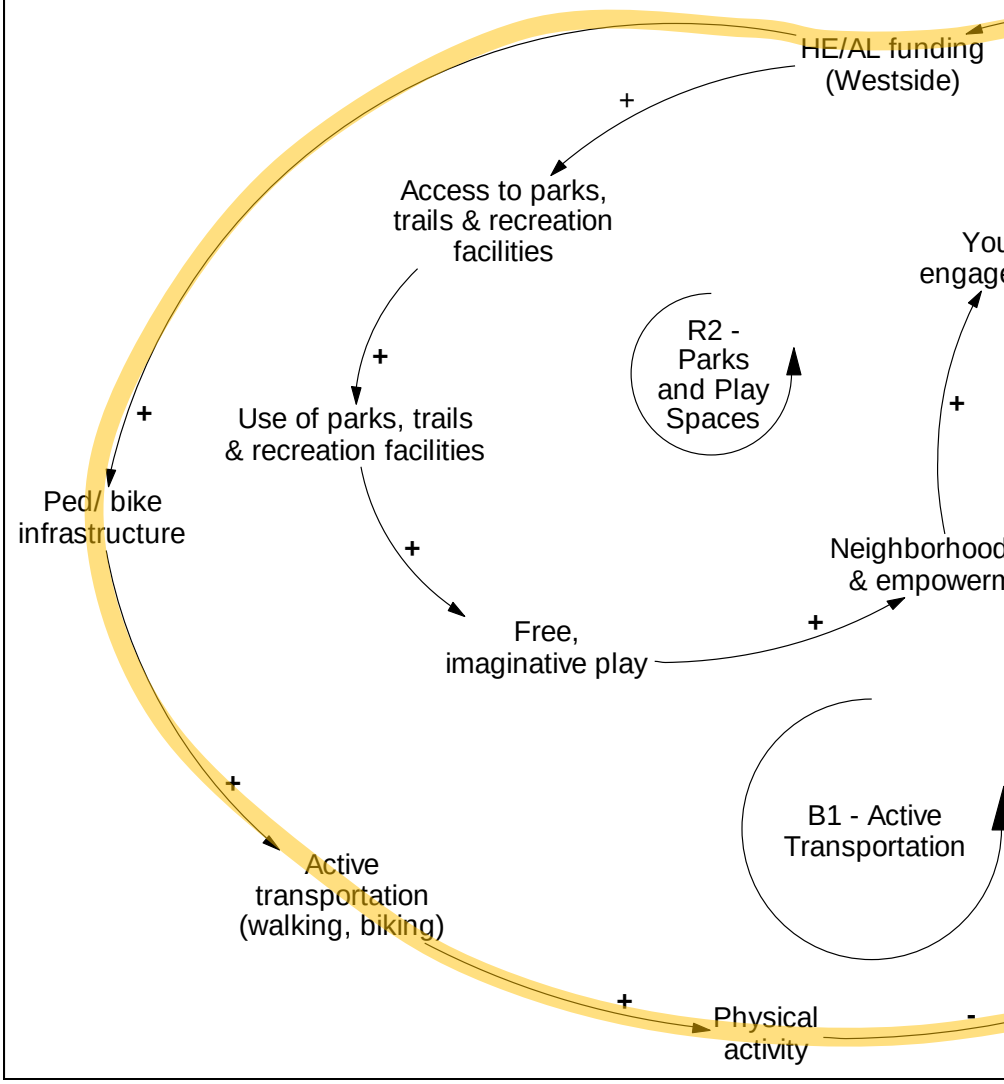
Each one of these subsystems has many more variables, causal relationships (arrows), and feedback loops that can be explored in greater depth by the *HKHC San Antonio* partners or by other representatives in San Antonio, Texas . Using this CLD as a starting place, community conversations about different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

The next sections begin to examine the feedback loops central to the work of *HKHC San Antonio*. 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.

Active Transportation Feedback Loop

To simplify the discussion about feedback loops, several loops drawn from the HKHC San Antonio 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 San Antonio, Texas , each feedback loop tells a story about a more specific change process.

Figure 3: Active Transportation Feedback Loop



Causal Story for Feedback Loop

Story A: In this case , the story is about active transportation (orange highlighted loop in Figure 3). San Antonio, Texas partners facilitated adoption of a Complete Streets policy and a street and infrastructure bond to fund elements of the Complete Streets policy, provided training and input regarding street design protocols and Complete Streets concepts, and implemented environmental changes in Collins Garden as part of the Healthy Hub pilot project. Participants described how pedestrian and bike infrastructure increases active transportation and physical activity as well as reduces obesity. In turn, lower rates of obesity lead to reductions in the need for advocacy to stimulate more funding for pedestrian and bike infrastructure (as it is already in place).

Story B: While the preceding story reflected a positive scenario for San Antonio, Texas , the same feedback loop also tells the opposite story. An absence of pedestrian and bike infrastructure results in fewer people engaging in active transportation, thus reducing physical activity and increasing obesity. Consequently, more obesity requires organized advocacy efforts to increase funding for active living initiates to improve pedestrian and bike infrastructure where it is lacking or in poor condition.

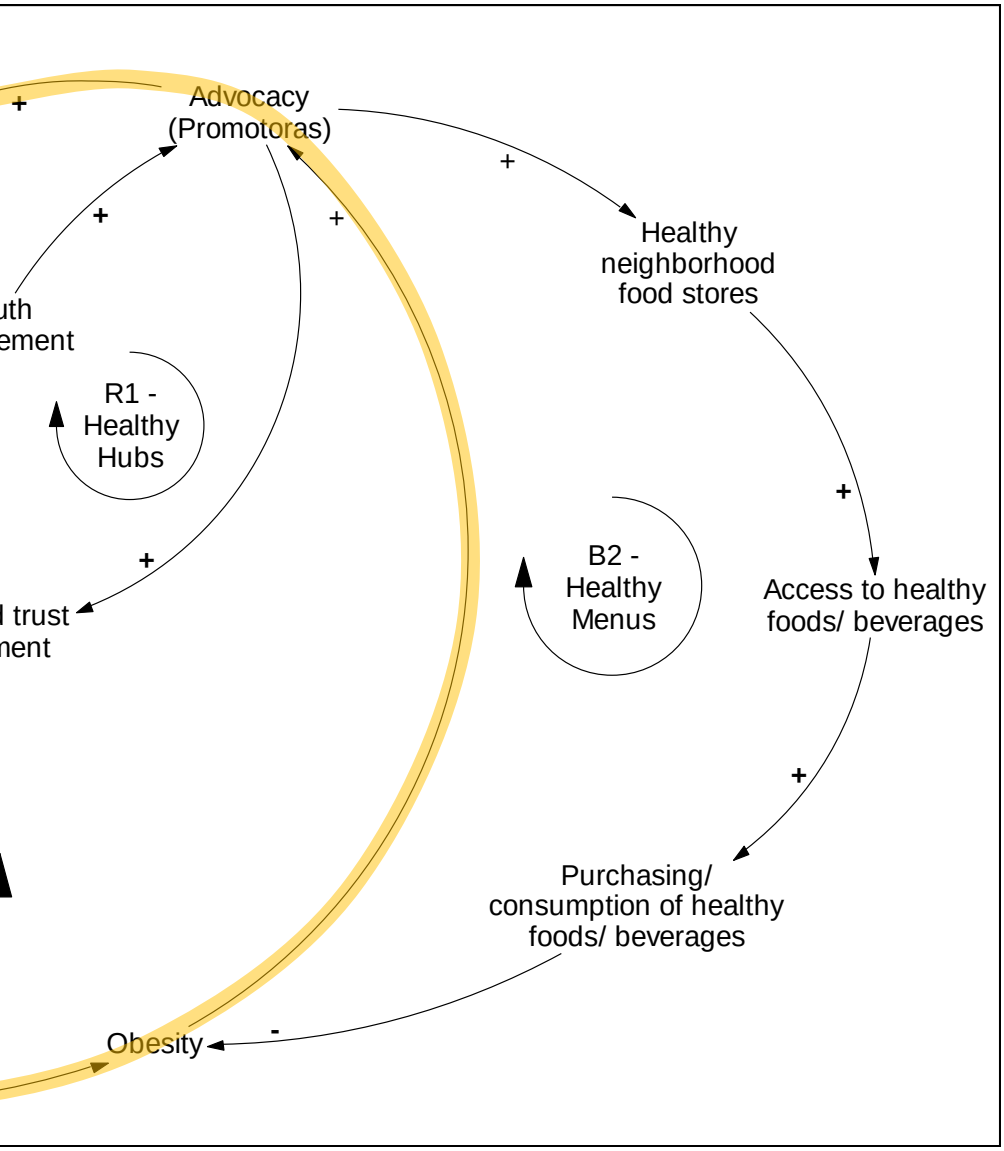
Balancing Loop and Notation

These stories represent a balancing loop, and the notation in the feedback loop identifies it as a balancing loop (see “B1 — Active Transportation” 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

“My fear is that there will just be this low level of funding for the West Side for infrastructure improvements, and what I mean by that is street repair, sidewalk repair, better crosswalks, basically anything that has to be built to make it easier for people to walk and bike around. My hope, because of work like this and good people, that that will just go up drastically in terms of funding for this community for infrastructure improvements, because I think everyone knows that this is the most densely populated part of the city.” (Participant)

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.

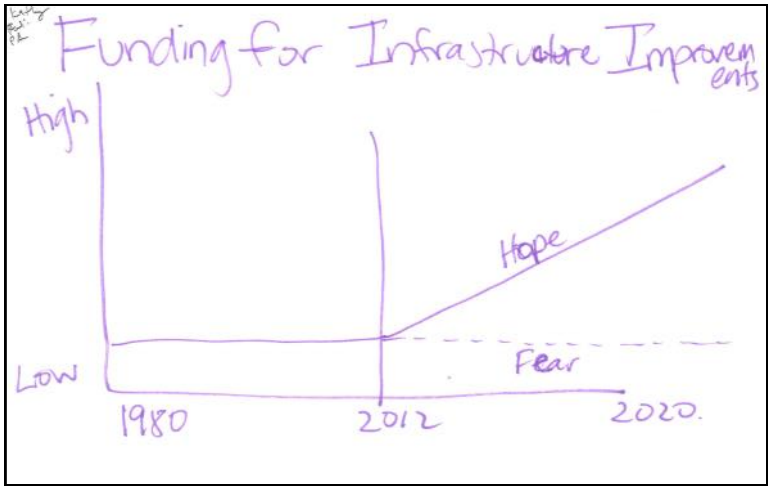
In isolation, this balancing loop represents the influence of pedestrian and bike infrastructure on physical activity and obesity. To understand other influences on these variables, it is important to remember that this reinforcing loop is only one part of the larger CLD (see Figures 1 and 2), and the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

<u>System Insights for *HKHC San Antonio*</u>

Participants also identified that funding for infrastructure improvements has remained low and steady since 1980 in San Antonio, Texas (see behavior over time graph).

From the systems thinking exercises, several insights can inform partners' active transportation strategy. For instance, stepping up advocacy efforts to change the trend for funding infrastructure improvements can include a focus on the burden of obesity in San Antonio communities, particularly where resources are needed most (see quote on previous page).

In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including developing measures to assess the effectiveness of advocacy initiatives, such as those delivered by Promotoras; evaluating the impact of pedestrian and bike infrastructure on active transportation; and examining the return on investment of funding for infrastructure improvements in order to identify optimal levels of funding.



Opportunities for Systems Thinking in San Antonio, Texas

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

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 San Antonio, Texas to promote healthy eating and active living as well as preventing childhood overweight and obesity.

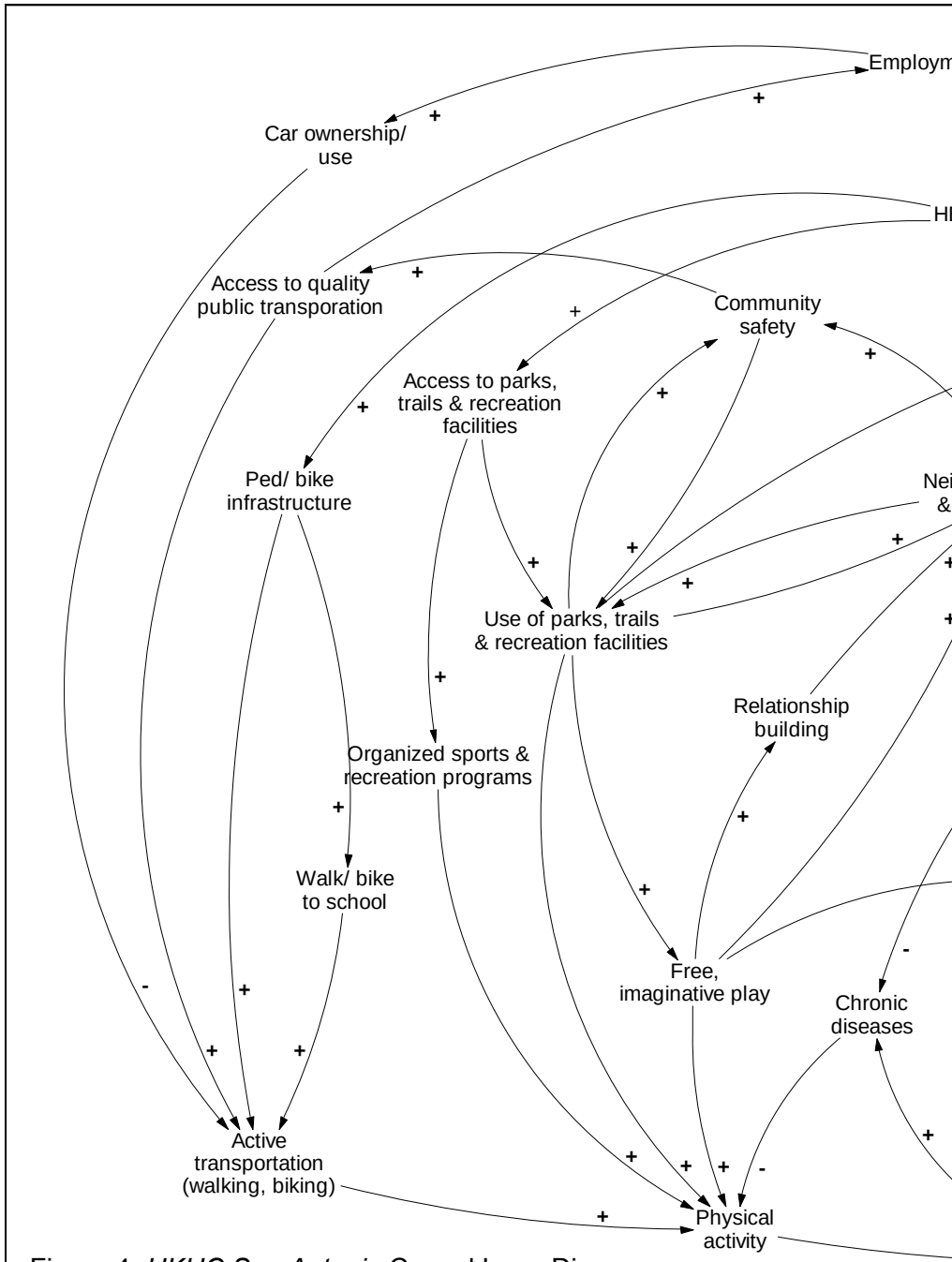


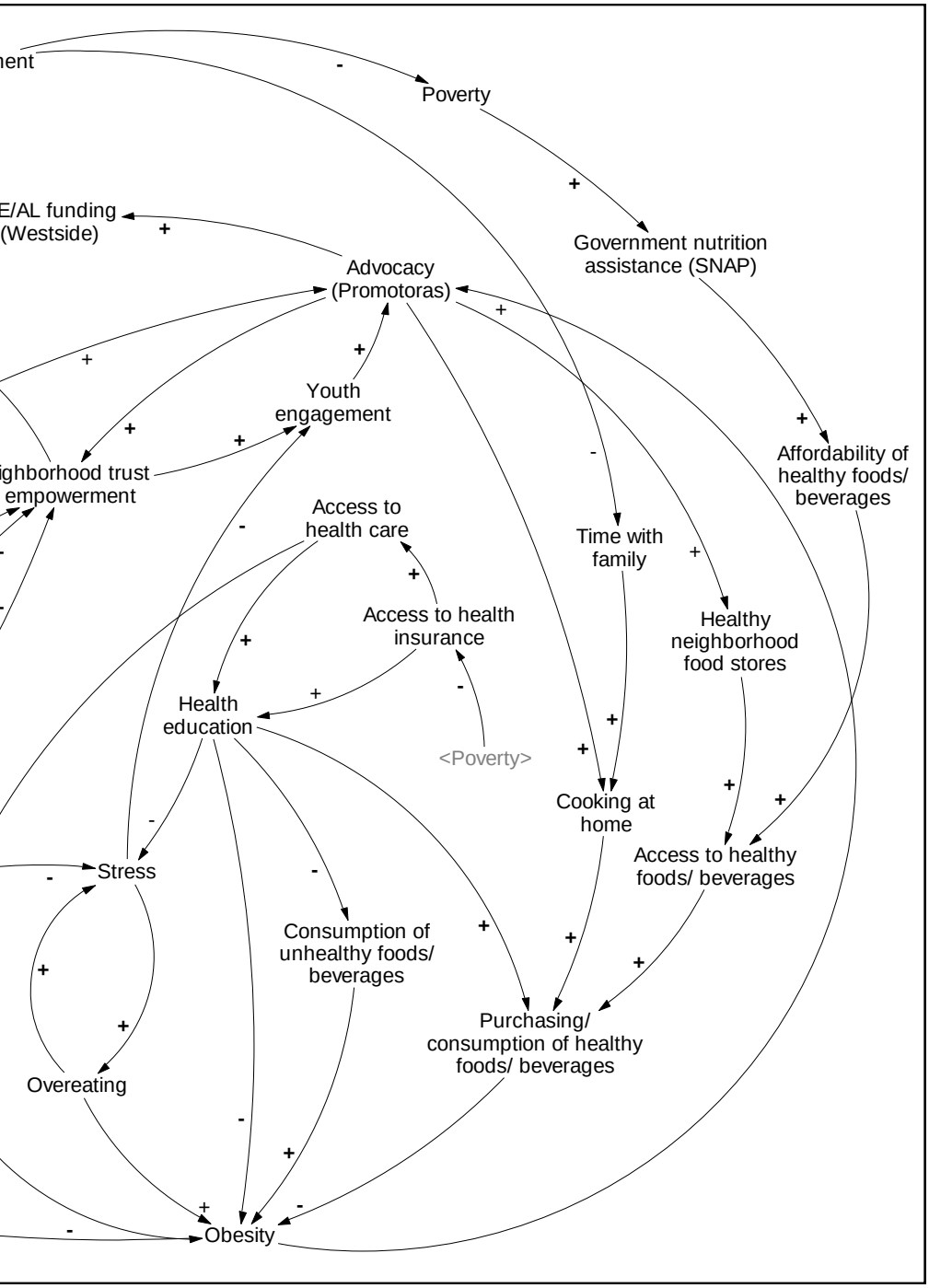
Figure 4: *HKHC San Antonio* Causal Loop Diagram

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

- the participants represent a sample of the *HKHC San Antonio* 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 car insurance; gas prices; social stigmas; affordability of programs; schools in neighborhoods; stray dogs; substances use; crime and violence (gangs); air, water, soil quality; school PE and recess; quality nutritional foods/ beverages at school; fear of scarcity; corporatization of food productions, distribution and retail; healthy restaurants; community gardens; unhealthy corner/convenience stores; fast food restaurants; street/mobile vendors; unhealthy food marketing; provider reimbursement policies; technology and screen time; 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 San Antonio 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 *HKHC San Antonio* 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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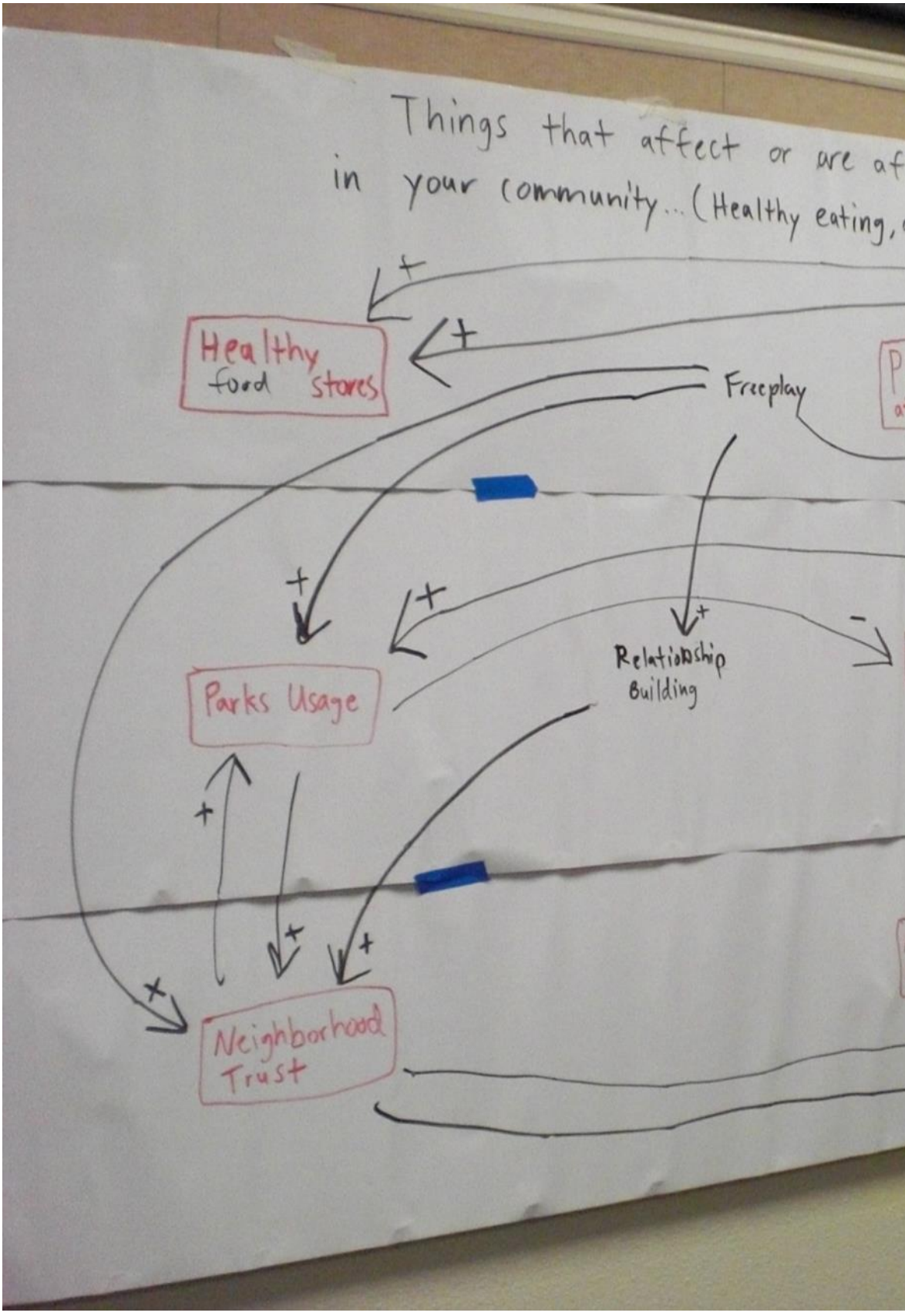
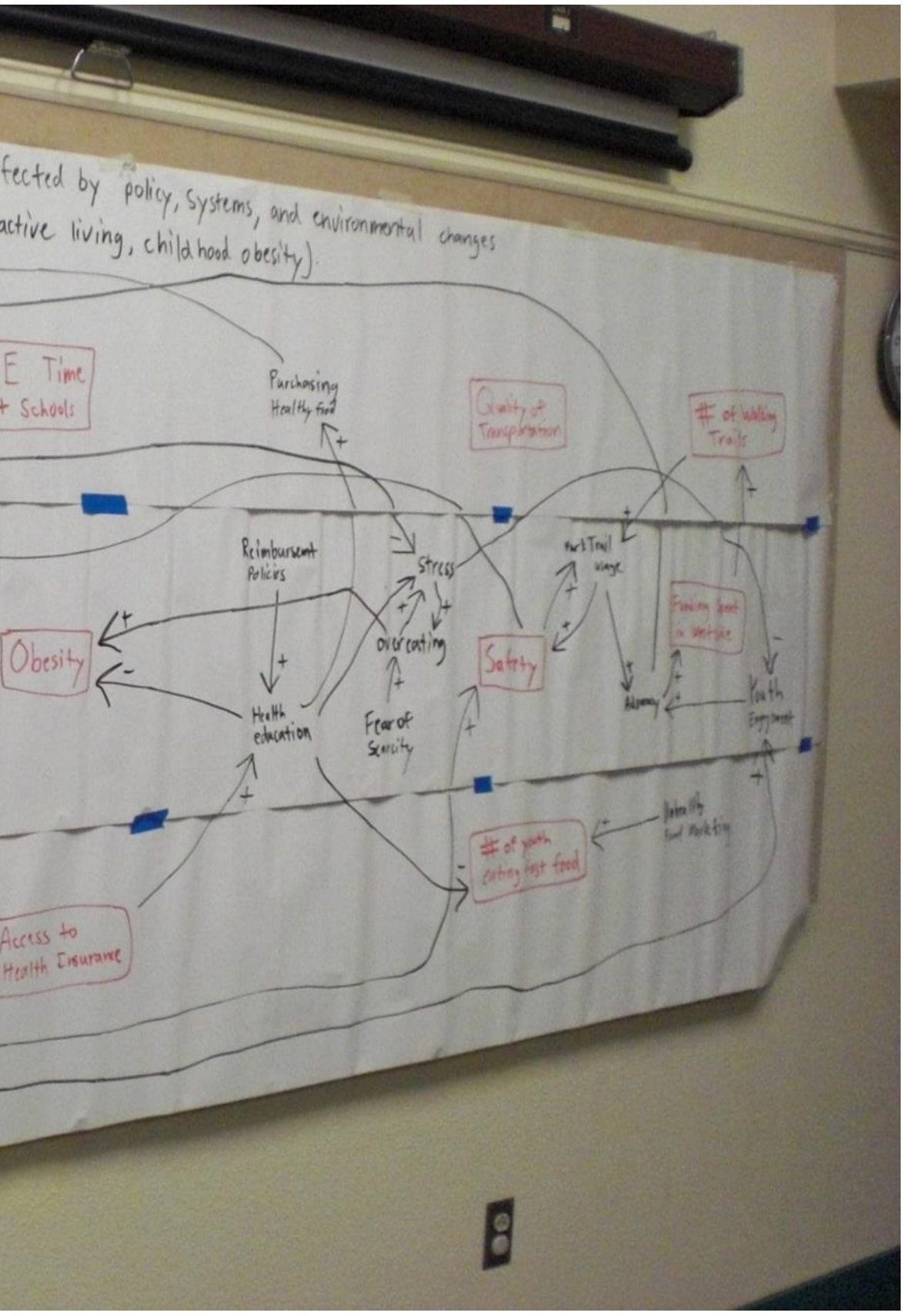
Zagonel, A. and J. Rohrbaugh (2008). Using group model building to inform public policy making and implementation. Complex Decision Making. H. Qudart-Ullah, J. M. Spector and P. I. Davidsen, Springer-Verlag: 113-138.

Appendix A: Behavior Over Time Graphs Generated during Site Visit

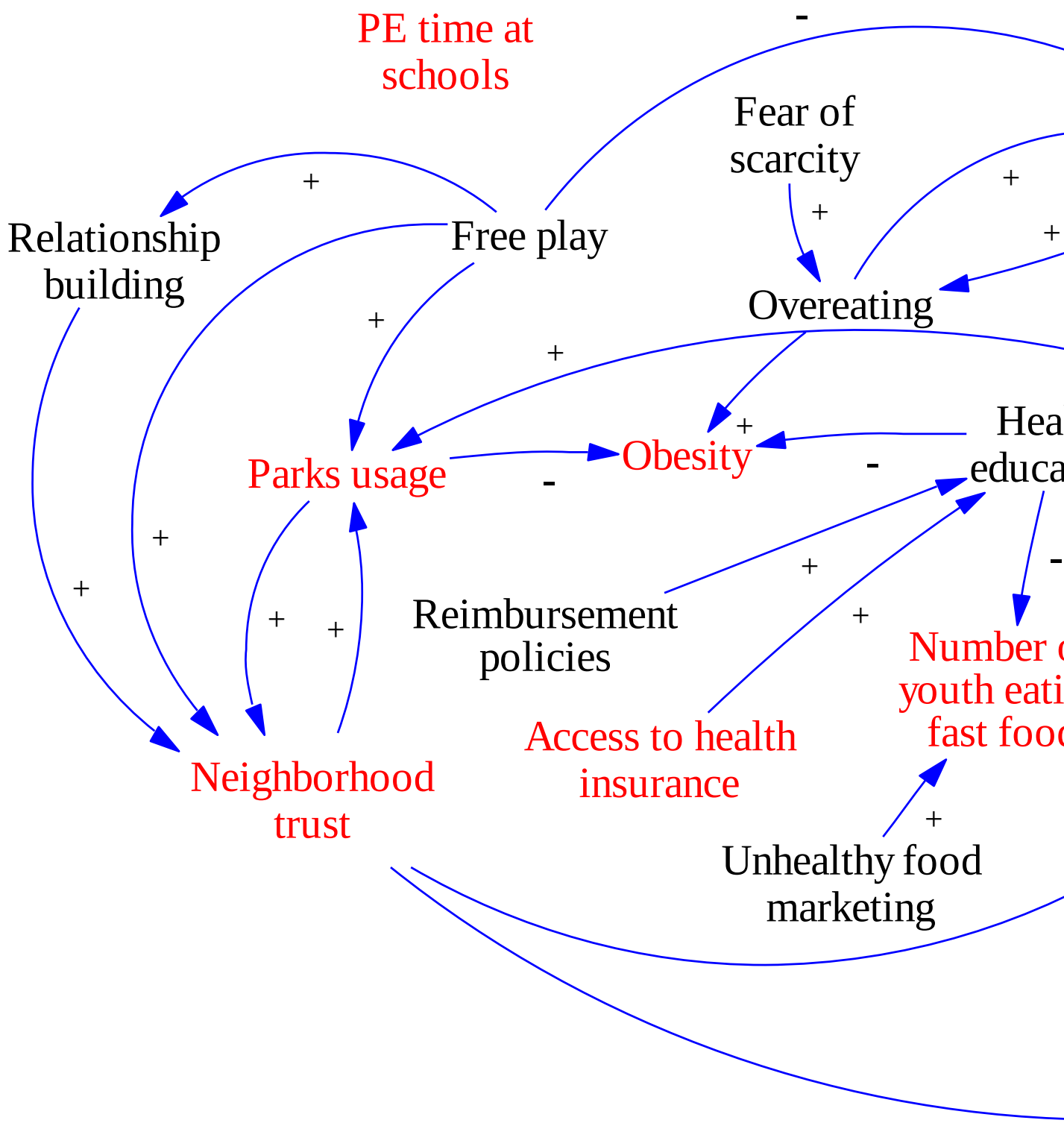
San Antonio, Texas: *HKHC San Antonio*	
Categories	**Number of Graphs**
Active Living Behavior	3
Active Living Environments	4
Funding	1
Healthy Eating Behavior	3
Healthy Eating Environments	8
Marketing and Media Coverage	0
Obesity and Long Term Outcomes	3
Partnership & Community Capacity	3
Policies	2
Programs & Promotions (Education and Awareness)	2
Social Determinants of Health	7
Total Graphs	**37**

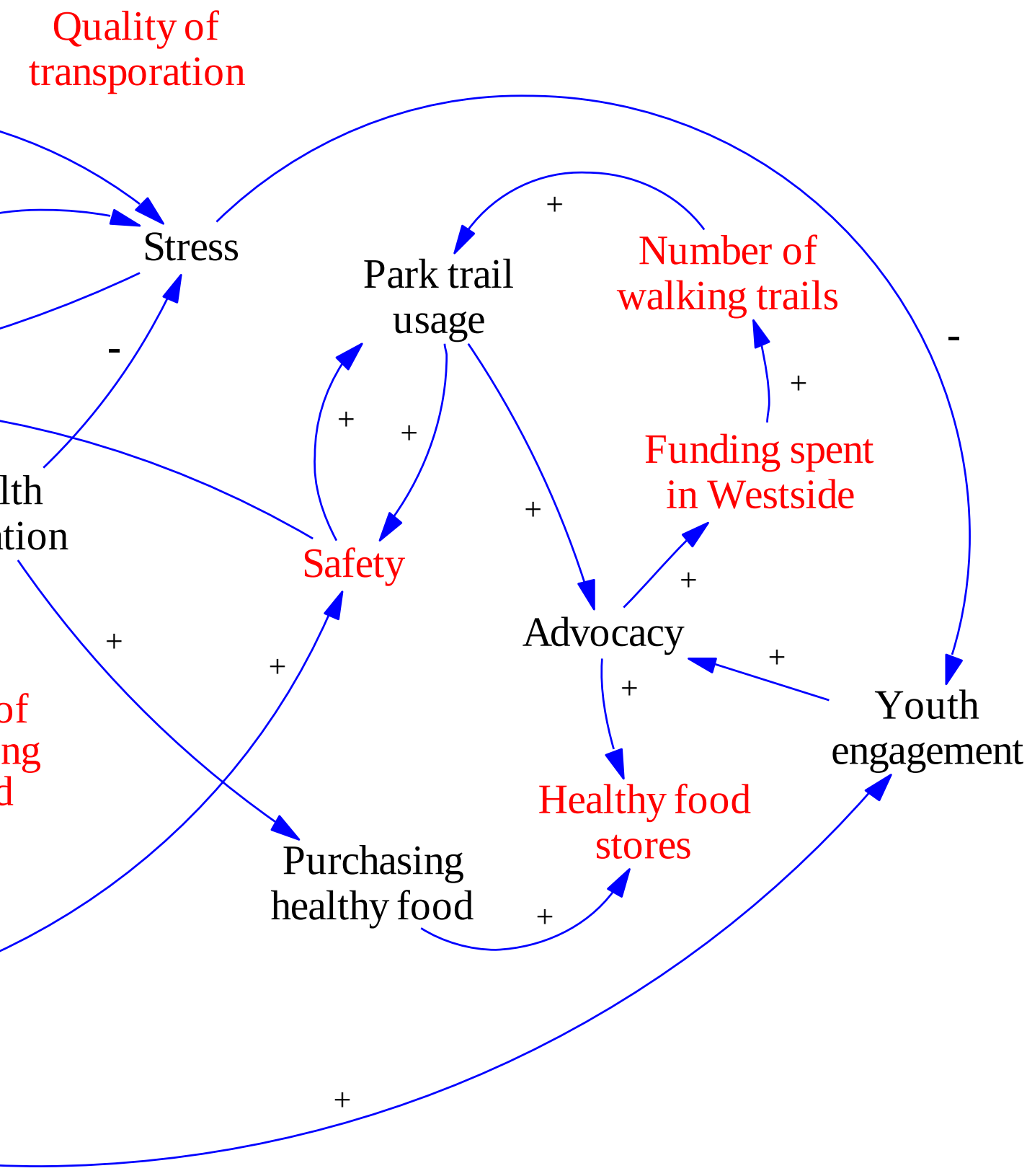
Appendix B: Photograph of the Original Version of the *HKHC San Antonio* Causal Loop Diagram



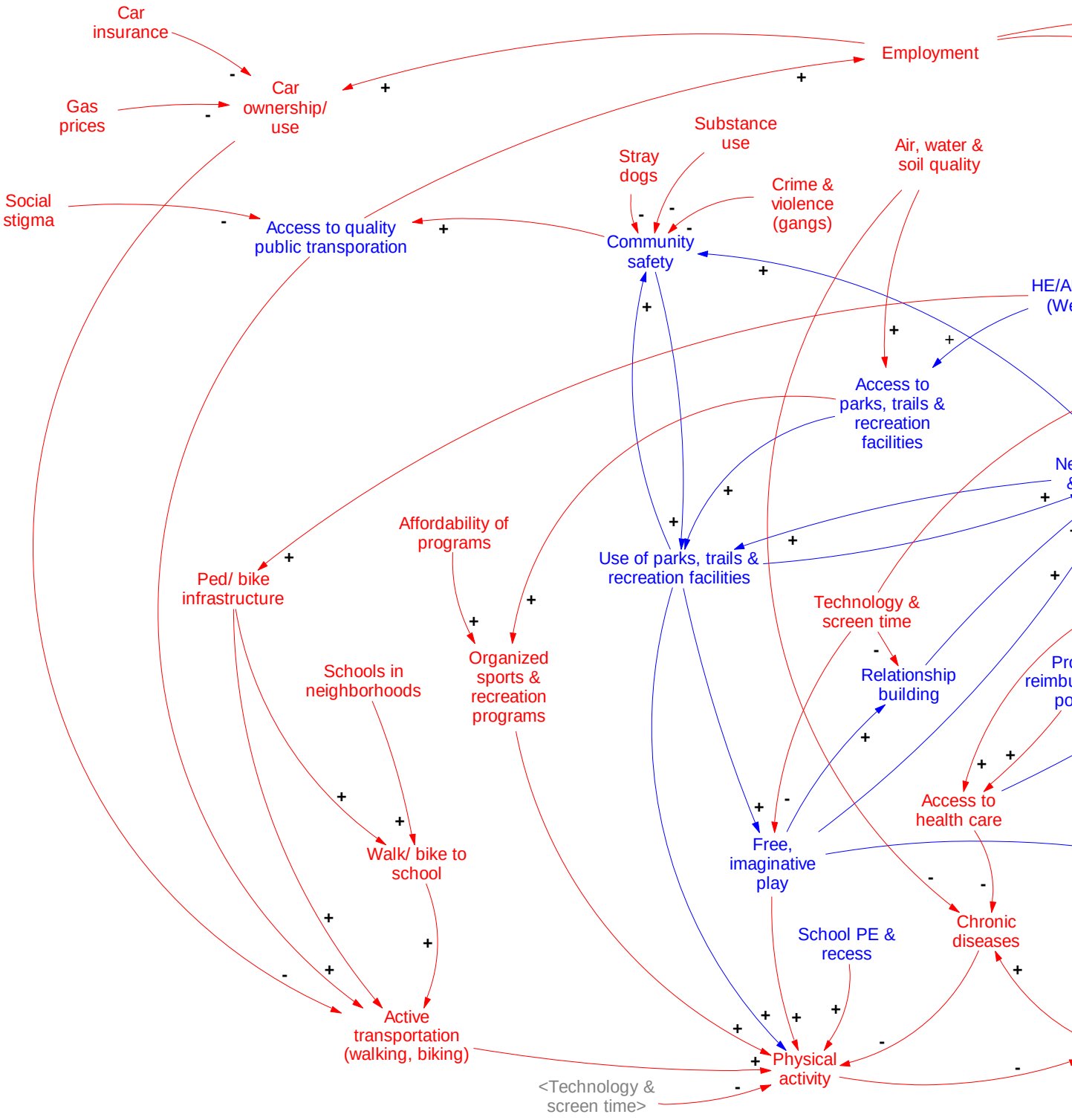

fected by policy, systems, and environmental changes
active living, childhood obesity).
E Time
+ Schools
Purchasing
Healthy food
Quality of
Transportation
# of Walking
Trails
Reimbursement
Policies
Stress
Obesity
Overeating
Safety
Health
education
Fear of
Scarcity
Youth
Employment
# of youth
eating fast food
Access to
Health Insurance

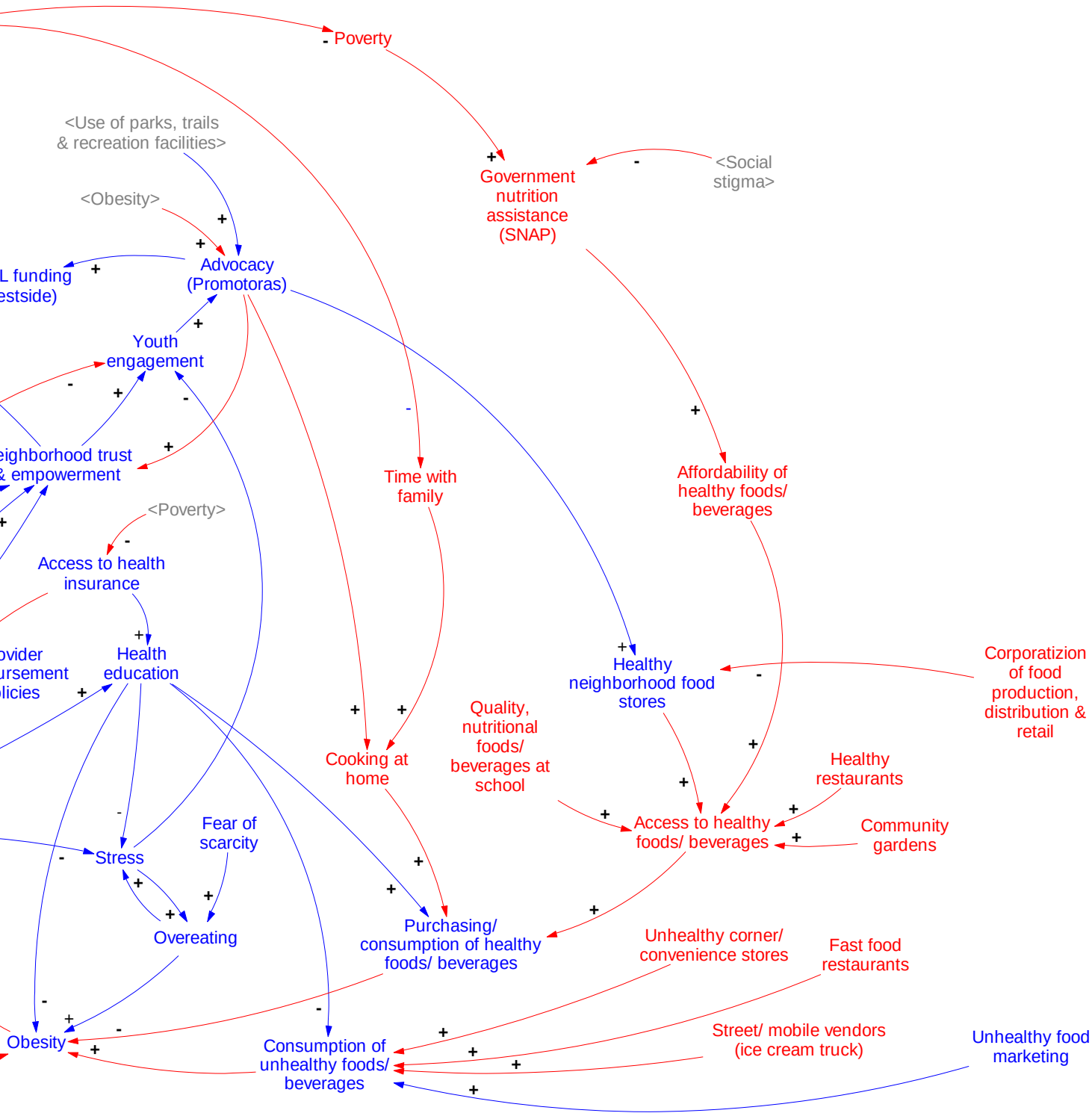
Appendix C: Original Translation of the Causal Loop Diagram into Vensim PLE



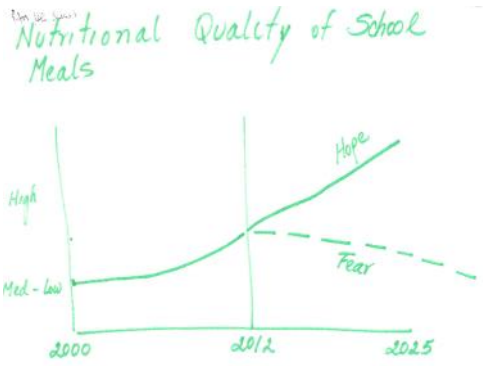

Quality of transporation
Stress
Park trail usage
Number of walking trails
Funding spent in Westside
Safety
Advocacy
Youth engagement
Healthy food stores
Purchasing healthy food
+
-

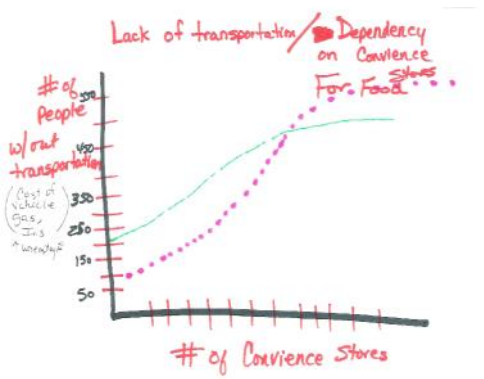
Appendix D: Transcript Translation of the Causal Loop Diagram into Vensim PLE

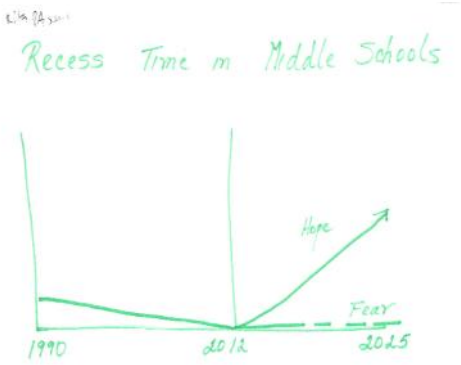


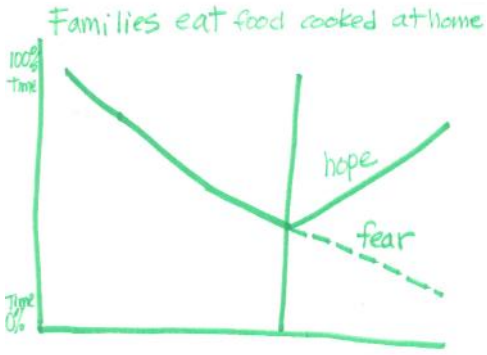

Poverty
<Use of parks, trails & recreation facilities>
Government nutrition assistance (SNAP)
<Social stigma>
<Obesity>
L funding estside)
Advocacy (Promotoras)
Youth engagement
eighborhood trust & empowerment
Time with family
Affordability of healthy foods/ beverages
<Poverty>
Access to health insurance
ovider ursement olicies
Health education
Healthy neighborhood food stores
Corporatizion of food production, distribution & retail
Quality, nutritional foods/ beverages at school
Cooking at home
Healthy restaurants
Access to healthy foods/ beverages
Community gardens
Fear of scarcity
Stress
Overeating
Purchasing/ consumption of healthy foods/ beverages
Unhealthy corner/ convenience stores
Fast food restaurants
Obesity
Consumption of unhealthy foods/ beverages
Street/ mobile vendors (ice cream truck)
Unhealthy food marketing

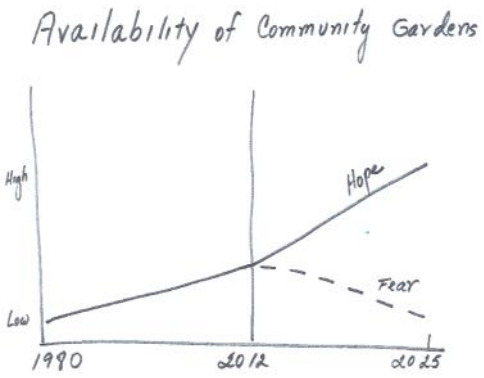
Appendix E: Behavior Over Time Graphs not Represented in the Storybook

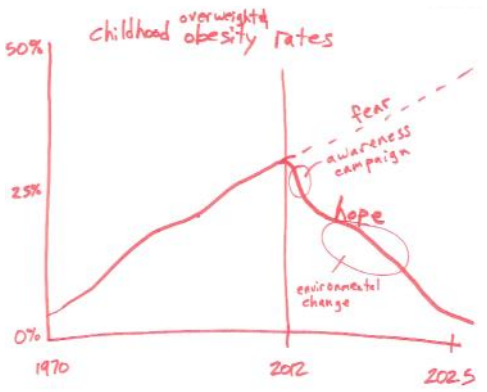


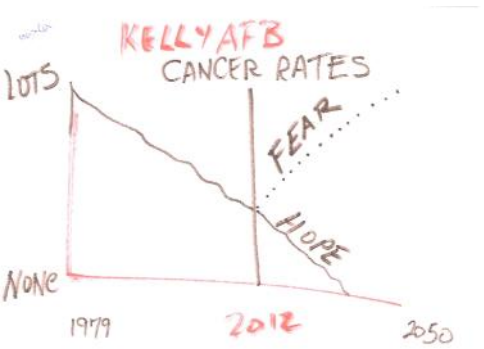


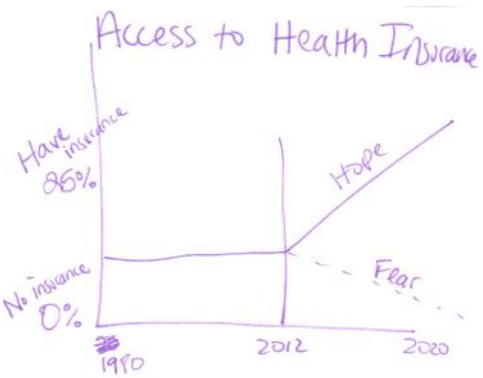


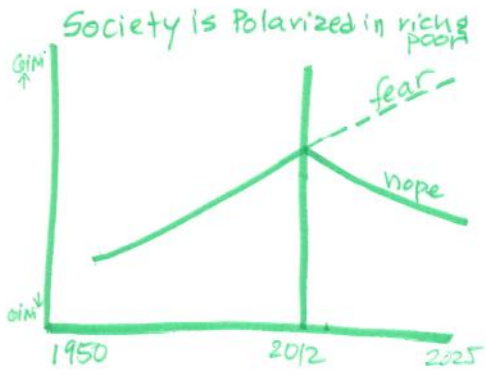


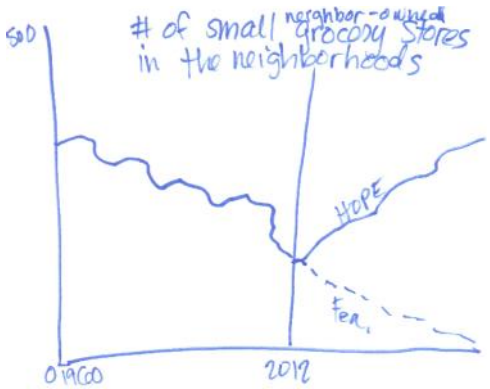






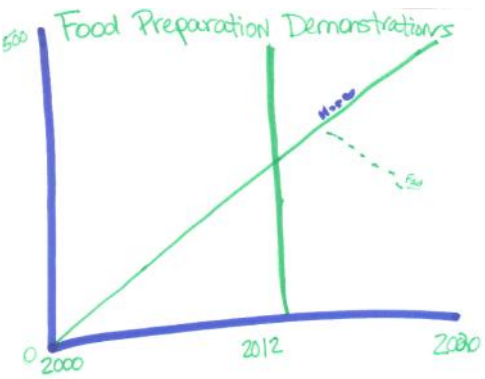


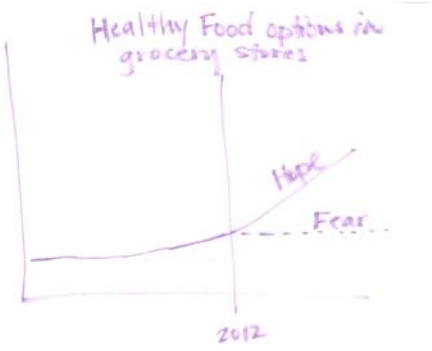


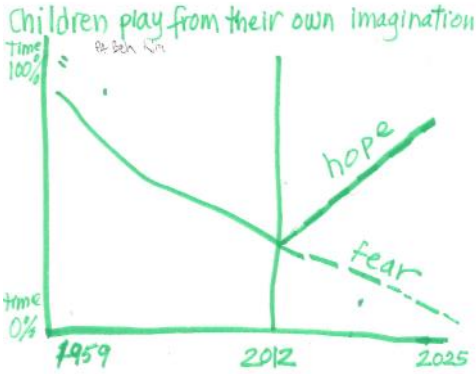


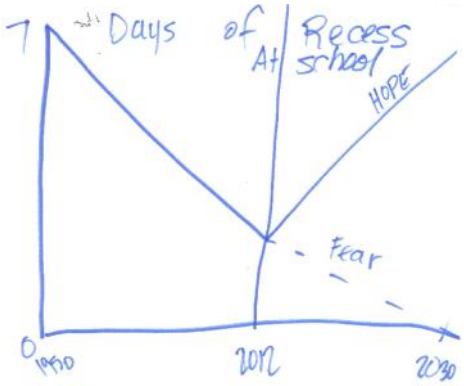

Ice Cream truck choices (Healthy)
Hope
Fear
0
1970
2012
2015
2020


Availability of Fresh Produce in Walking Distance
High
Low
Hope
Fear
1980
2012
2020

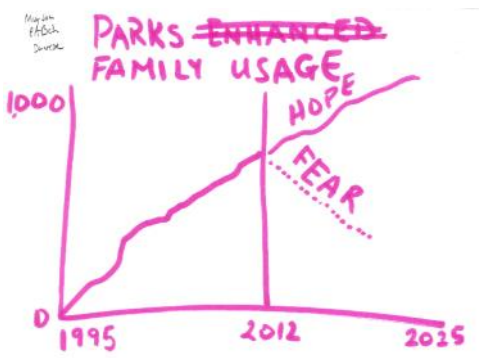

Food Preparation Demonstrations
Hope
Fear
0
2000
2012
2030

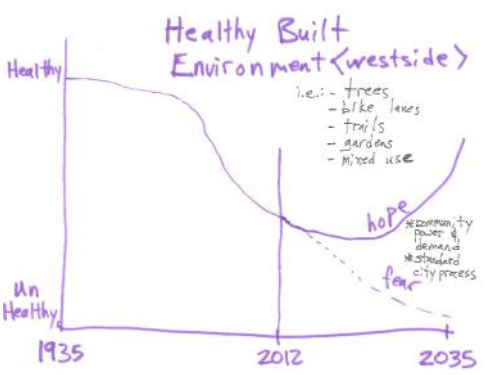

Healthy Food options in grocery stores
Hope
Fear
2012

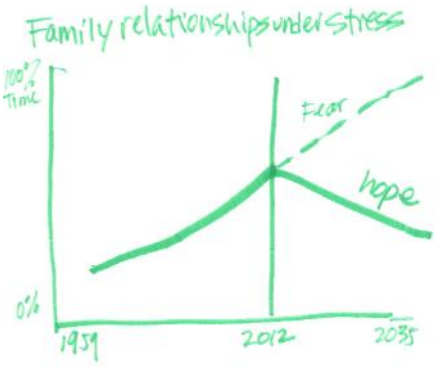

Children play from their own imagination
Time 100%
hope
fear
time 0%
1959
2012
2025

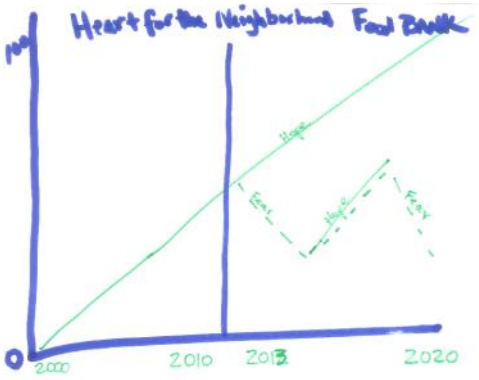

Days of Recess
At school
Hope
Fear
0
1980
2012
2030

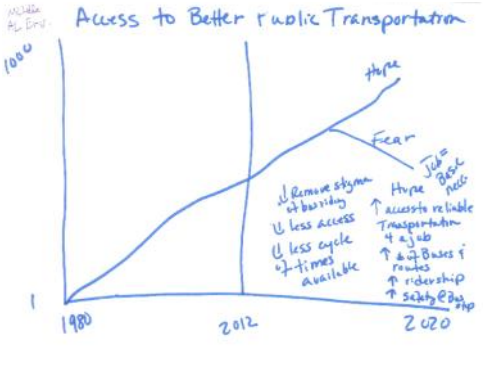

Obesity
Fast Food Choices
Fear
Hope
5
10
15
20
25
1980
2012
2035

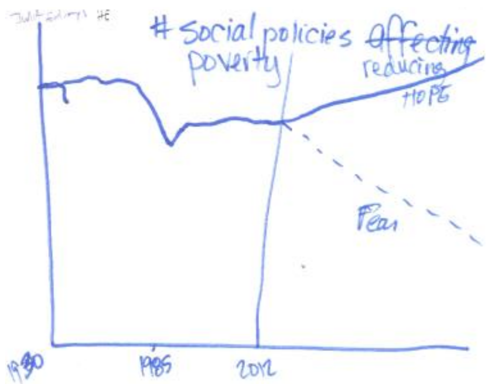

PARKS ENHANCED
FAMILY USAGE
1000
HOPE
FEAR
0
1995
2012
2025


Healthy Built Environment (westside)
Healthy
UnHealthy
i.e.:- trees
- bike lanes
- trails
- gardens
- mixed use
hope
fear
1935
2012
2035

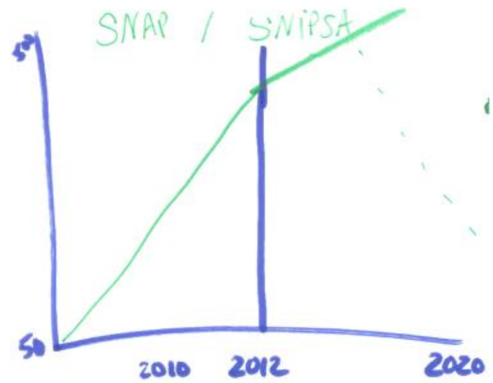

Family relationships under stress
100% Time
Fear
hope
0%
1959
2012
2035


Heart for the Neighborhood Food Bank
100
Hope
Fear
0
2000
2010
2013
2020

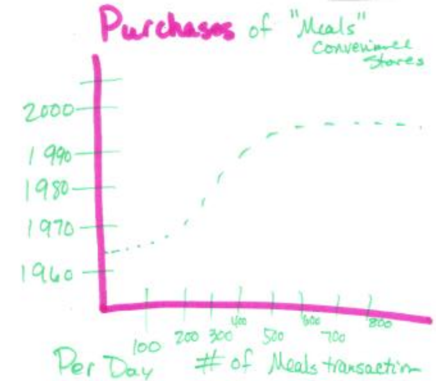

Access to Better Public Transportation
1000
Hope
Fear
1
1980
2012
2020



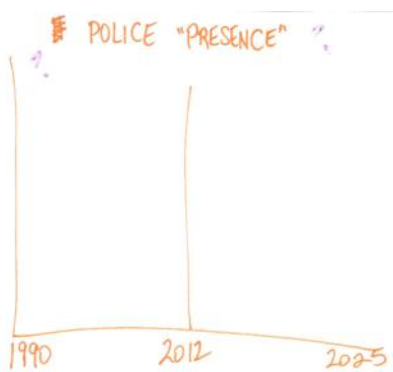
Social policies affecting poverty
reducing
HOPE
Fear
1980
1985
2012



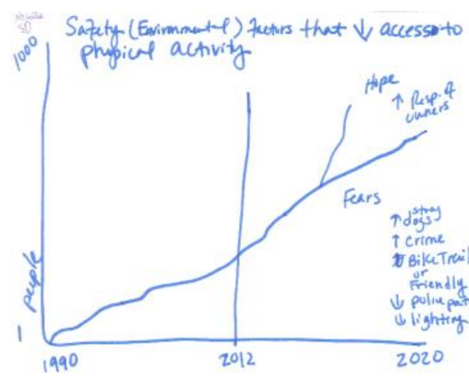
SNAP / SNIPSA
50
2010
2012
2020



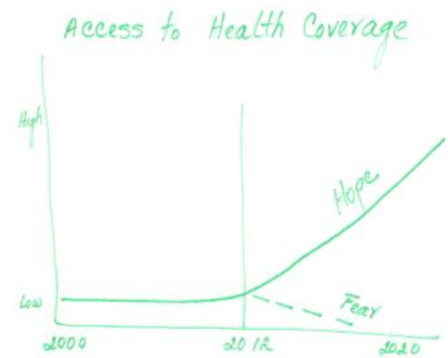
Purchases of "Meals" Convenience Stores
2000
1990
1980
1970
1960
100
200
300
400
500
600
700
800
Per Day # of Meals transaction



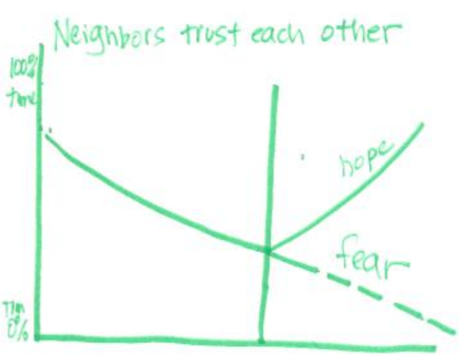
POLICE "PRESENCE"
1990
2012
2025



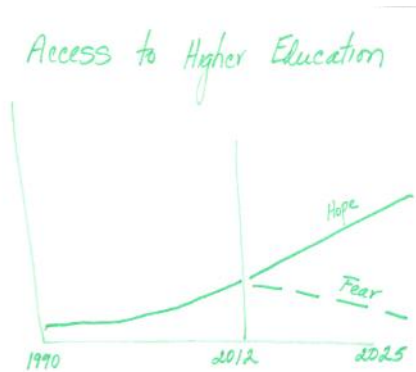
Safety (Environmental) factors that ↓ access to physical activity
1000
people
1
Hope
↑ Resp. 4 owners
Fears
↑ stray dogs
↑ crime
↓ Bike Trails or Friendly
↓ police patrol
↓ lighting
1990
2012
2020



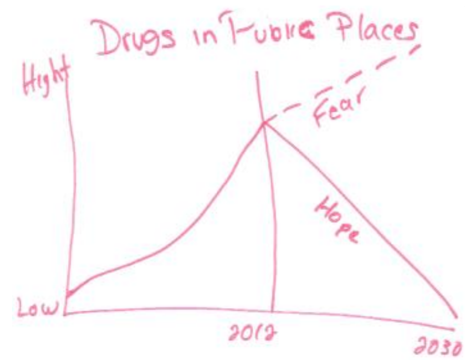
Access to Health Coverage
High
Low
Hope
Fear
2000
2012
2020



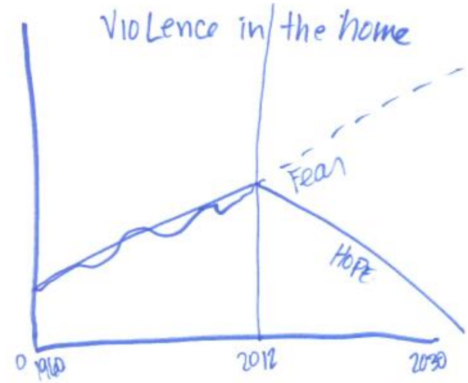
Neighbors trust each other
100%
hope
fear
0%



Access to Higher Education
Hope
Fear
1990
2012
2025



Drugs in Public Places
High
Low
Fear
Hope
2012
2030



Violence in the home
Fear
Hope
0
2012
2030