Systems Thinking in Communities:

Understanding the Causes of Inactivity, Poor Diet/Nutrition, and Childhood Obesity in Milwaukee, Wisconsin

This community storybook was developed by Transtria LLC.

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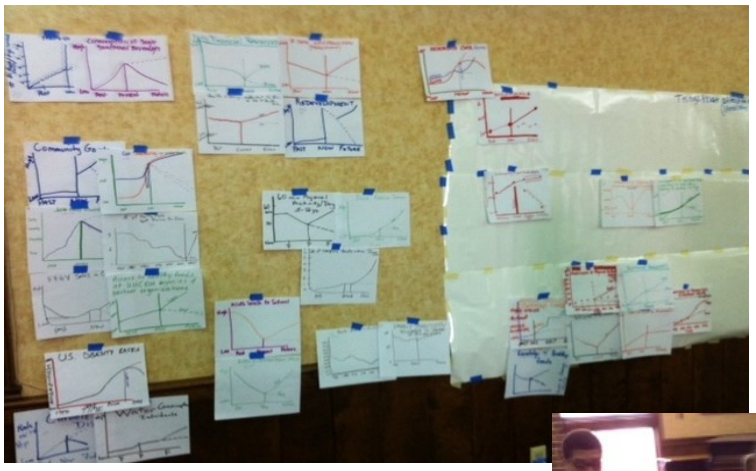
Milwaukee Childhood Obesity Prevention Project



Introduction

Milwaukee Childhood Obesity Prevention Project (MCOPP) 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 MCOPP effort was to introduce systems thinking at the community level by identifying the essential parts of the Milwaukee, Wisconsin 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, elected officials, 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.

Milwaukee, Wisconsin: Background and Local Participation

Milwaukee, Wisconsin, the 23rd largest city in the United States, borders the western shore of Lake Michigan. The city is home to approximately 600,000 ethnically and racially diverse residents. Health disparities in the city are greater than the rest of the state. Milwaukee ranks eighth in poverty rates among United States cities with a population of 300,000 or more. Data reported by the Youth Risk Behavior Survey indicate that approximately 37% of students are overweight or obese.

Formed in 1995, the United Neighborhood Centers of Milwaukee served as the lead agency for *Healthy Kids, Healthy Communities*. The collaborative partnership includes eight neighborhood centers and more than 20 satellite program sites that each has their own board of directors, policies, and procedures. The United Neighborhood Centers of Milwaukee serve more than 55,000 Milwaukee residents per year and provide services from early childhood to the twilight years. The eight agencies are Agape Community Center, Silver Springs Neighborhood Center, COA Youth and Family Centers, Neighborhood House of Milwaukee, Northcott Neighborhood House, Next Door Foundation, Milwaukee Christian Center, and Journey House.

The MCOPP partnership formed in 2008 and brought together several stakeholders and organizations to address childhood obesity. The Project Director, David Nelson, and Project Coordinator, Sarah O'Connor, led the partnership since the inception of *Healthy Kids, Healthy Communities*. With leadership and support of the Executive Director of the United Neighborhood Centers of Milwaukee, an Administrative Team, a Leadership Team, and four specialized subcommittees were developed to address healthy eating and active living in the centers and surrounding communities. The four subcommittees included:

- Healthy Eating/Active Living Curriculum and Professional Development:* This subcommittee led the development of policies and practices for ongoing, consistent professional development using evidence-based curricula across the centers. Committee members also developed and implemented trainings for youth-serving direct service staff at the centers and for other partner organizations.
- Active Living/Physical Activity:* This subcommittee led the development of active living policies and environmental change strategies.
- Healthy Food and Beverage: This subcommittee led the development of healthy food and beverage policies and environmental change strategies. Committee members originally focused on vending policies, and later expanded to include healthy snacks and healthy meetings.
- Land Use: This subcommittee led the development of organizational land use policies, practices, and environmental change strategies. Members provided recommendations for the development of asset maps to illustrate positive nutrition and physical activity resources that are available within a one-mile radius of the centers. The asset maps were developed for three centers.

*The Active Living Subcommittee and the Healthy Eating and Active Living Curriculum and Professional Development Subcommittee merged due to significant overlap of members.

Over 71 individuals, representing at least 39 different organizations, supported or participated in at least one of the partnership meetings.

Healthy Eating and Active Living Priorities and Strategies

The MCOPP partnership identified priority steps needed to increase healthy eating and active living in the targeted neighborhood centers, such as increasing the availability of affordable, nutritious foods and increasing physical activity opportunities for children and families.

The partnership and capacity building strategies of *MCOPP* included:

- **Healthy Eating and Active Living Curriculum and Professional Development:** The Board of Directors for the United Neighborhood Centers of Milwaukee voted to approve the policy developed by MCOPP, stating that all staff who instruct and serve as role models for children or youth: (1) have access to evidence-based curriculum and resource materials related to healthy eating and active living for use with youth and their families; and, (2) participate in professional development opportunities that focus on healthy eating and active living twice annually.
- **Asset Mapping (Land Uses):** The Board of Directors voted to approve the policy developed by MCOPP, stating that the organization is to provide information about and promotion of healthy eating and active living assets and opportunities at the organization and in the surrounding neighborhood.

The healthy eating and active living strategies of *MCOPP* included:

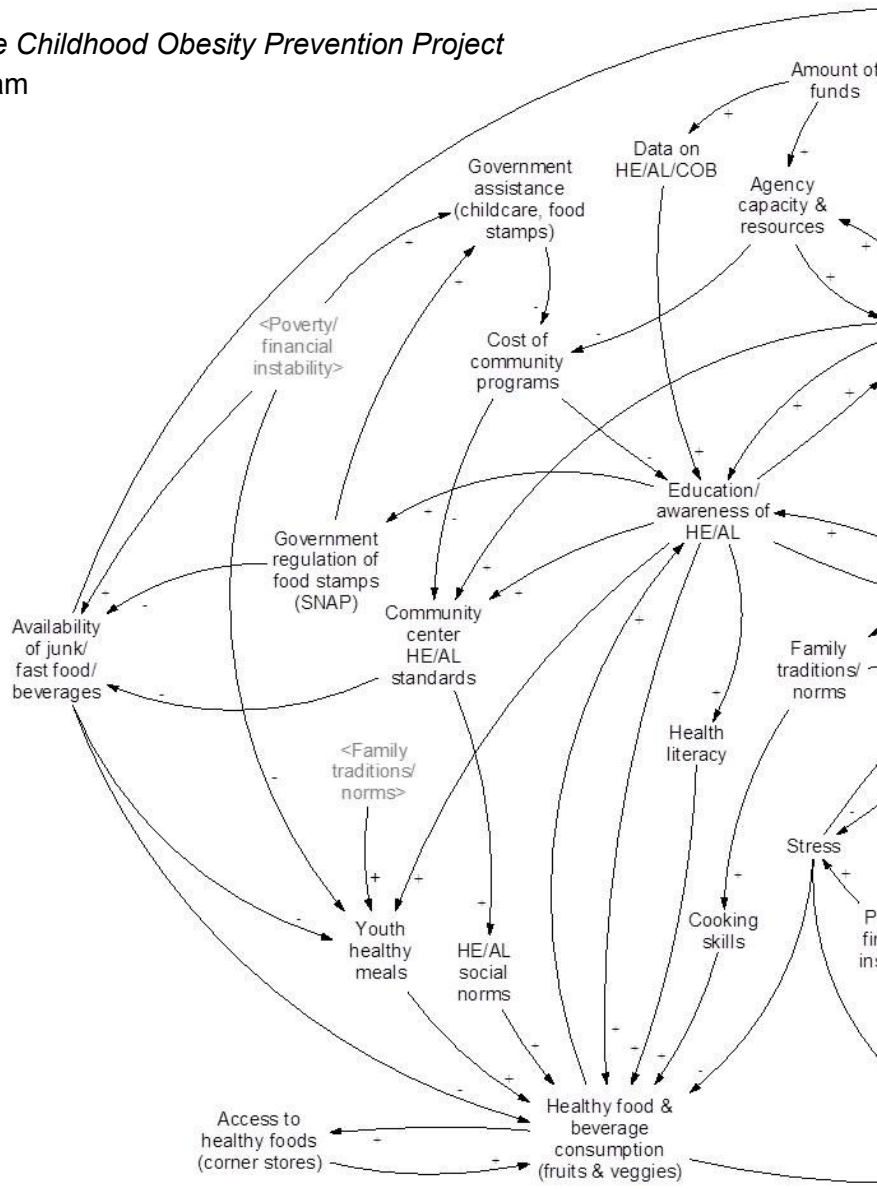
- **Childcare Active Living/Physical Activity Standards:** The Board of Directors voted to approve the policy developed by MCOPP, stating that all children or youth will participate in physical activity while attending organization programming. The organization will strive to achieve the goal of providing 60 minutes of moderate-to-vigorous, age-appropriate, and lifetime-oriented activity as part of its larger goal of promoting active living to all participants and employees.
- **Childcare Healthy Food and Beverage Standards:** The Board of Directors voted to approve the policy developed by MCOPP, stating that the organization is to provide food service that supports and encourages healthy, nutritious foods and beverages that are served in appropriate portion sizes. Food service includes, but is not limited to, meals, snacks, vending machines, concession stands, community events, and staff meetings.

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

Systems Thinking in Communities: Milwaukee, Wisconsin

"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 Milwaukee, Wisconsin 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.

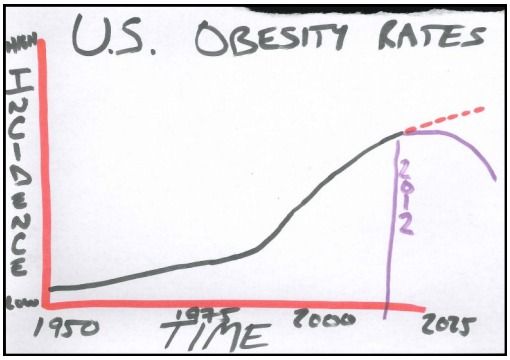
Figure 1: *Milwaukee Childhood Obesity Prevention Project*
Causal Loop Diagram



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

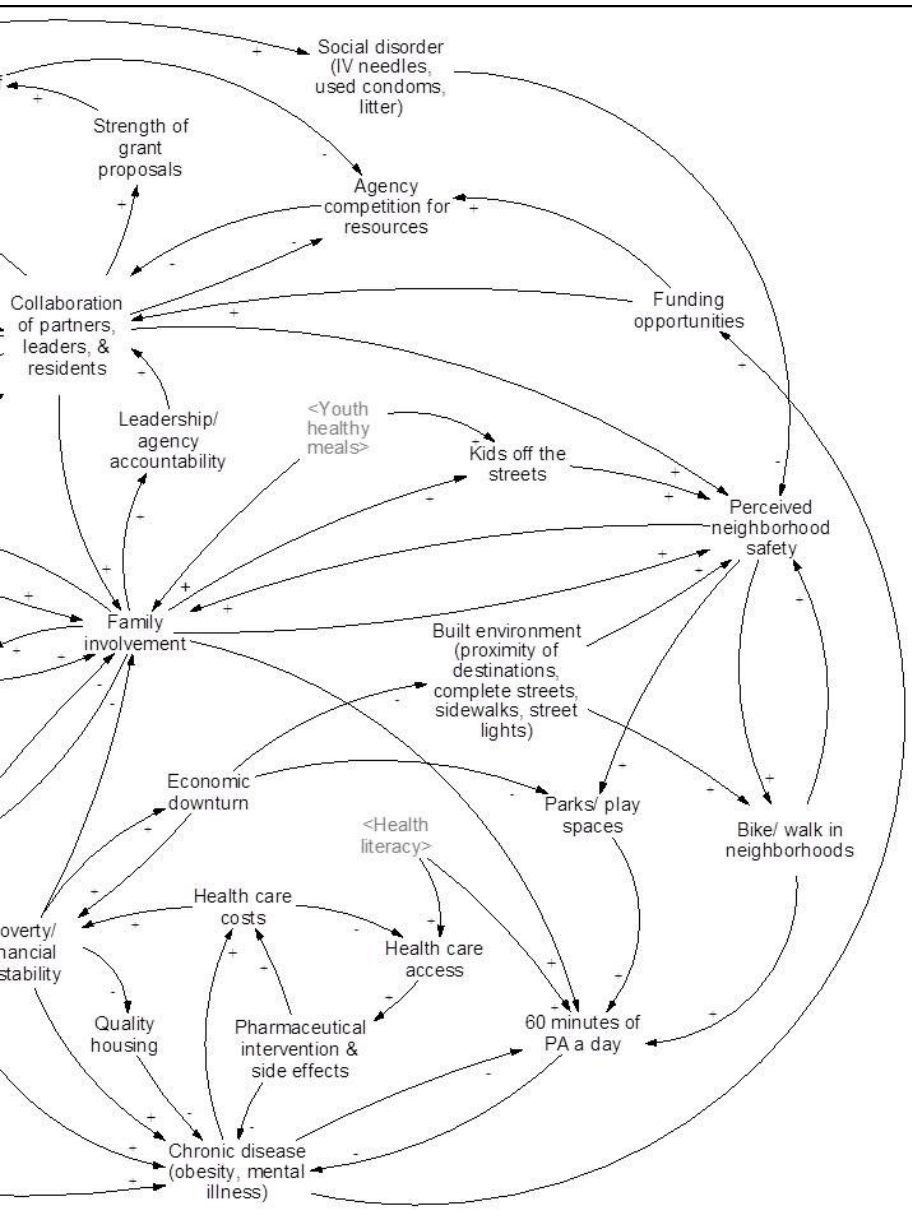
Members of the *MCOPP* partnership participated in a group model building session in February, 2012 and generated this system. also referred to as a causal loop diagram (Figure 1). Participants in the group model building session included Participants in the group model building session included residents as well as representatives of UNCOM member agencies, non-profit agencies, academic institutions, and advocates. 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 Milwaukee 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 obesity rates, the incidence of

obesity has steadily increased since 1950 with a more dramatic increase since 1990. The participant hopes obesity rates will decline 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.

For instance, there are many feedback loops influencing or influenced by family involvement in this causal loop diagram. One feedback loop is: family involvement → kids off the streets → perceived neighborhood safety → family involvement. A second feedback loop is: family involvement → leadership and agency accountability→ collaboration of partners, leaders, and residents → family involvement.

What is important to notice in these examples is that there are two different feedback loops interacting simultaneously to influence or to be influenced by family involvement. Some variables may increase family involvement while other variables limit family involvement. 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.

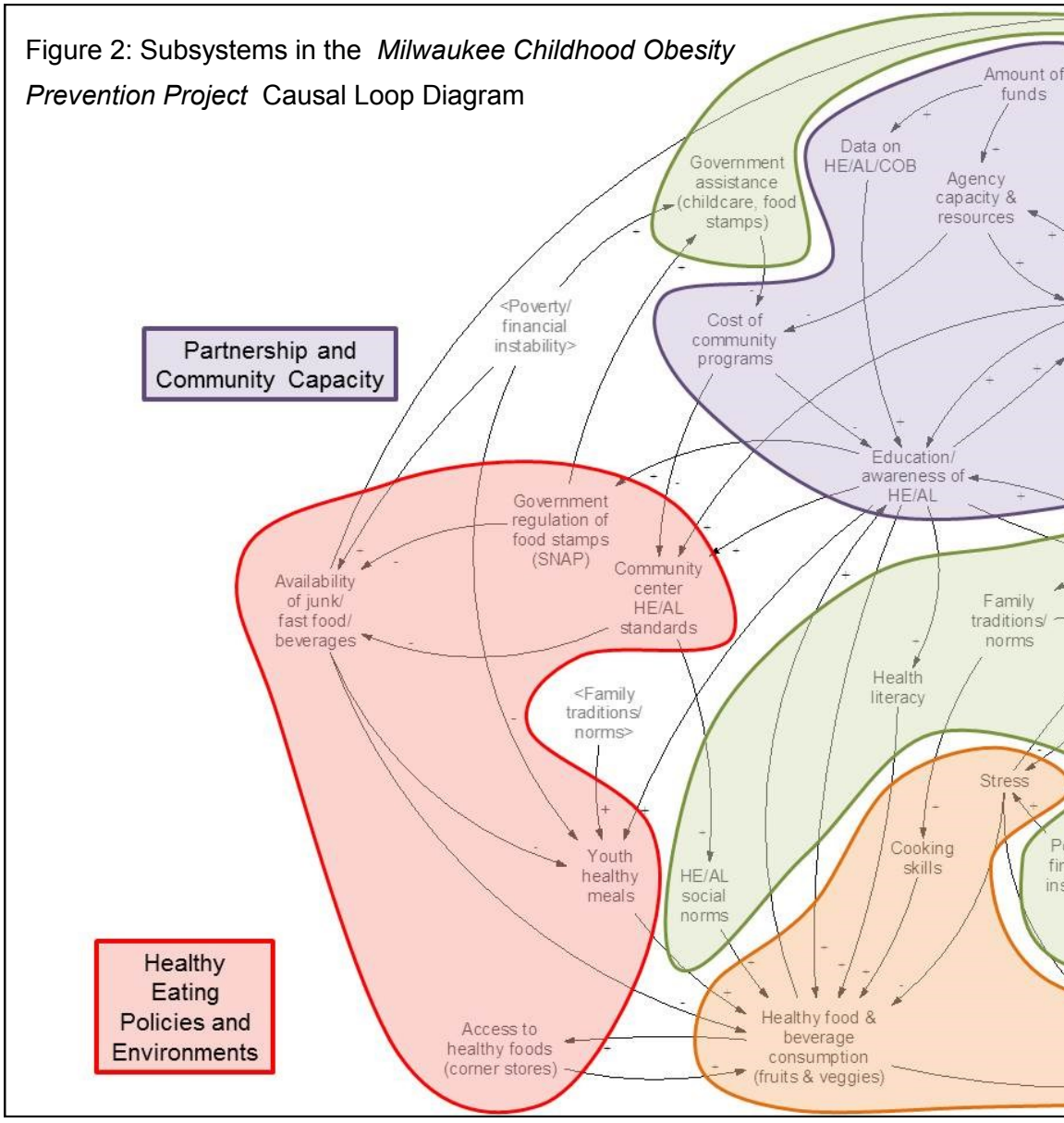
Based on this preliminary work by the *MCOPP* partnership, this "storybook" ties together the behavior over time graphs, the participants' stories and dialogue, and feedback loops from the causal loop diagram to understand the behavior of the system affecting health in Milwaukee, Wisconsin and to stimulate greater conversation related to Milwaukee'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 Milwaukee. 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 *Milwaukee Childhood Obesity Prevention Project* Causal Loop Diagram



Healthy Eating Policies and Environments (Red)

The healthy eating policy and environmental subsystem includes food retail (e.g., availability of junk or fast food and beverages) and food production, distribution, and procurement (not in this model). During the behavior over time graphs exercise, the participants generated 18 graphs related to policy or environmental strategies (e.g., community center healthy eating and active living standards) or contexts (e.g., government regulations of food stamps) that affected or were affected by the work of *MCOPP.* 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 13 graphs related to policy or environmental strategies (e.g., new or improved built environments) or contexts that affected or were affected by the partnership's work.

Health and Health Behaviors (Orange)

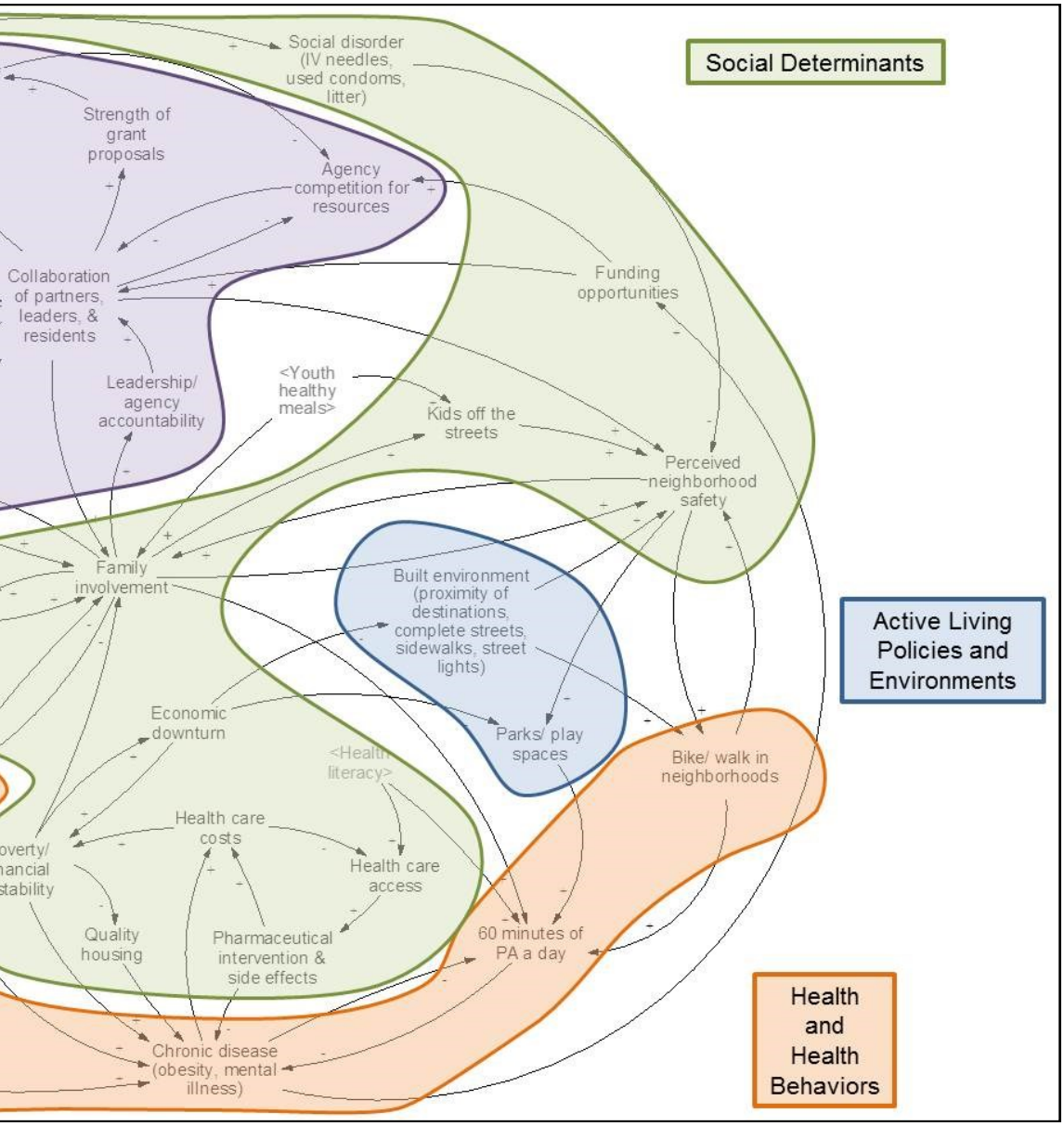
The subsystem for health and health behaviors includes health outcomes (e.g., chronic disease), health behaviors (e.g., healthy food and beverage consumption, 60 minutes of physical activity a day), and behavioral proxies or context-specific behaviors (e.g., cooking skills, biking and walking in neighborhood).

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, *MCOPP* collaborated with staff from the United Neighborhood Centers of Milwaukee and other local partners to increase healthy foods and beverages and opportunities for physical activity in the centers and the surrounding areas. This subsystem also includes community factors outside the partnership that may influence or be influenced by their efforts, such as agency competition for resources or the cost of community programs.

Social Determinants

Finally, the social determinants subsystem denotes societal conditions (e.g., economic downturn, quality of housing, health care costs) and psychosocial influences (e.g., perceived neighborhood 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 *MCOPP* partners or by other representatives in Milwaukee. Using this CLD as a starting place, community conversations about different theories of change within subsystems may continue to take place. For instance, these participants identified interest in understanding more about the relationships of the strength of grant proposals, the amount of funding, and access to data on healthy eating, active living, and childhood overweight and obesity to education and awareness of healthy eating and active living.

The next sections begin to examine the feedback loops central to the work of *MCOPP*. 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.

Healthy Eating and Active Living Curriculum and Professional Development Feedback Loop

To simplify the discussion about feedback loops, several loops drawn from the *MCOPP* CLD (see Figures 1 and 2) are highlighted in Figures 3-6. While the CLD provides a theory of change for the childhood obesity prevention movement in Milwaukee, Wisconsin, 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 the healthy eating and active living curriculum and professional development efforts (green highlighted loop in Figure 3). Milwaukee developed and implemented a policy that staff at the United Neighborhood Centers of Milwaukee will have access to information, resources, and ongoing professional development opportunities to increase their knowledge, skills, and abilities related to healthy eating and active living. Participants described how these educational opportunities increased collaboration with other partners, leaders, or residents through networking and training. In turn, increased local collaboration with residents helps to increase involvement from families in the community. Greater family involvement increase the overall education and awareness of the community related to healthy eating and active living.

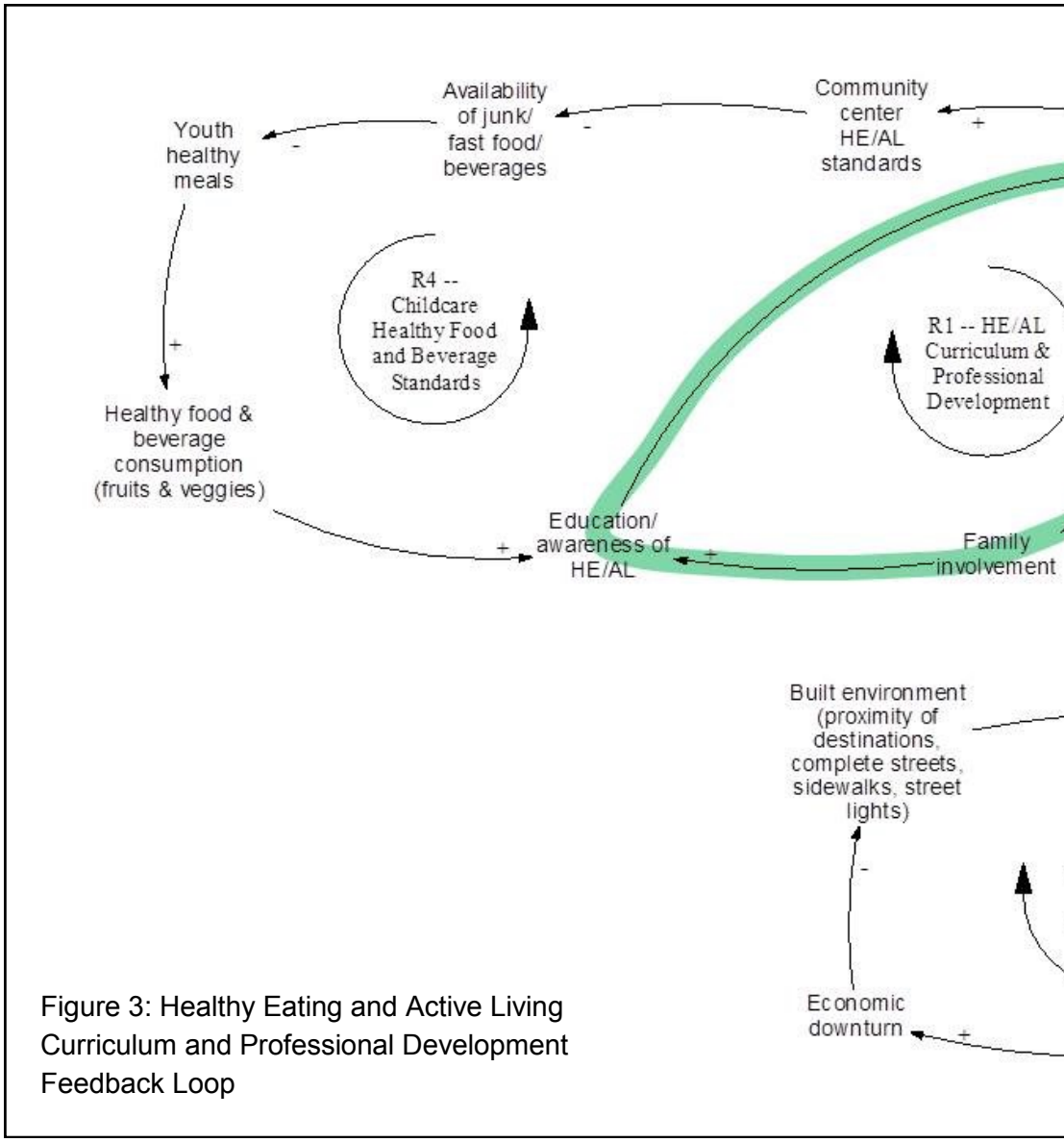


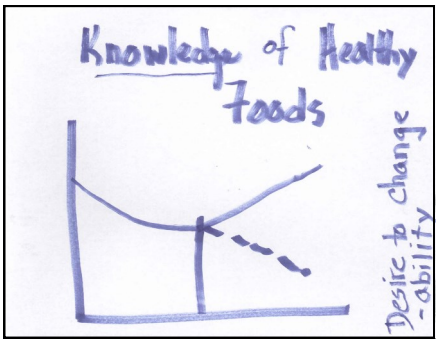
Figure 3: Healthy Eating and Active Living Curriculum and Professional Development Feedback Loop

Story B: While the preceding story reflected a positive scenario for Milwaukee, the same feedback loop also tells the opposite story. As fewer opportunities for education and professional development are available, there are fewer opportunities to connect and collaborate with other partners, leaders, and residents. As residents are less engaged in collaboration, family involvement and general community education and awareness related to healthy eating and active living also decrease.

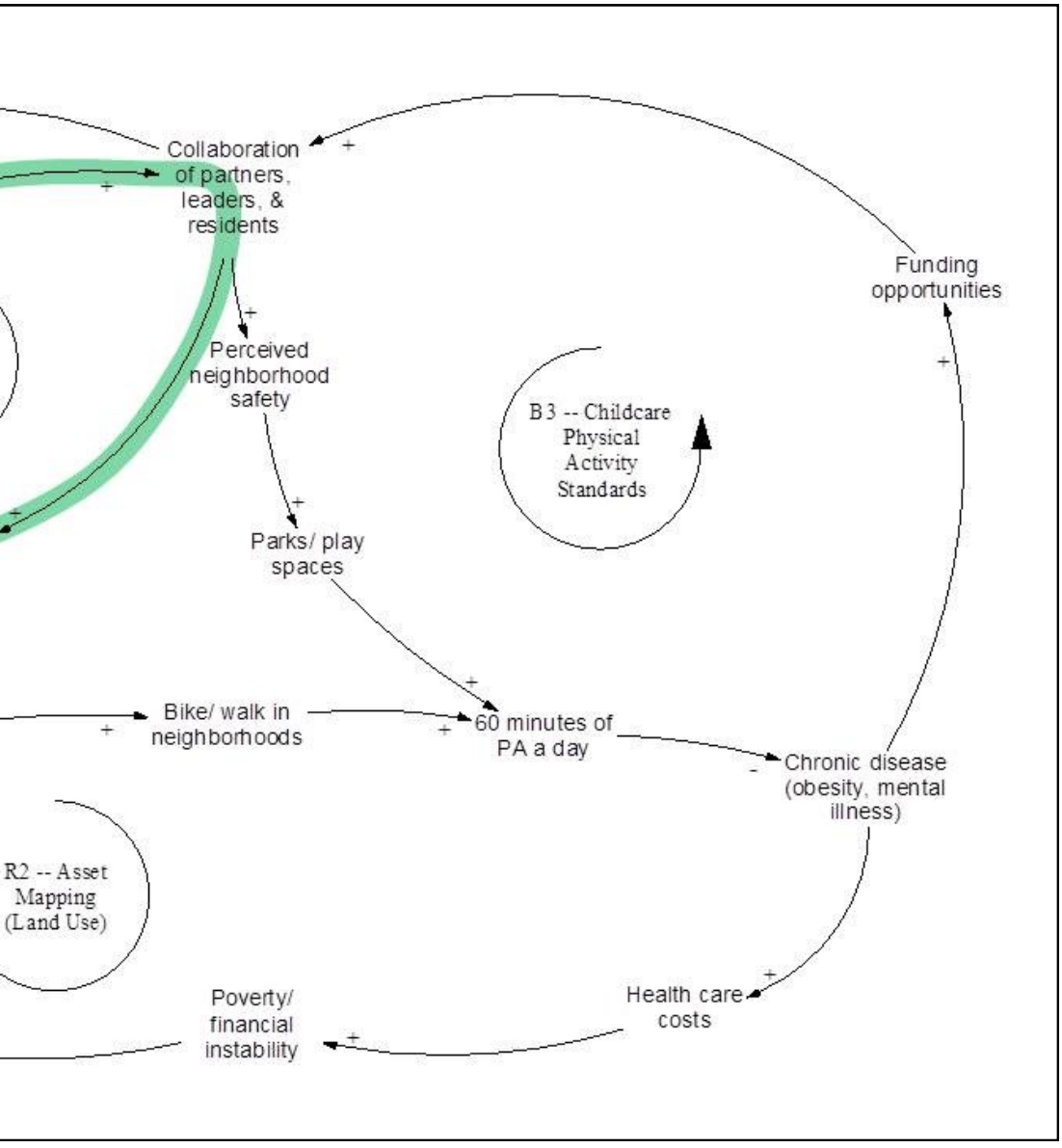
Reinforcing Loop and Notation

These stories — pro and con — represent a reinforcing loop, and the notation in the feedback loop identifies it as a reinforcing loop (see "R1 — HE/ AL Curriculum & Professional Development" and green 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.

In a reinforcing loop, the effect of an increase or decrease in a variable continues through the cycle and returns an increase or decrease to the same variable, respectively. Looking specifically at the "+" or "-" notation, a feedback loop that has zero or an even number of "-" signs, or polarities, is considered a reinforcing loop. This loop has all "+" signs, so it is a reinforcing loop. Balancing loops, with an odd number of "-" signs in the loop, are another type of feedback loop and are referenced in the next sections.



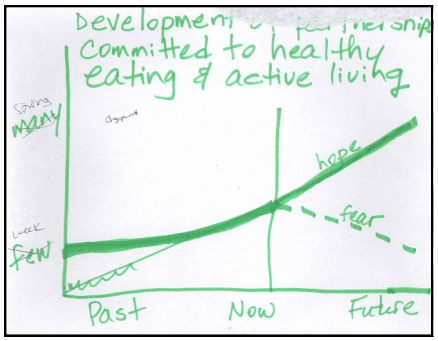
In isolation, this reinforcing loop represents a virtuous cycle in Story A as these assets positively support one another, or a vicious cycle in Story B as these challenges perpetuate a downward spiral. Yet, the influence of a professional development likely levels off at some point when staff in the centers increase their expertise in healthy eating and active living. To understand what specifically leads to the leveling off of the influence of professional development, it may be helpful for the partners in Milwaukee to consider other variables that influence or are influenced by education and awareness of healthy eating and active living. In addition, 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 *MCOPP*</u>

System insights for the partnership's healthy eating and active living curriculum and professional development efforts include:

- The overall decline in knowledge of healthy foods (see behavior over time graph above) suggests the timeliness of increasing personnel and capacity prepared to educate and increase awareness of the benefits of healthy eating and active living in the community.
- With the increased personnel capacity and the increasing collaboration of local partners (see behavior over time graph on bottom right), families from Milwaukee can become more involved in improving healthy eating and active living behaviors as well.



Asset Mapping (Land Uses) Feedback Loop

Given the introduction to feedback loops and CLD notation in the previous section, this discussion of the feedback loop highlighted in orange in Figure 4 expands on the concepts and notation, and highlights asset mapping associated with land uses to support active living and healthy eating in close proximity to the United Neighborhood Centers of Milwaukee.

Causal Story for Feedback Loop

Story A: With greater understanding of the built environment around the centers through asset mapping, staff from the centers can help youth navigate these environments to increase their walking and biking to and from the centers (and encourage them to shop at vendors that provide healthy foods and beverages — not illustrated in this loop). As the youth walk or bike to the centers, they are more likely to meet or exceed 60 minutes of physical activity per day, which will minimize their risk for chronic diseases and the associated health care costs. With less burden from the cost of health care, residents are less likely to live in poverty or financial instability which improves the overall economy. With a better economy, there are more resources to support new or improved built environments around the centers.

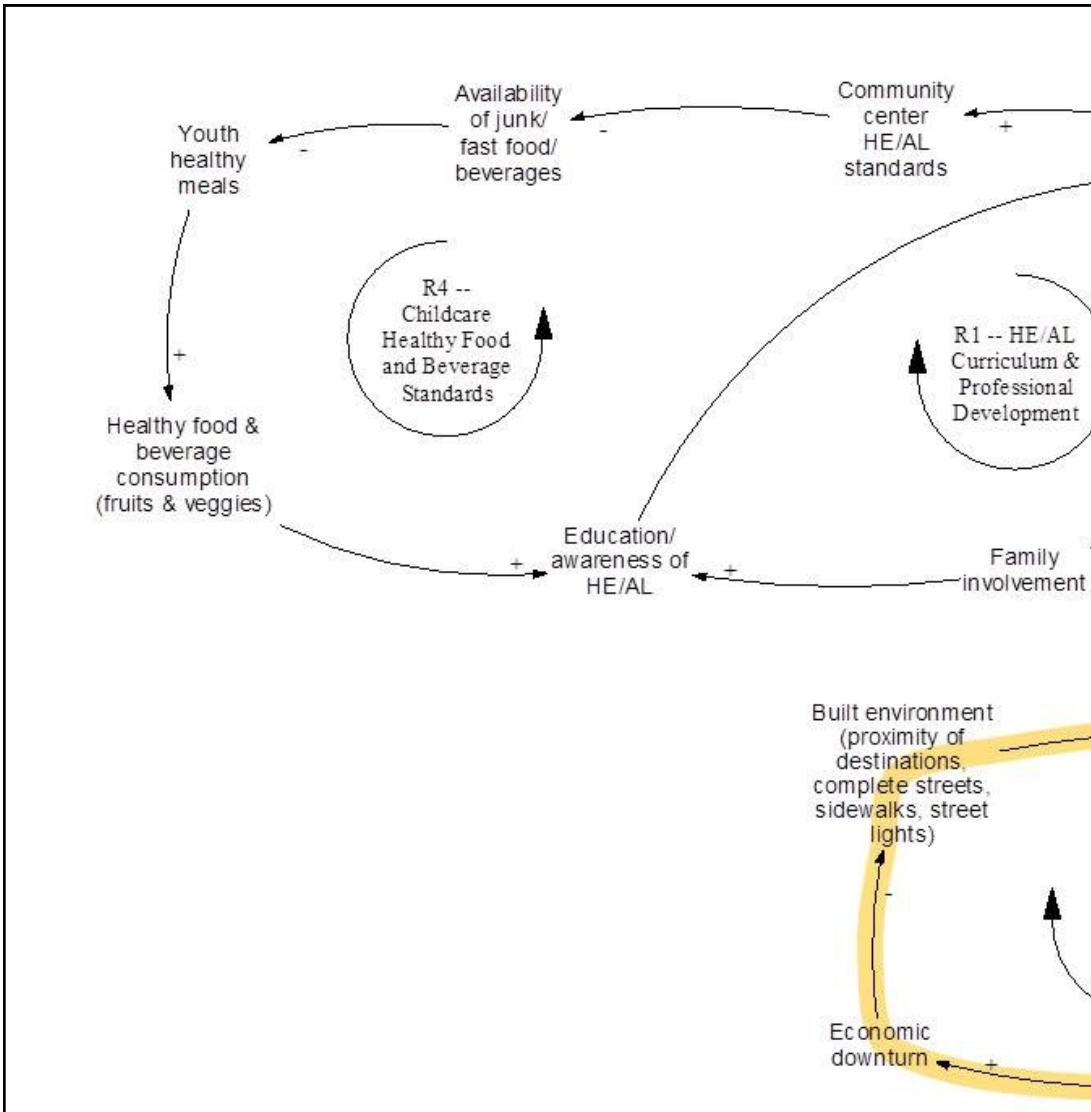


Figure 4: Asset Mapping (Land Uses) Feedback Loop

Story B: Alternatively, poor quality environments make it difficult to bike or walk to the centers (or to choose healthy foods and beverages along the way). Less biking and walking leads to less physical activity and increased risk for chronic diseases and associated health care costs. As these costs become more burdensome, residents are at increased risk for poverty or financial instability and the economy suffers in turn.

Reinforcing Loop and Notation

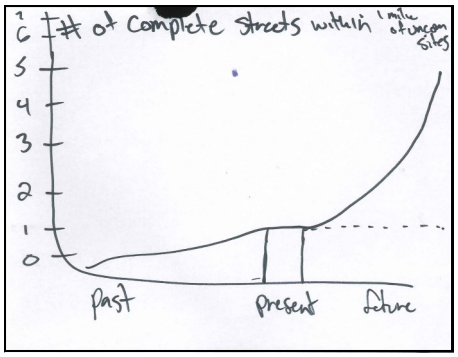
Unlike the food policy council loop in Figure 3, this loop does have two "-" signs or polarities; because this is an even number, it is still a reinforcing loop (see R2—Asset Mapping (Land Use) in Figure 4).

Some of these causal relationships may have more immediate effects (e.g., biking and walking increase physical activity) and other relationships may have delayed effects (e.g., the influence of health care costs on poverty or financial instability). This delayed effect is noted using two hash marks through the middle of the arrow line (not included in Figure 4).

System Insights for *MCOPP*

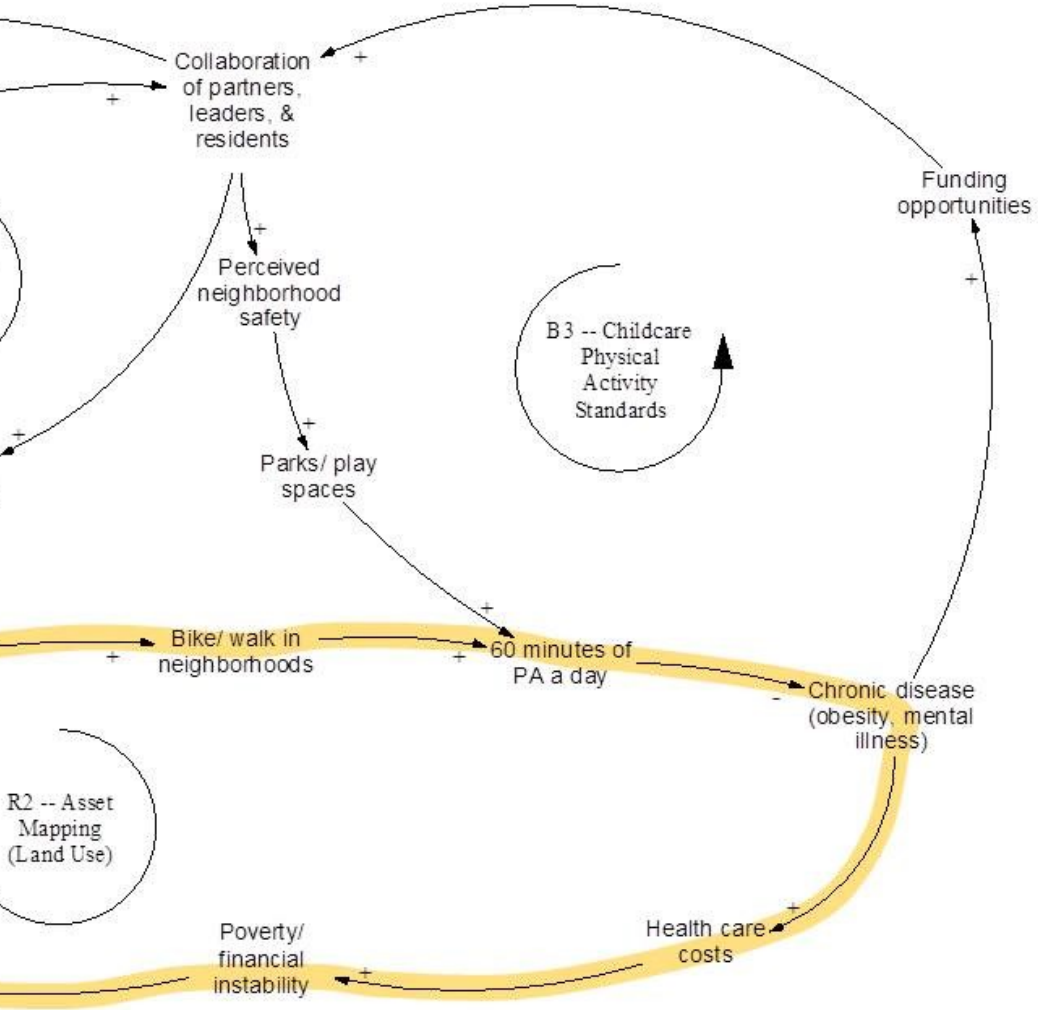
In the behavior over time graphs exercise, participants described how the number of complete streets within

one mile of the centers has been slowly increasing from the past to the present, and the hope is for this number to increase much faster into the future (see illustration on top right). Similarly, participants documented a similar trend for fresh fruit and vegetable sales in corner stores in the past and present, with the hope for a serious increase into the future.



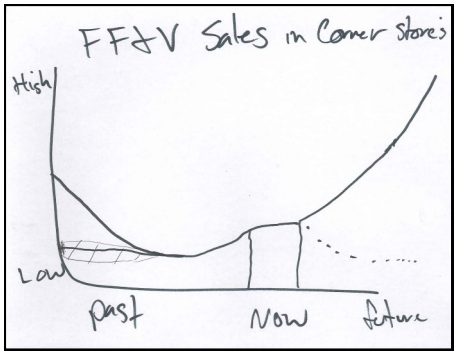
System insights for the partnership's asset mapping (land use) efforts include:

- The graphs depict environments around the centers that require immediate improvements in order to increase access to opportunities for physical activity and healthy eating.
- These environments are critical to support healthy behaviors for youth attending the centers.
- Healthy eating and active living behaviors have influence on residents' economic viability, which, in turn, influence the overall economy of the community.



In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including:

- What built environments best support walking and biking for youth? What types of vendors increase sales of fresh fruits and vegetables to youth?
- How many of these environments and vendors are located within a one-mile radius of the centers? (Asset maps)
- What is the economic burden of physical activity in the community (e.g., health care costs associated with chronic diseases, loss in attendance at school or productivity at work)?
- What proportion of overweight or obese residents live in poverty or financial instability?



"As it stands now, there may be one complete street within one mile radius of an UNCOM [United Neighborhood Centers of Milwaukee site and that's something as a land use subcommittee we can look into…to see how many are actually there." (Participant)

Childcare Active Living/Physical Activity Standards Feedback Loop

Highlighted in blue in Figure 5, the childcare active living standards feedback loop represents one of the *MCOPP* strategies to increase active living in Milwaukee, Wisconsin.

Causal Story for Feedback Loop

Story A: The board for the United Neighborhood Centers of Milwaukee approved a policy supporting 60 minutes of moderate-to-vigorous, age-appropriate, and lifetime-oriented activity for all youth attending the centers as part of its larger goal of promoting active living to all participants and employees. As described in the last section, participants described how meeting the 60 minutes a day can reduce risk for chronic diseases. With lower rates of chronic diseases, partners may end up receiving less funding to support these types of collaborations and activities. With less collaboration across partners, leaders, and residents, perceptions of neighborhood safety may decline. With less perceived safety, fewer youth are allowed to be outside in parks or other play spaces, minimizing their ability to get 60 minutes of physical activity.

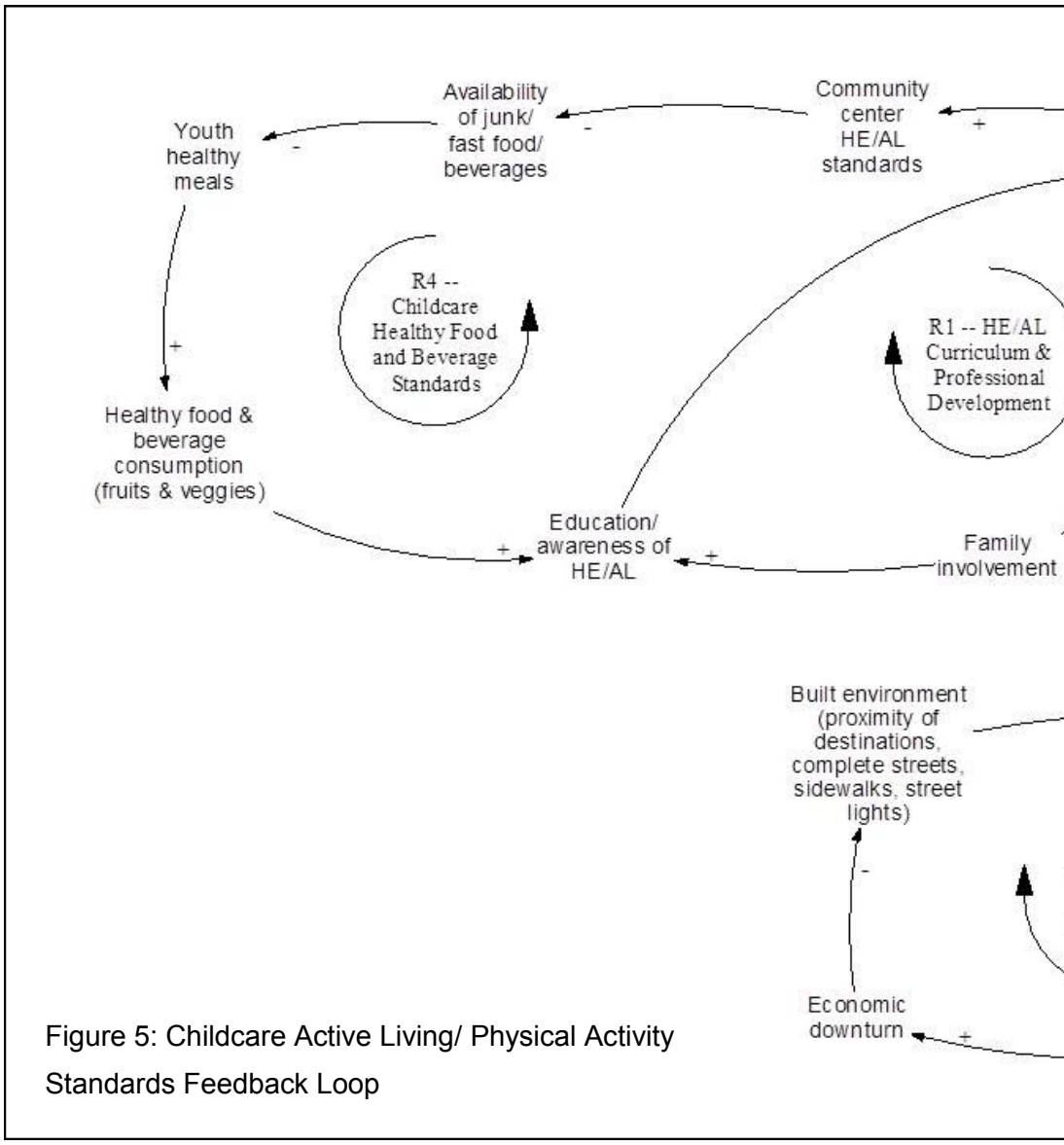


Figure 5: Childcare Active Living/ Physical Activity Standards Feedback Loop

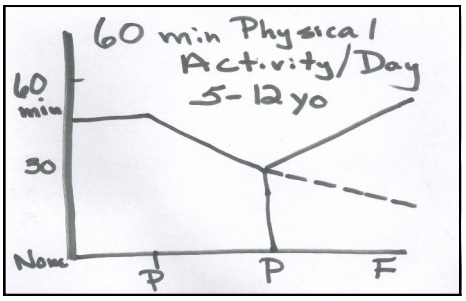
Story B: The same feedback loop also tells the opposite story. Less physical activity results in more chronic diseases and greater funding for these diseases, More funding supports local collaboration to make improvements and these improvements can increase perceptions of neighborhood safety, increasing outside activity in parks and other play spaces and the likelihood of getting 60 minutes of physical activity each day.

Reinforcing Loop and Notation

Unlike the previous loops, this one has one "-" sign or polarity on the arrows, suggesting it is a balancing loop. As indicated by the name, balancing loops tend to create more of a stable trend over time, as opposed to one that is continually increasing or decreasing. Some of the causal relationships have more immediate effects (e.g., parks and play spaces increasing physical activity) and others have more delayed effects (e.g., partner collaboration increasing perceived neighborhood safety).

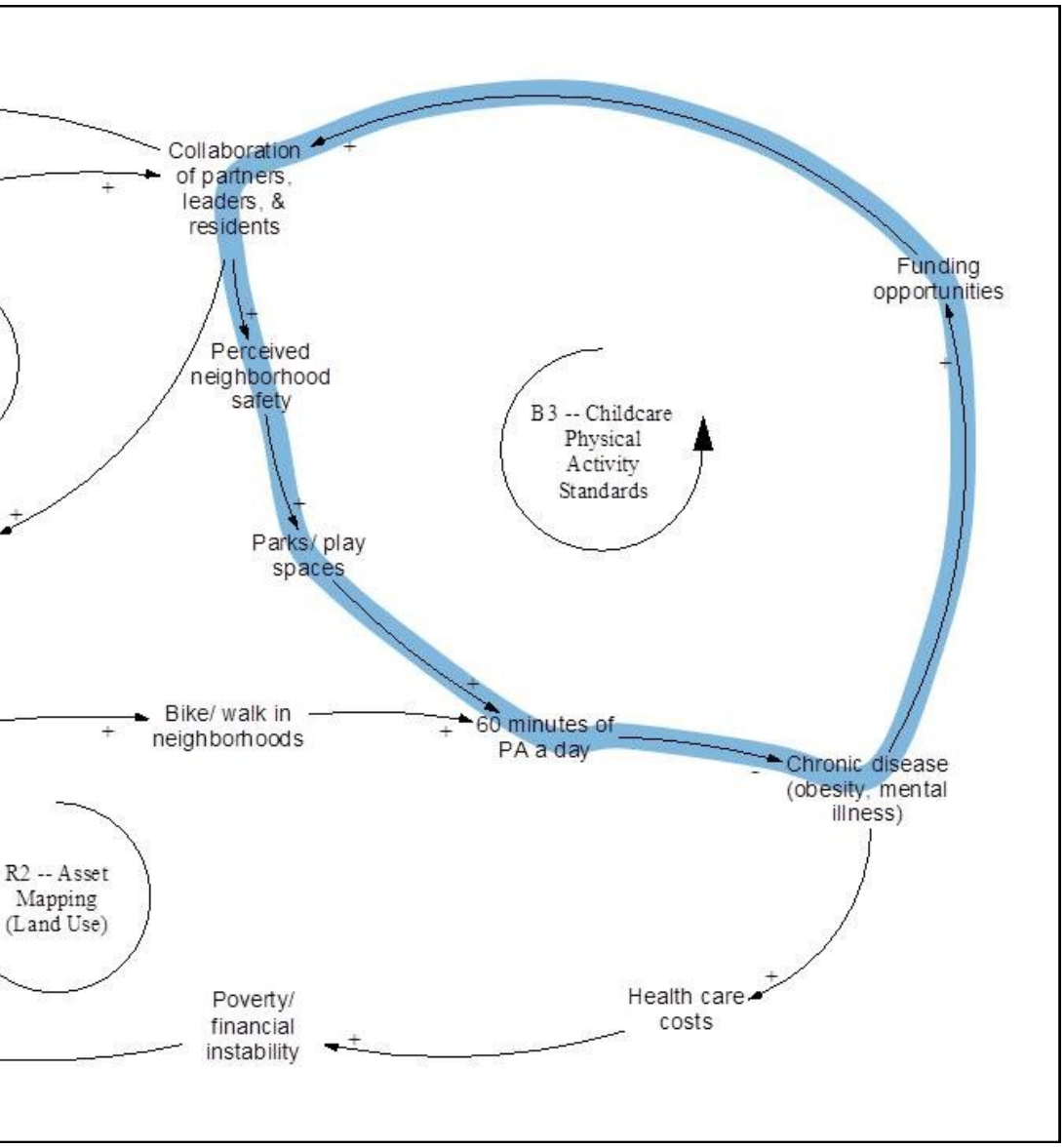
"Within the past year I've become aware of one obese child that comes to our agency that's been diagnosed with diabetes and we've got a couple kids who have hypertension and so I see that chronic disease is ever-increasing at an earlier age in our population." (Participant)

Story A provides a good illustration of the reason why it is not advantageous to separate the feedback loops from the causal loop diagram (see Figures 1-2). For instance, while physical activity may have an influence on chronic diseases, many other factors influence chronic disease rates. In this case, examining this loop without the context of the other variables and loops may lead to inappropriate conclusions.



<u>System Insights for *MCOPP*</u>

Participants identified increases in symptoms of chronic diseases in younger kids (see quote on previous page) coupled with reductions in youth meeting the requirements for 60 minutes of physical activity per day (top right) and declining numbers of safe play spaces (bottom right) in Milwaukee.

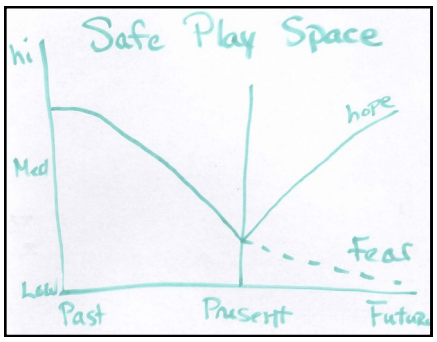


From the systems thinking exercises, several insights can inform next steps with the efforts to increase physical activity in and around the centers, including:

- Designing and maintaining safe play spaces for youth of all ages in order to increase their rates of physical activity.
- Addressing crime and violence in and around the centers in order to improve perceptions of safety.
- Seeking funding opportunities that are not tied to specific health conditions but address common risk factors or determinants of health.

In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including:

- What factors influence neighborhood safety (e.g., rates of crime, violent actions)? Are these the same factors that influence perception of neighborhood safety? What are the actual rates of crime and violence as compared to perceptions?
- How many parks and play spaces are within a one-mile radius of the centers? What types of facilities and amenities are needed to increase use of parks and play spaces by youth of different ages in the community?
- What drives community collaboration when funding support is not available?



Childcare Healthy Food and Beverage Standards Feedback Loop

The loop highlighted in red in Figure 6 represents the *MCOPP* strategy to implement childcare healthy food and beverage standards, complementing the previous strategy on active living with one on healthy eating.

Causal Story for Feedback Loop

Story A: The board for the United Neighborhood Centers of Milwaukee approved a policy for food service supporting and encouraging healthy, nutritious foods and beverages that are served in appropriate portion sizes. Food service includes, but is not limited to, meals, snacks, vending machines, concession stands, community events, and staff meetings. With an increase in healthy eating standards, the availability of junk or fast food and beverages is limited. In turn, the number of healthy meals for youth increases giving rise to consumption of healthy foods and beverages. As these young people increase their exposure to healthy foods and beverages in the centers, their education and awareness of the benefits of healthy eating and active living also improve and they can influence their families and others around them. As general awareness and education among residents goes up, they may be more inclined to collaborate with others to continue to improve community standards for healthy eating and active living.

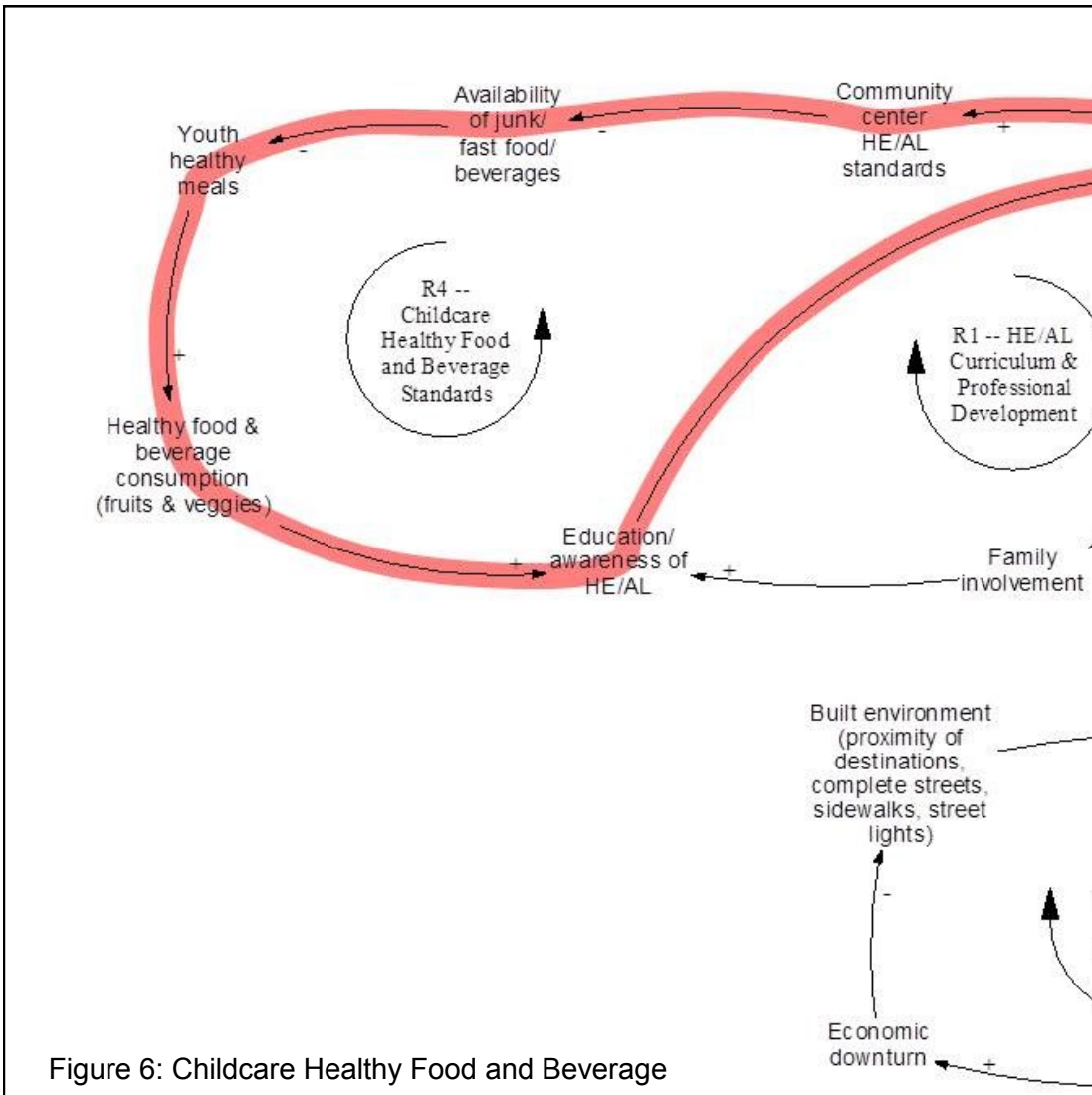


Figure 6: Childcare Healthy Food and Beverage Standards Feedback Loop

Story B: Alternatively, an absence of healthy eating and active living standards may result in a high level of access to junk or fast foods and beverages that diminishes the number of youth receiving healthy meals, and, as a consequence, lessens the amount of healthy foods and beverages consumed. This may lead to less education and awareness among residents of the benefits of healthy eating and active living and, therefore, less impetus to collaborate to try to improve these standards.

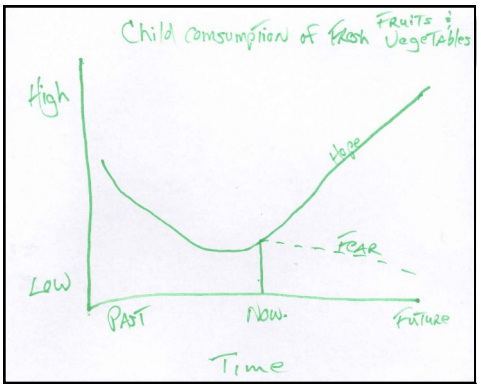
Reinforcing Loop and Notation

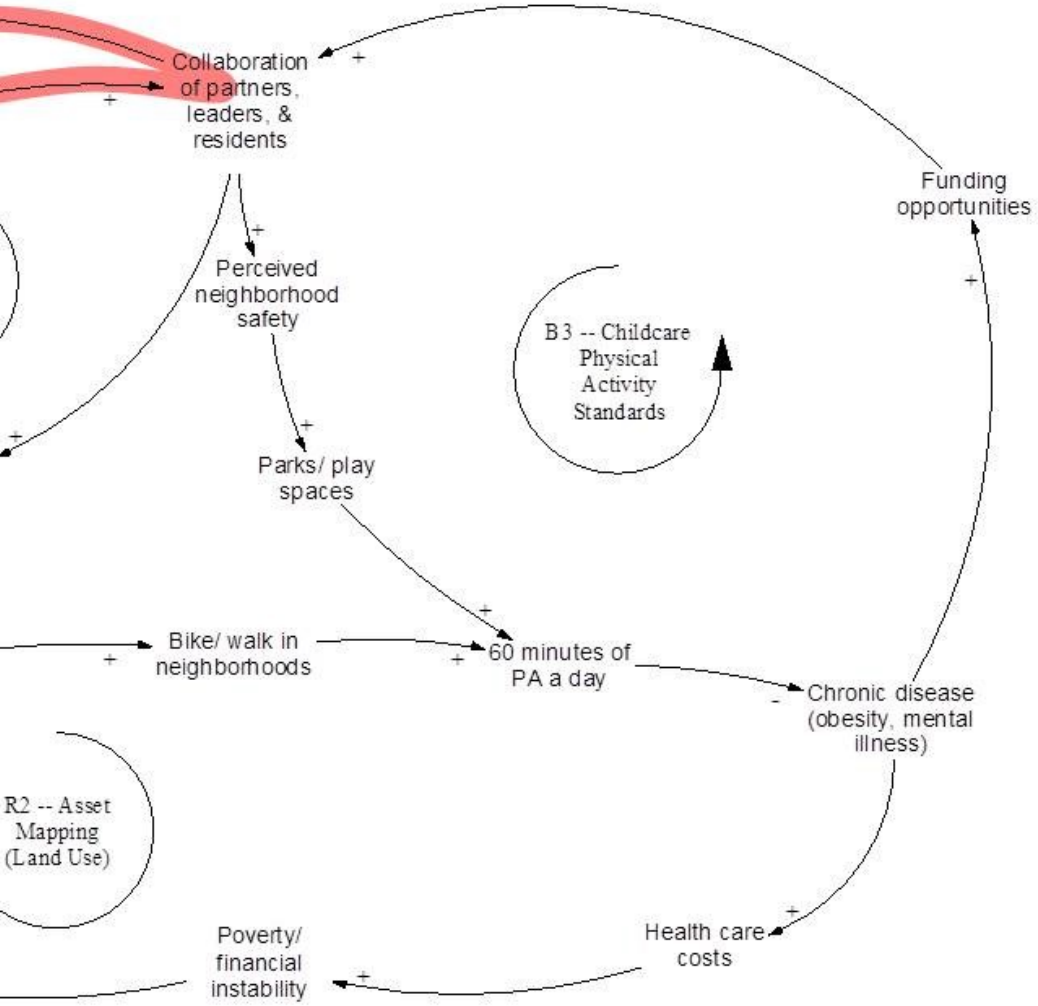
Unlike the childcare active living/physical activity loop in Figure 3, this loop does have two "-" signs or polarities; because this is an even number, it is still a reinforcing loop (see R4—Childcare Healthy Food and Beverage Standards in Figure 6). Some of these causal relationships may have more immediate effects (e.g., the influence of standards on the availability of junk or fast foods and beverages) and other relationships may

"With fruit and vegetable consumption, we made a very conscious decision to pull out our vending machines [at the agency] and serve very specific after school snacks, which limited [youth access] to junk food. We let them buy more nutritious afternoon snacks." (Participant)

have delayed effects (e.g., the influence of collaboration on new or modified standards for healthy eating and active living). Again, this delayed effect is noted using two hash marks through the middle of the arrow line (not shown here).

In Figure 1-2, some loops are disconnected. In order to prevent loops from crossing over other loops, these figures use shadow variables to keep the image from getting too messy. Youth healthy meals has a shadow variable (shown in Figures 1-2) and it is presented in gray text with brackets on either side to show that it "shadows," or duplicates, the original youth healthy meals variable.





System Insights for *MCOPP*

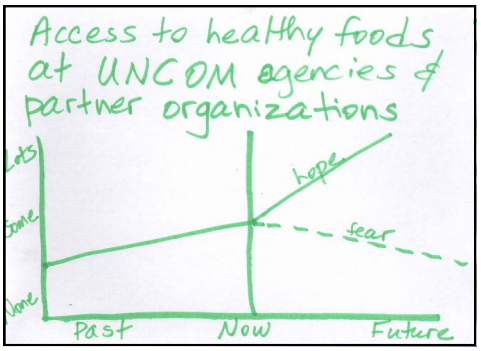
In the behavior over time graphs, participants identified a general decrease in children's consumption of fresh fruits and vegetables with a recent leveling off of this trend and a hope for a significant increase into the future (see top right). At the same time, the centers have slowly increased access to healthy foods in their agencies and among partners.

System insights can inform the partnership's next steps with these standards including:

- Working with youth to inform and educate their families and friends about the benefits of healthy eating in order to generate greater collaboration in the community.
- Developing community organizing strategies to increase advocacy from partners, leaders, and residents for improved healthy eating standards community-wide.
- Teaching youth to prepare meals and snacks with fresh fruits and vegetables.

In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including:

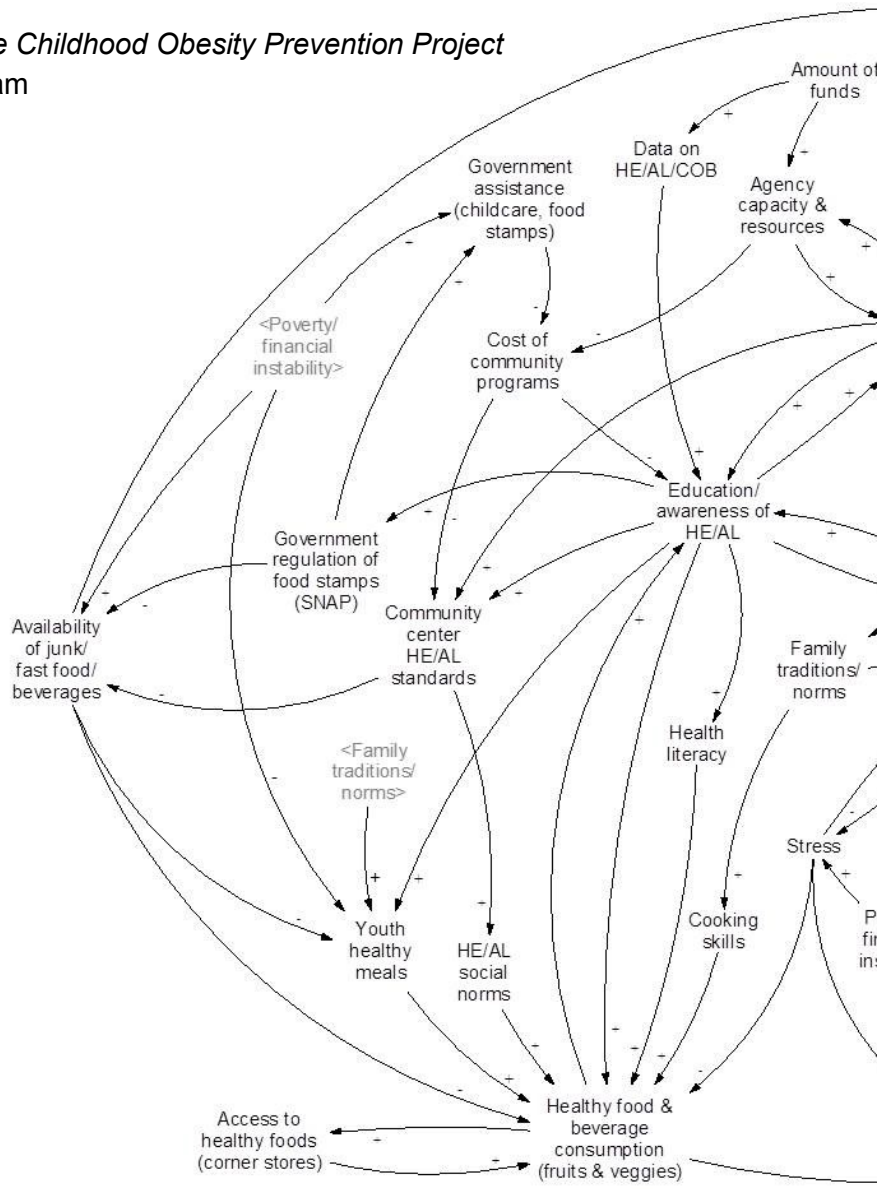
- How accessible are junk and fast foods and beverages compared to fresh fruits and vegetables in the centers and among vendors within a one-mile radius of the centers?
- What factors influence partners, leaders, and residents to collaborate to improve healthy food and beverage standards?



Opportunities for Systems Thinking in Milwaukee, Wisconsin

This storybook provided an introduction to some basic concepts and methods for systems thinking at the community level, including: causal loop diagrams, variables and shadow variables, causal relationships and polarities, reinforcing feedback loops, and balancing feedback loops, among others. For the *MCOPP* partners, this storybook also summarized the healthy eating, active living, partnership and community capacity, social determinants, and health and health behaviors subsystems in the Milwaukee causal loop diagram as well as four specific feedback loops corresponding to the partnership's primary strategies.

Figure 7: *Milwaukee Childhood Obesity Prevention Project* Causal Loop Diagram



This causal loop diagram reflects a series of conversations among partners and residents from 2012 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.

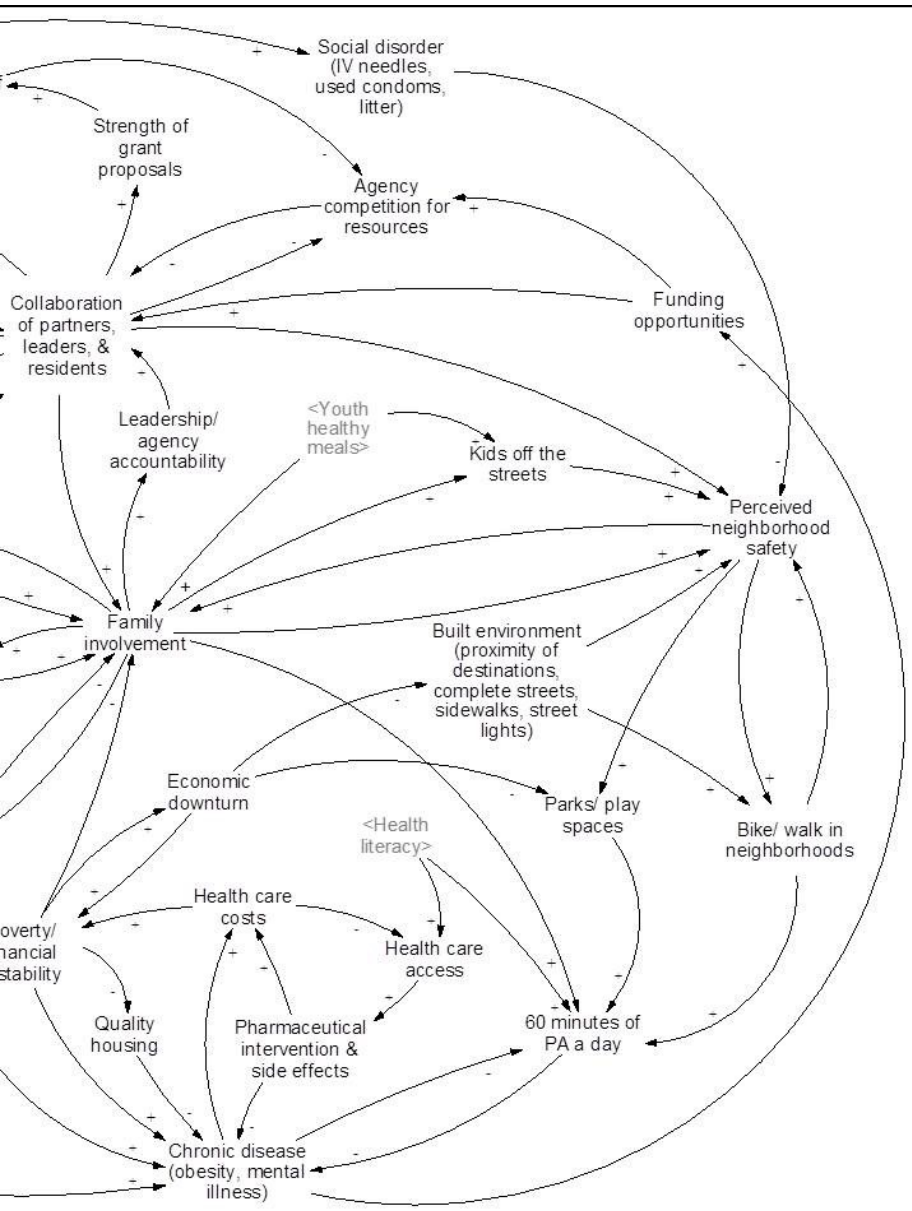
This represented a first attempt to collectively examine the range of things that affect or are affected by policy, system, and environmental changes in Milwaukee, Wisconsin to promote healthy eating and active living as well as preventing childhood overweight and obesity.

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

- the participants represent a sample of the *MCOPP* 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 community gardens, bike knowledge/ skills, sustainability of work, video games/TV, jobs, trust, technology, marketing/advertising, unhealthy foods/ beverages; 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 Milwaukee 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 *MCOPP* 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/

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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.

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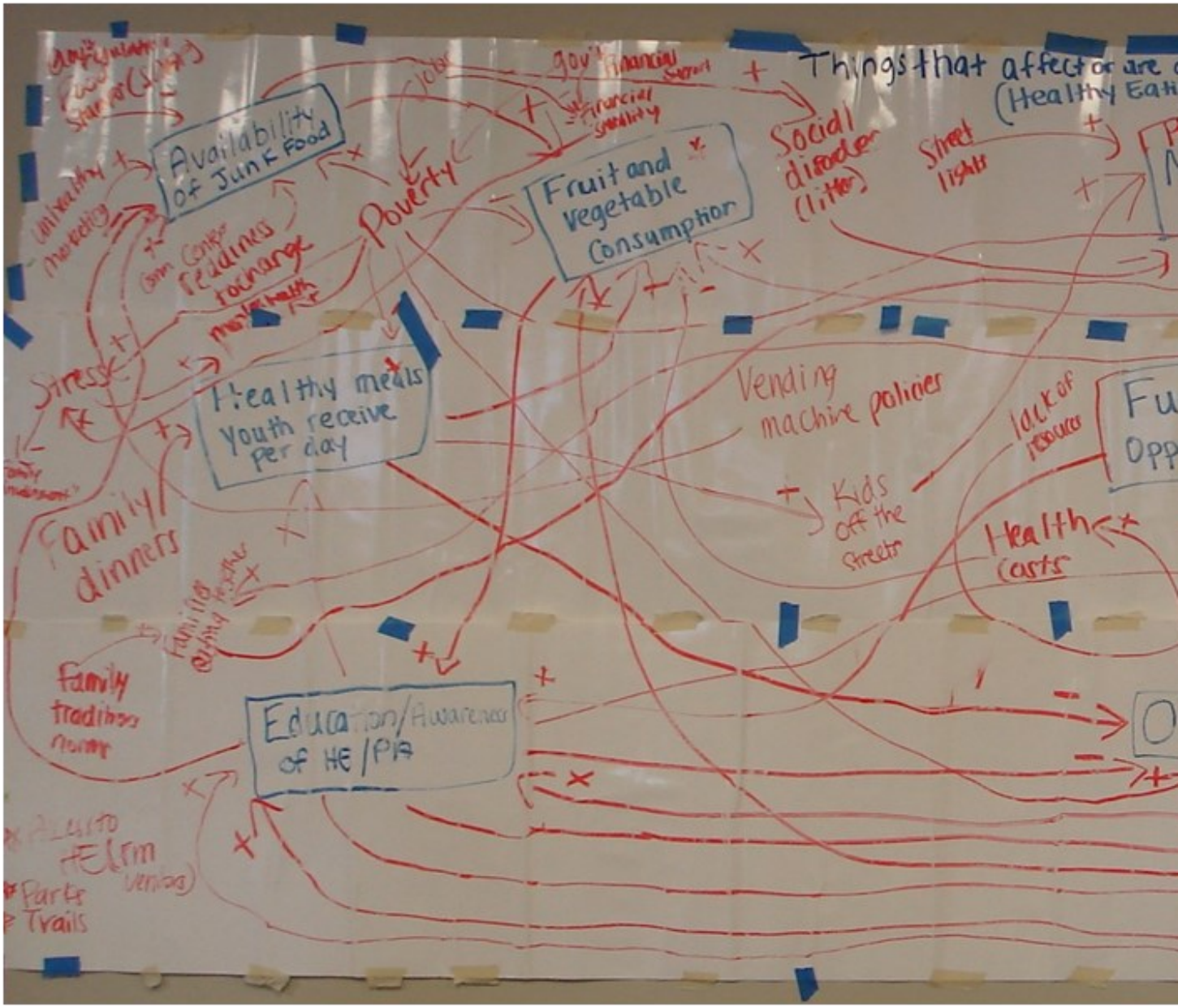
Vennix, J. (1996). Group model building. New York, John Wiley & Sons.

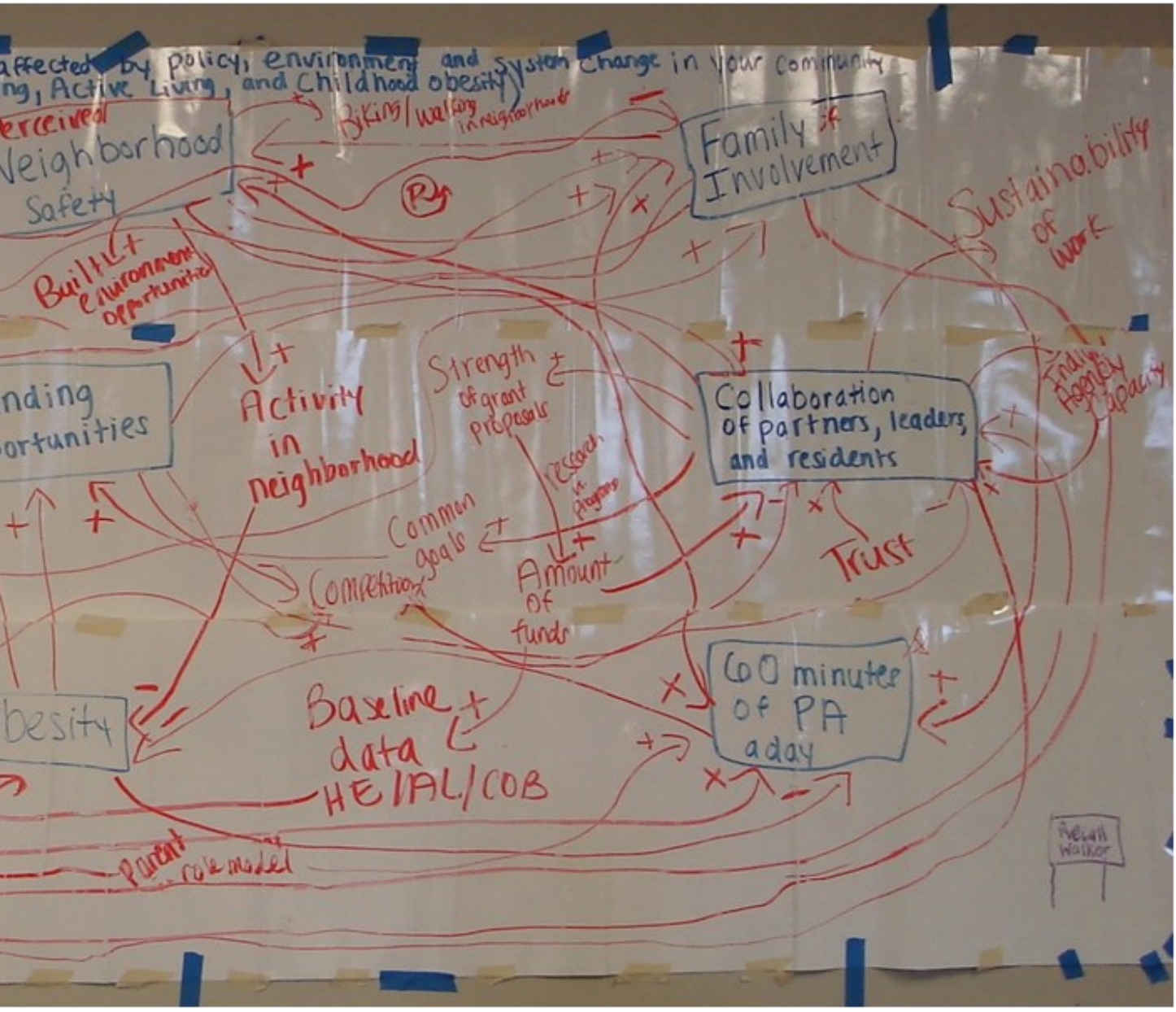
Zagonel, A. and J. Rohrbaugh (2008). Using group model building to inform public policy making and implementation. Complex Decision Making. H. Qudart-Ullah, J. M. Spector and P. I. Davidsen, Springer-Verlag: 113-138.

Appendix A: Behavior Over Time Graphs Generated during Site Visit

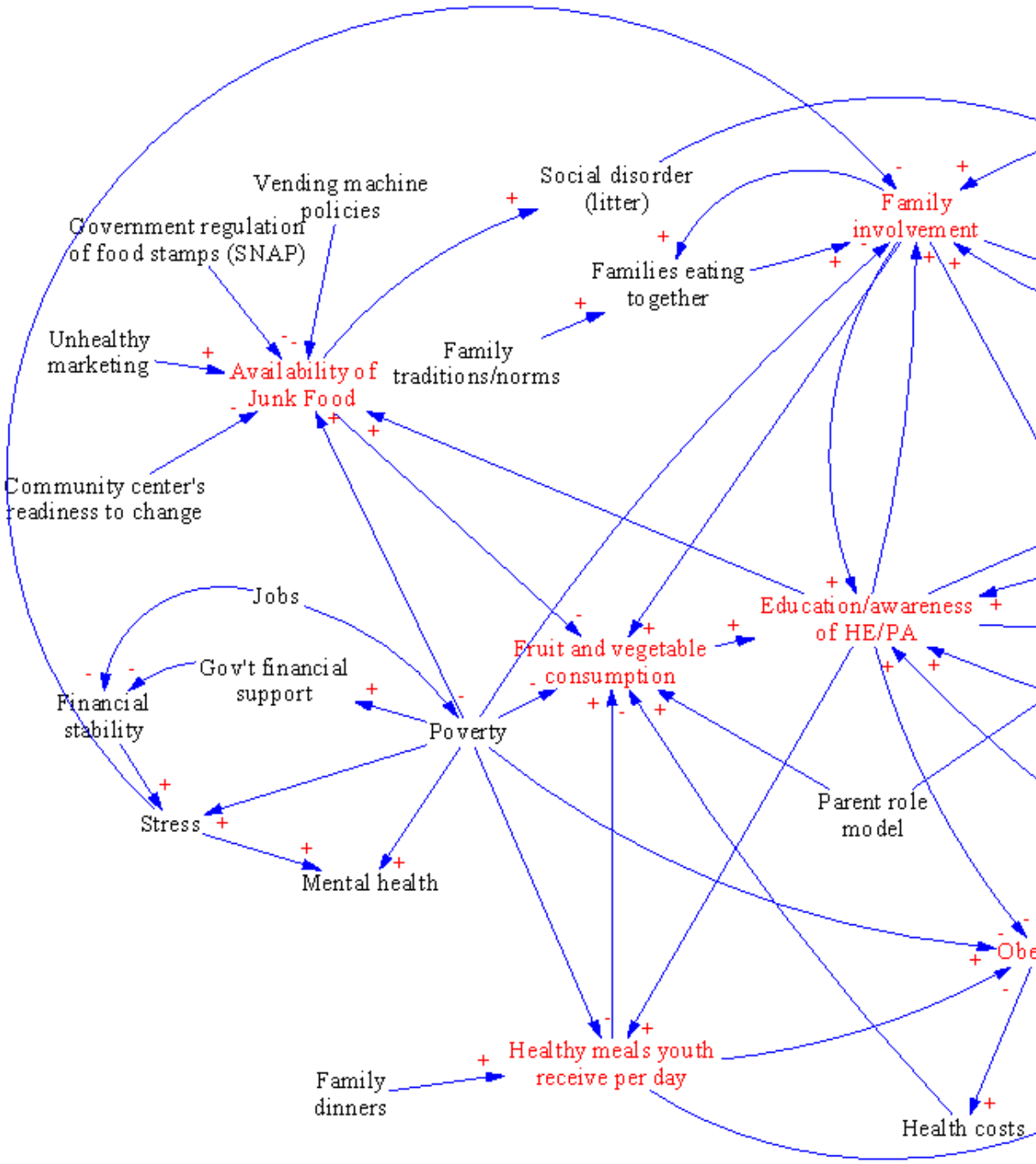
Milwaukee, Wisconsin: *Milwaukee Childhood Obesity Prevention Project (MCOPP)*	
Categories	**Number of Graphs**
Active Living Behavior	10
Active Living Environments	3
Funding	0
Healthy Eating Behavior	8
Healthy Eating Environments	10
Marketing and Media Coverage	2
Obesity and Long Term Outcomes	3
Partnership & Community Capacity	6
Policies	1
Programs & Promotions (Education and Awareness)	9
Social Determinants of Health	9
Total Graphs	**61**

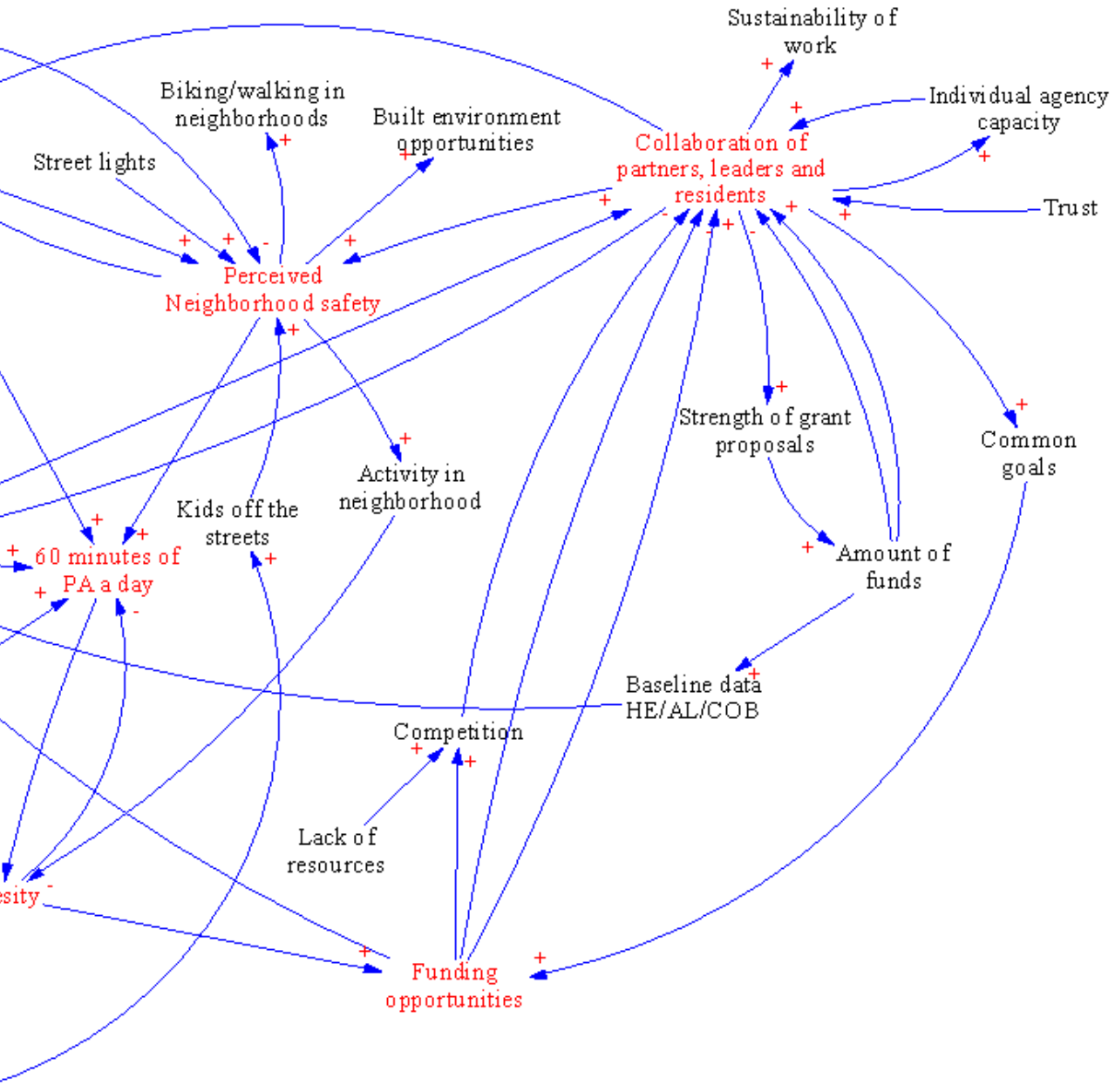
Appendix B: Photograph of the Original Version of the *MCOPP* Causal Loop Diagram



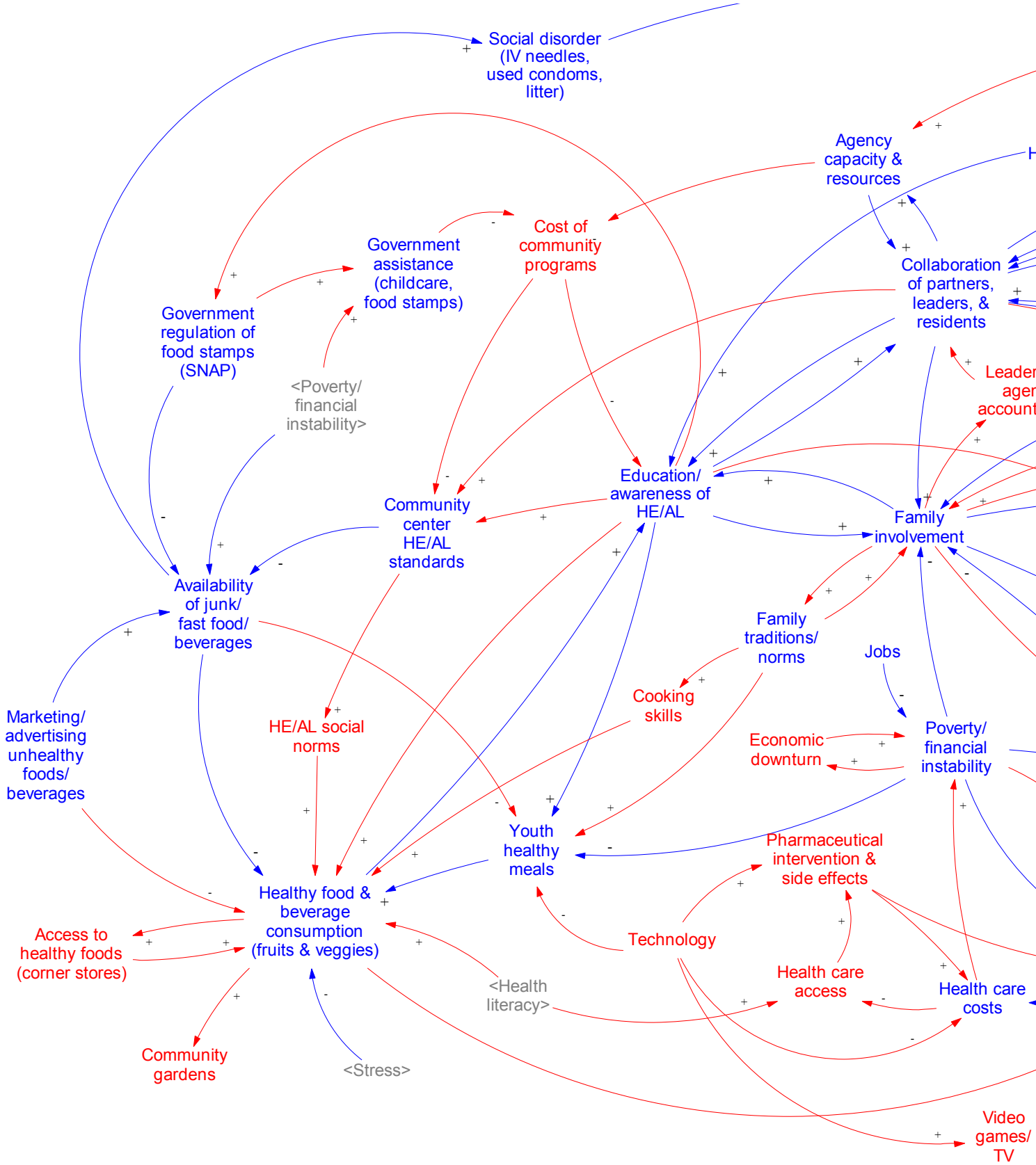

affected by policy, environment and System Change in your community
ng, Active Living, and Childhood obesity
Perceived
Neighborhood Safety
Biking/Walking in neighborhood
Family Involvement
Sustainability of Work
Built Environment Opportunities
Activity in neighborhood
Strength of grant Proposals
Collaboration of partners, leaders, and residents
Trust
Common goals
Competition
Amount of funds
Baseline data HEIAL/COB
60 minutes of PA a day
Parent role model
Health Walker

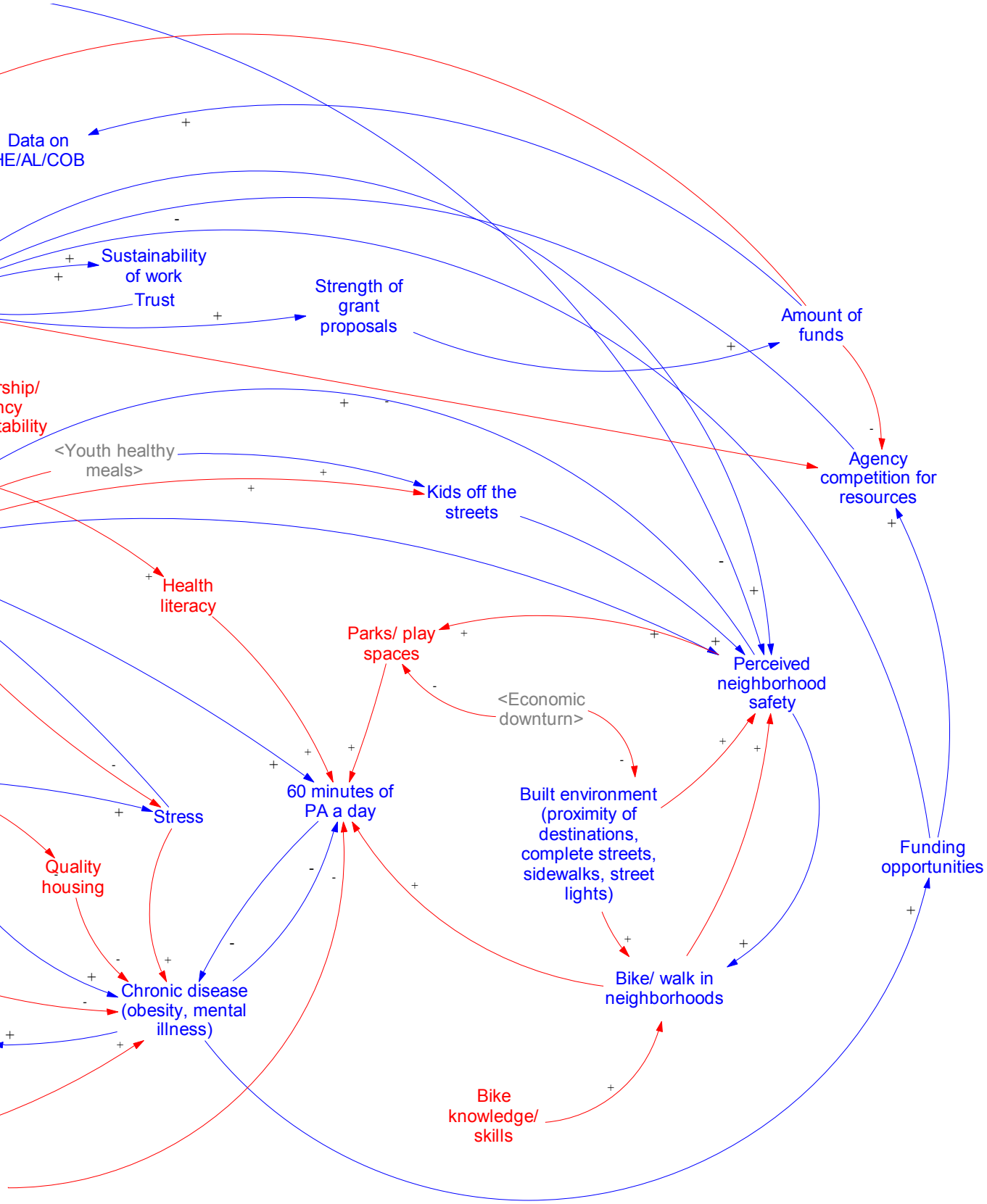
Appendix C: Original Translation of the Causal Loop Diagram into Vensim PLE



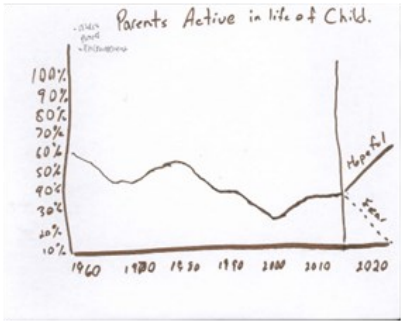

Sustainability of work
Individual agency capacity
Biking/walking in neighborhoods
Built environment opportunities
Street lights
Collaboration of partners, leaders and residents
Trust
Perceived Neighborhood safety
Strength of grant proposals
Common goals
Activity in neighborhood
Kids off the streets
60 minutes of PA a day
Amount of funds
Baseline data HE/AL/COB
Competition
Lack of resources
Funding opportunities

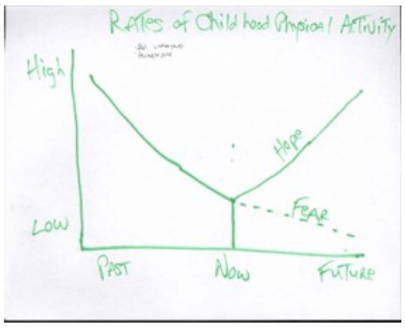
Appendix D: Transcript Translation of the Causal Loop Diagram into Vensim PLE

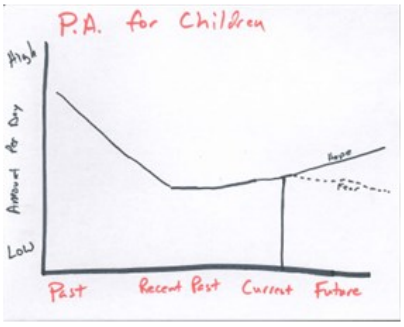


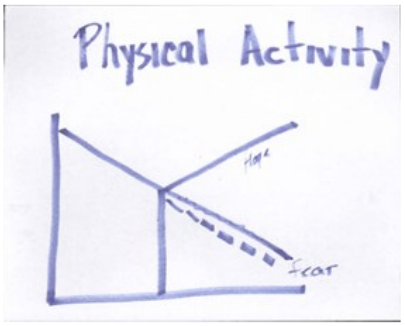

Data on
HE/AL/COB
Sustainability
of work
Trust
Strength of
grant
proposals
Amount of
funds
rship/
ncy
tability
<Youth healthy
meals>
Agency
competition for
resources
Kids off the
streets
Health
literacy
Parks/ play
spaces
Perceived
neighborhood
safety
<Economic
downturn>
60 minutes of
PA a day
Built environment
(proximity of
destinations,
complete streets,
sidewalks, street
lights)
Stress
Quality
housing
Funding
opportunities
Chronic disease
(obesity, mental
illness)
Bike/ walk in
neighborhoods
Bike
knowledge/
skills

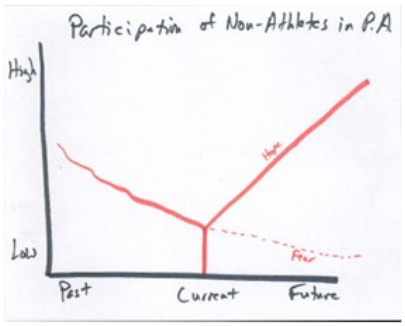
Appendix E: Behavior Over Time Graphs not Represented in the Storybook

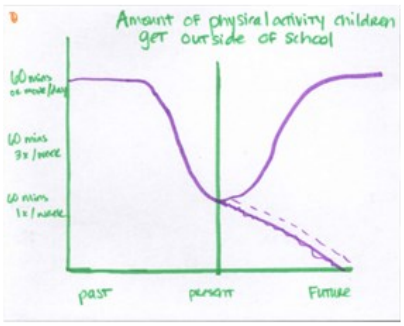


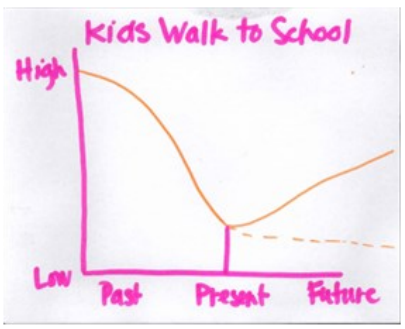


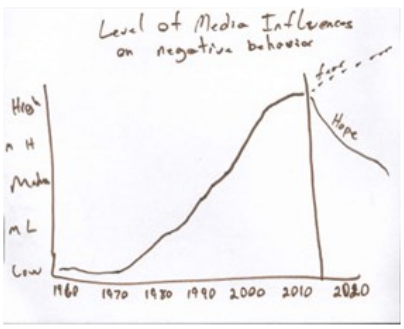


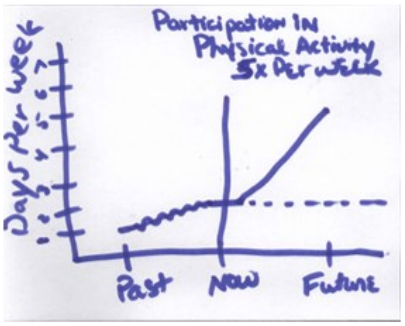


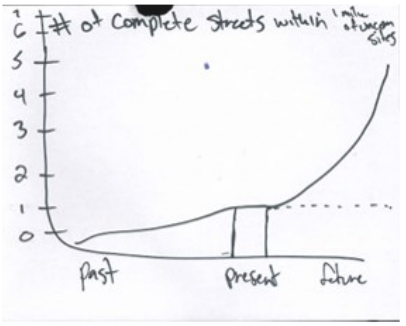


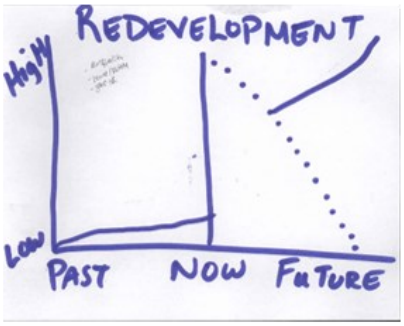


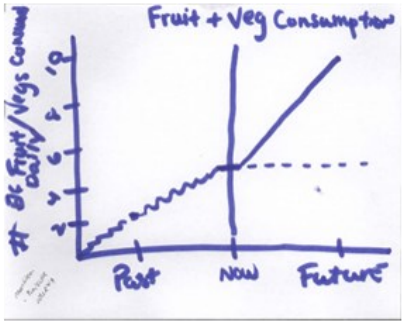


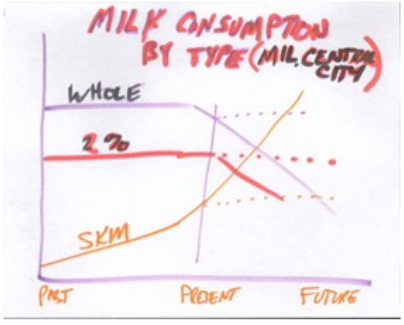


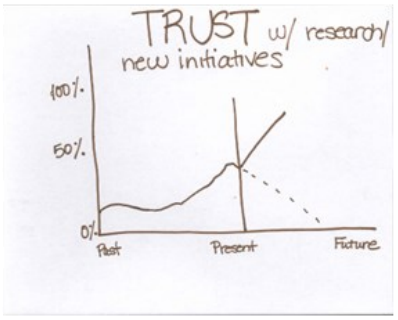


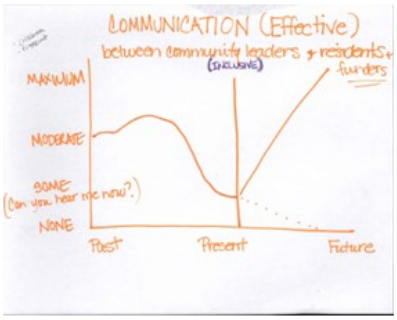








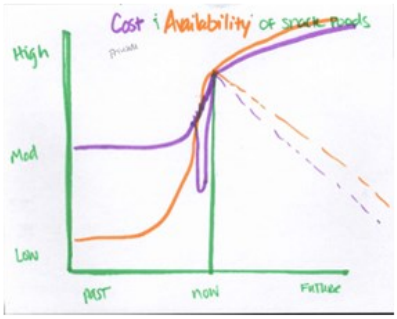

TRUST w/ research/ new initiatives
100%
50%
0%
Past
Present
Fiture

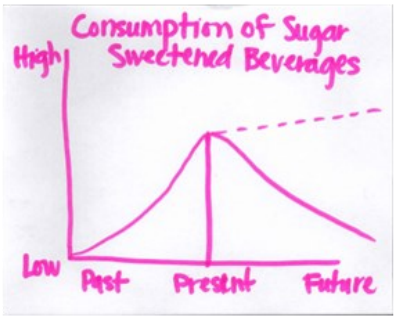

COMMUNICATION (Effective)
between community leaders + residents + funders
(inclusive)
MAXIMUM
MODERATE
SOME
(Can you hear me now?)
NONE
Past
Present
Fiture

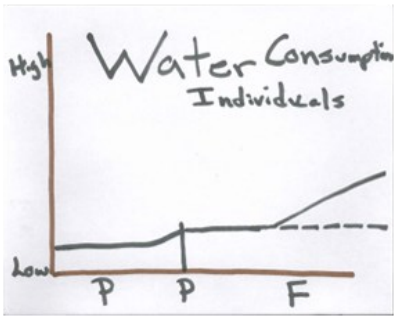

Obesity Rates
Past
Time
Now
Future

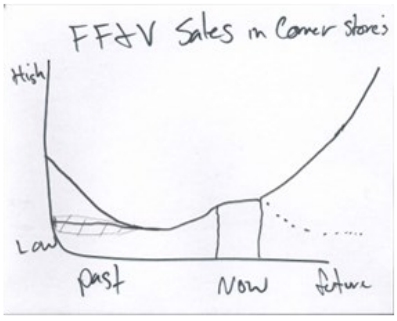

Access to Healthy Food
High
Low
Past
Present
Future

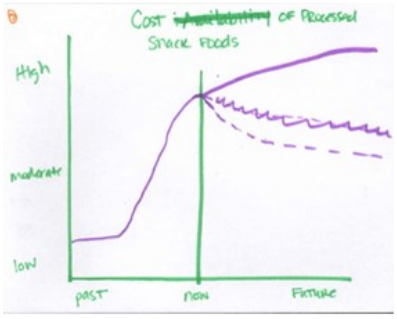

Access to Healthy Food
Past
Now
future

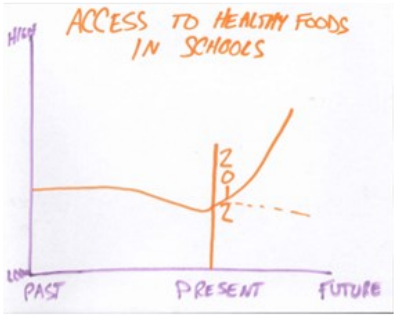

Cost i Availability of snack foods
High
Mod
Low
past
now
Future


Consumption of Sugar Sweetened Beverages
High
Low
Past
Present
Future


Water Consumption
Individuals
High
Low
P
P
F

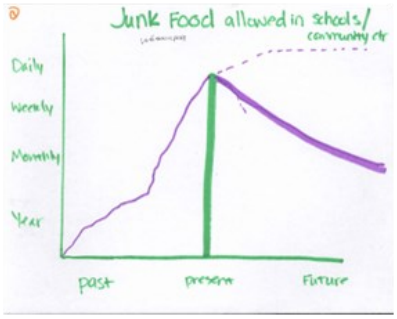

FF&V Sales in Corner Stores
High
Low
past
Now
future


Cost ~~affordability~~ of Processed Snack Foods
High
moderate
low
past
now
Future


ACCESS TO HEALTHY FOODS IN SCHOOLS
High
2012
Low
PAST
PRESENT
FUTURE

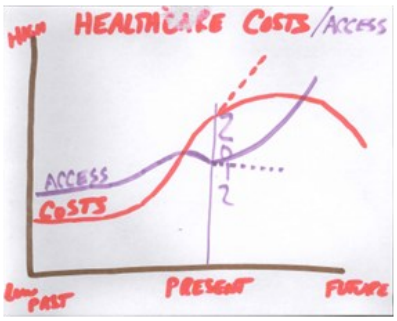

Community Garden
High
Low
PAST
NOW
FUTURE

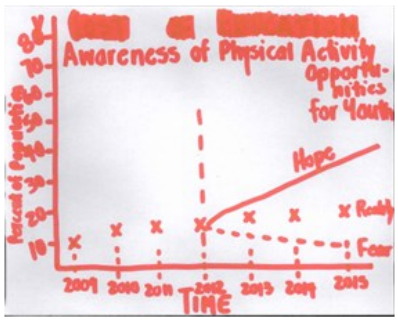

Chronic Disease
Rate
IN High
Pop
Low
Past
Now
future

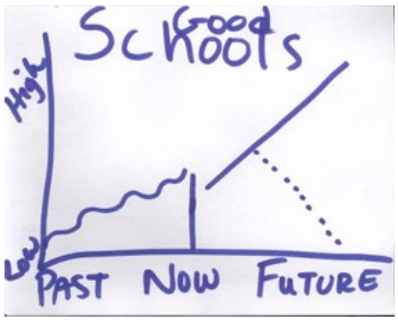

Junk Food allowed in schools/ community etc
Daily
Weekly
Monthly
Year
past
present
Future

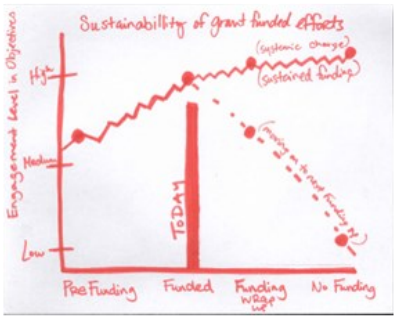

Confusing Messages About Nutrition
High
Low
Past
Present
Future

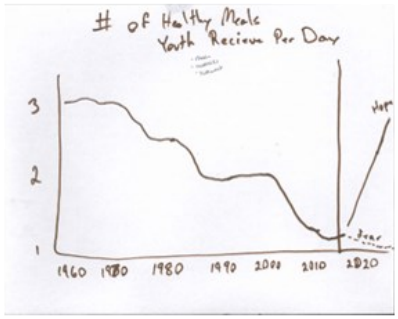
Appendix E (continued): Behavior Over Time Graphs not Represented in the Storybook

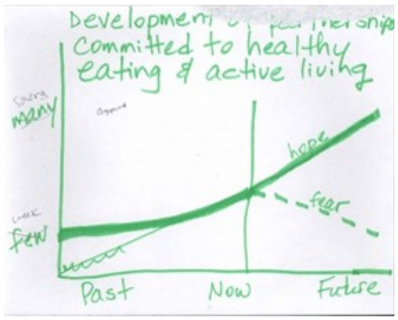


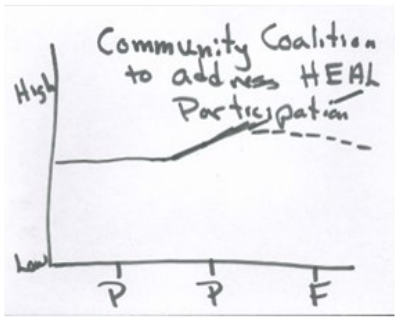


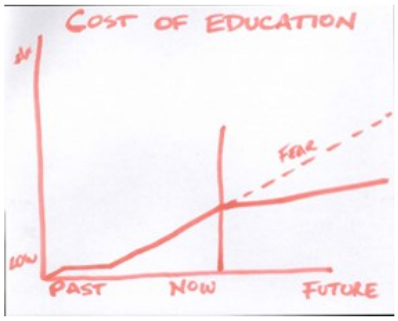


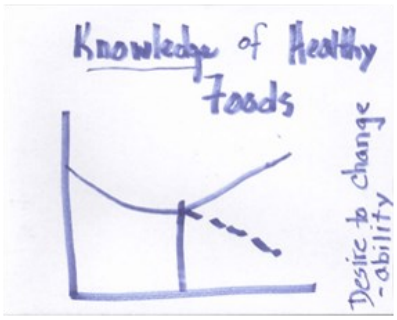


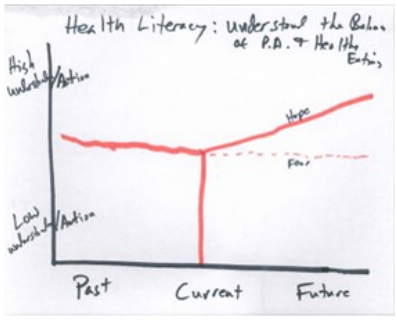


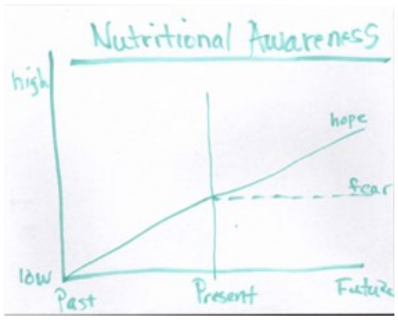


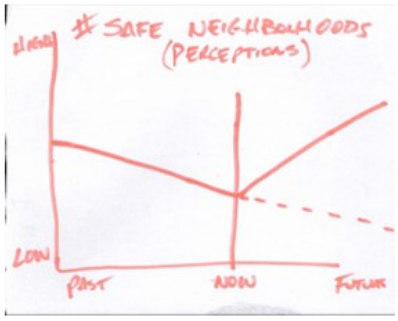


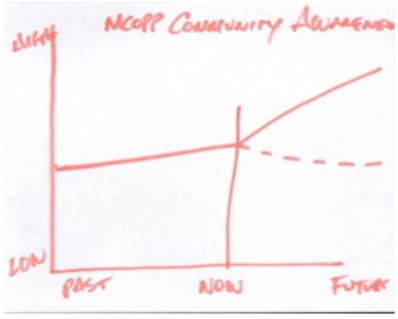


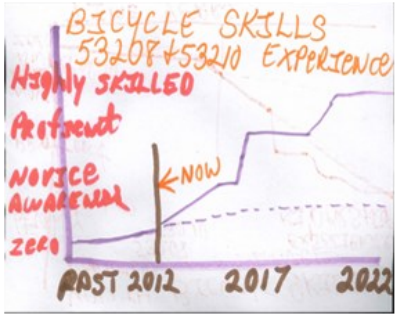




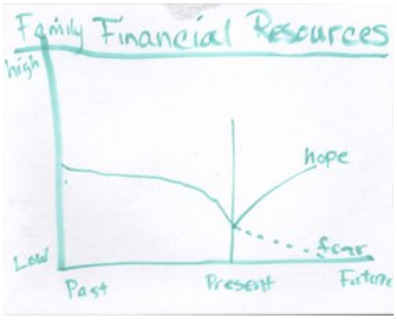









FINANCIAL Stability
High
Low
PAST
NOW
Future


Family Financial Resources
High
hope
fear
Low
Past
Present
Future