

Systems Thinking in Communities:

Understanding the Causes of Inactivity, Poor Diet/Nutrition, and Childhood Obesity in Flint, Michigan



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Introduction

Where Do Flint's Children Play? 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 *Where Do Flint's Children Play?* project was to introduce systems thinking at the community level by identifying the essential parts of the Flint, Michigan 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, non-profit organizations, government agencies, community-based organizations, foundations, youth organizations, academic institutions) 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.

Flint, Michigan : Background and Local Participation

Flint, Michigan is located seventy miles west of Lake Huron, 140 miles east of Lake Michigan, and 70 miles northwest of Detroit. It is the seat of Genesee County. The 2010 US Census estimated Flint's population at 102,434. The median age is 32 with 28% of the population less than 18 years of age. The education levels are low; only 12% of the population earned a bachelor's degree or higher compared to 22% statewide, and 25% of Flint residents have not earned a high school diploma. In Flint, 28% of families live below the poverty line and 47% of children live in poverty. Of the approximately 15,000 children in the Flint Community Schools, 75% are eligible for free or reduced-priced lunch.

As a result of economic and population decline in the past decade, there has been little resource allocation by the city of Flint to support healthy eating and active living efforts. However, due to existing efforts in the Flint community, led and supported by local non-profits and foundations, to address healthy eating and active living, Flint HKHC was able to narrow its scope to focus on parks. *Where Do Flint's Children's Play?* was an initiative led by Crim Fitness Foundation (Crim) and Michigan Fitness Foundation (MFF) to help create a safe and maintained park system that provided opportunities for youth and families to be physically active. The project area of the Flint HKHC initiative was the entire city of Flint by catalyzing and implementing change related to park policy and systems strategies, such as updating the parks plan; while the two focus parks, Max Brandon and Brennan and the surrounding neighborhoods, served as places to pilot park interventions (e.g., physical improvements, safety initiatives, and activities/events) that could be replicated throughout the city parks system.

Crim and MFF were the lead agencies of the community partnership. Crim has been in the community for over 36 years and is a Flint-based organization that focuses on creating active communities through policy and environmental strategies, events, and physical activity and healthy eating programs. Crim has physical activity and nutrition programs in all Flint schools and many other Genesee County schools. Many active living and healthy eating programs are funded by the Ruth Mott Foundation and USDA grants through the Michigan Nutrition Network, as well as other grants and donations. Crim is the lead organization for Safe and Active Genesee for Everyone (SAGE) Coalition, a collaborative of local advocates, non-profit, private, and government organizations working together to advocate for and support active living initiatives that promoted safe opportunities for people to be physically active throughout Genesee County.

Where Do Flint's Children Play? Priorities and Strategies

The partnership and capacity building strategies of *Where Do Flint's Children Play?* included:

- **Friends of Max Brandon:** Residents formed a neighborhood group near Max Brandon Park in order to make environmental changes, including building and installing tables and benches, conducting clean-ups and equipment repair, enhancing the existing walking trail, and holding activities in the park. Salem Housing, Inc. (Salem) was contracted to serve as the park champion and Crim with the Flint HKHC partnership transferred leadership skills to the Friends of Max Brandon.
- **Community Visioning:** As part of the assessment phase, several community visioning activities took place including community surveys, youth focus groups, and community conversations. Input to guide the community vision for parks and focus park selection was gathered during Neighborhood Action Sessions that the city of Flint hosted in each of the 9 city wards. This input combined with a community-wide survey and youth focus groups informed focus park selection. Further community conversations ('Your Park, Your Say') were hosted with residents and other stakeholders to determine specific needs and actions related to each neighborhood (focus) park. Ongoing community visioning and engagement occurred throughout the project to update the five-year parks and recreation plan (parks plan) and the city's master plan.
- **Youth Capacity:** In cooperation with Michigan State University and the Boys and Girls Club of Greater Flint, a pilot program was implemented in which local youth learned about planning basics, created 3-D models of their ideas for a local park, and presented their outcomes to local stakeholders.
- **Political Will:** To help residents more effectively navigate city bureaucracy, partnership coordinators and partners routinely met with key policymakers, including city staff, to build stronger relationships and foster political will to support neighborhood residents' park improvement efforts and better understand the status of the city Parks and Recreation Department (e.g., budget, staff capacity, maintenance plan). As a result, residents became empowered to provide comments on park-related discussions, and they spoke out about their needs and desires for parks in Flint.

The healthy eating and active living strategies of *Where Do Flint's Children Play?* included:

- **Parks and Play Spaces:** The partnership focused on providing opportunities for Flint children to be physically active outside by initiating community engagement, enhancing park features, and updating the five-year parks plan. Although there are over five dozen parks and green spaces in the city, they are not always maintained, safe places for children and families to be active. Improving the accessibility of Flint's parks provides an opportunity for children to improve their health.

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

Systems Thinking in Communities: Flint, Michigan

“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 Flint, Michigan that influence healthy eating, active living, and, ultimately, childhood obesity. This system and the dynamics within the system are complicated with many different elements interacting.

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

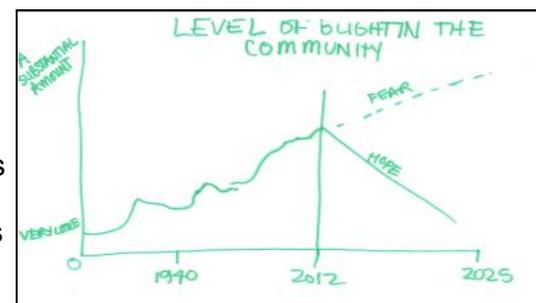
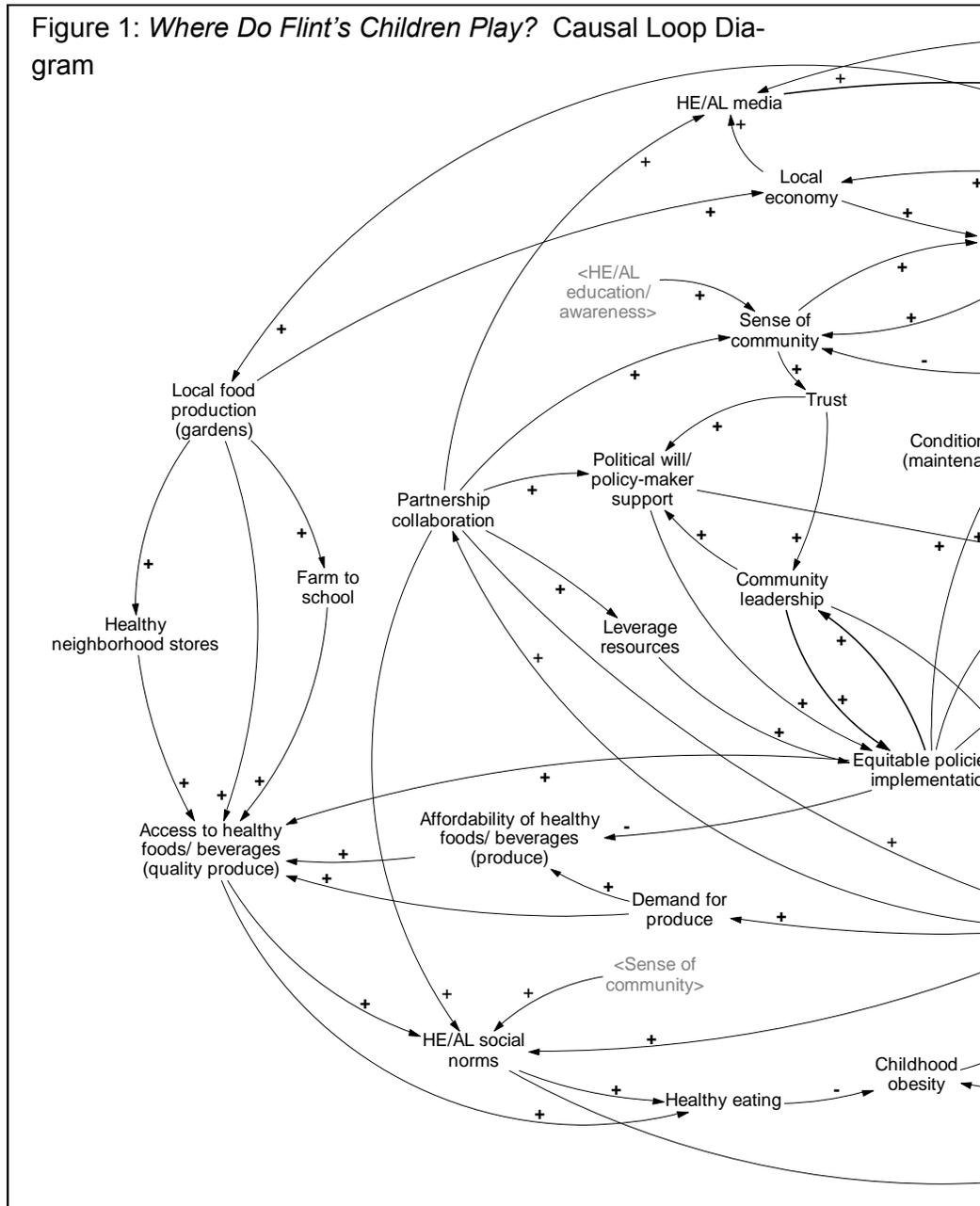
Group Model Building

Members of the *Where Do Flint's Children Play?* partnership participated in a group model building session in July, 2012 and generated this system, also referred to as a causal loop diagram (Figure 1). Participants in the group model building session included residents and representatives from non-profit organizations, government agencies, community-based organizations, foundations, youth organizations, and academic institutions. The group model building session had two primary activities: 1) a Behavior Over Time Graph exercise; and 2) a Causal Loop Diagram (or structural elicitation) exercise.

Behavior Over Time Graphs

To identify the range of things that affect or are affected by policy, system, and environmental changes in Flint related to healthy eating, active living, and childhood obesity, participants designed graphs to name the influences and to illustrate how the influences have changed over time (past, present, and future). In this illustration for the level of blight, the amount of blight has increased steadily for several decades, with the hope that it will decrease.

Figure 1: *Where Do Flint's Children Play?* Causal Loop Diagram



Causal Loop Diagram for the Childhood Obesity System

The causal loop diagram (CLD) represents a holistic system and several subsystems interacting in Flint, Michigan. 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.

Healthy Eating Policies and Environments (Red)

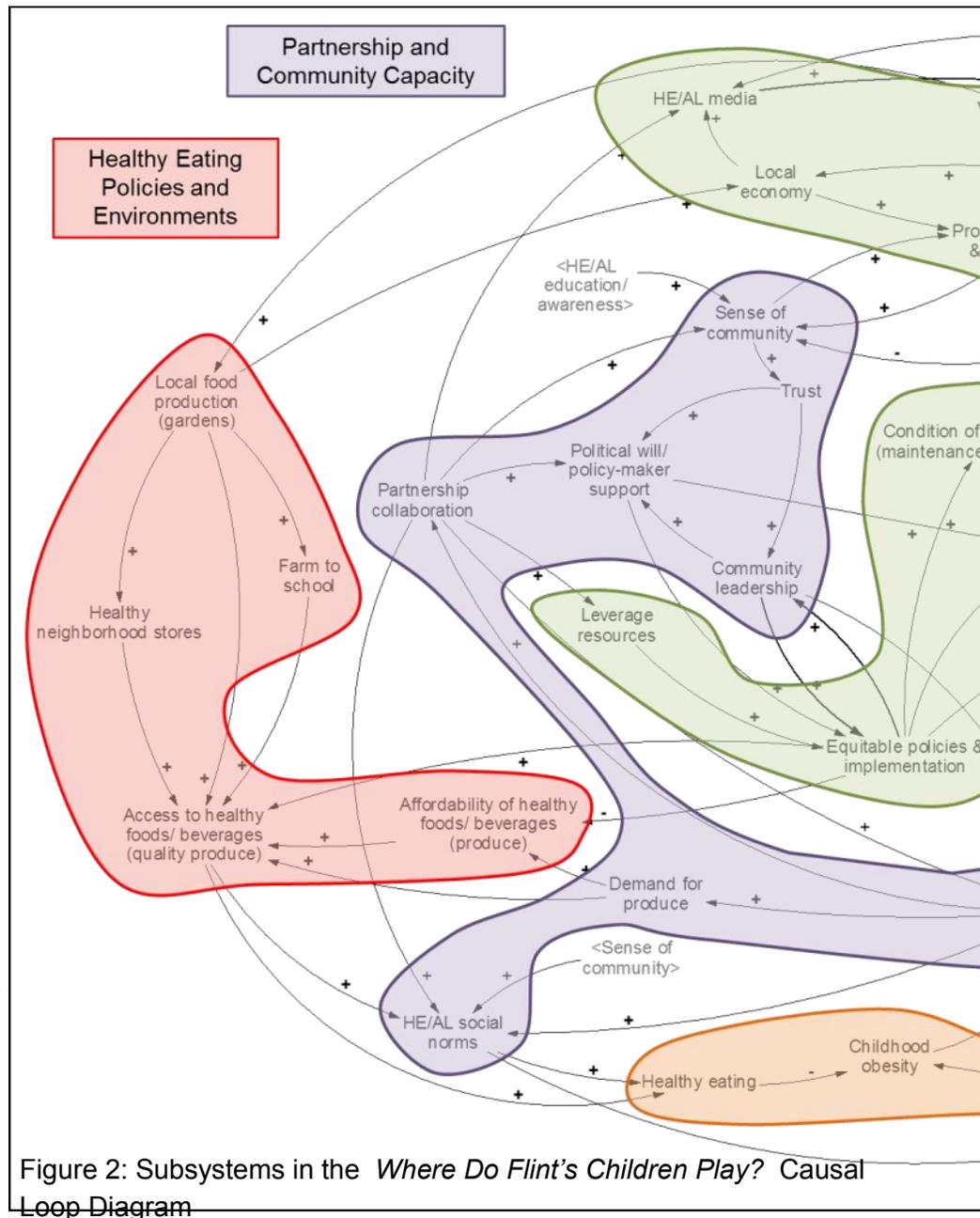
The healthy eating policy and environmental subsystem includes food production, food distribution and procurement, and food retail. During the behavior over time graphs exercise, the participants generated eight graphs related to policy or environmental strategies (e.g., farm to school) or contexts (e.g., local food production) that affected or were affected by the work of *Where Do Flint's Children Play?* 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 twelve graphs related to policy or environmental strategies (e.g., safe, playable spaces) or contexts that affected or were affected by the partnership's work.

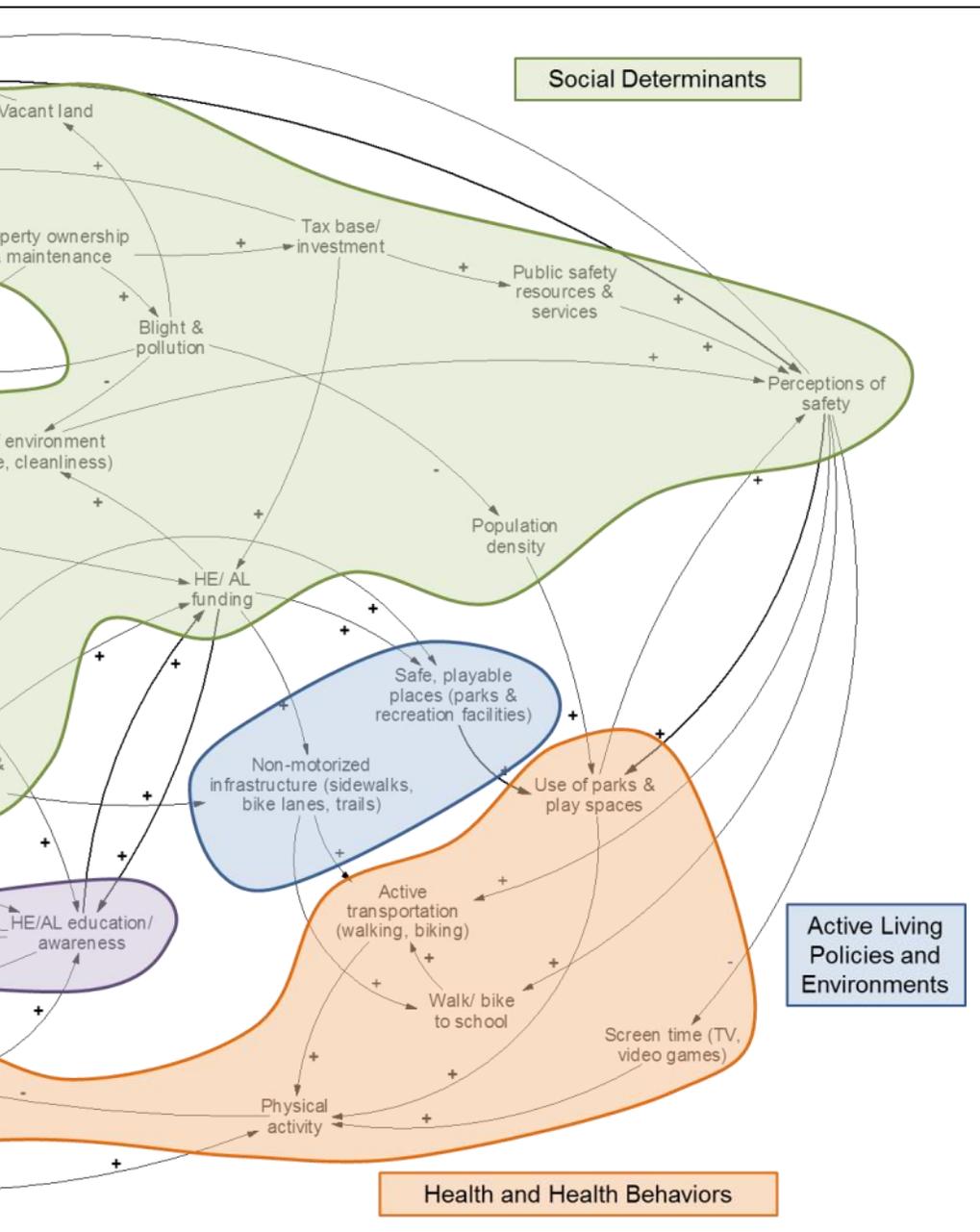
Health and Health Behaviors (Orange)

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



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, *Where Do Flint's Children Play?* Increased community leadership. This subsystem also includes community factors outside the partnership



that may influence or be influenced by their efforts, such as political will/policy-maker support.

Social Determinants

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

Each one of these subsystems has many more variables, causal relationships (arrows), and feedback loops that can be explored in greater depth by the *Where Do Flint's Children Play?* partners or by other representatives in Flint, Michigan. 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 *Where Do Flint's Children Play?* 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.

Community Resident Input and Political Will Feedback Loop

To simplify the discussion about feedback loops, several loops drawn from the *Where Do Flint's Children Play?* CLD (see Figures 1 and 2) are highlighted in Figures 3-4. While the CLD provides a theory of change for the childhood obesity prevention movement in Flint, Michigan, 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 resident input and political will (green highlighted loop in Figure 3). Flint, Michigan engaged residents and youth in community visioning processes with respect to the development of parks. Participants described how residents' political will with regard to park improvements and their interactions with local elected and appointed officials on these interests can increase funding for park initiatives. In turn, the funding can be used to further increase awareness and education of the connection between quality park design and increases in physical activity. As a result, residents, youth, and other partners in the community (e.g., businesses, government agencies, non-profit organizations) can improve their collaboration with respect to park improvement initiatives, feeding back to greater political will and policy-maker support.

Story B: While the preceding story reflected a positive scenario for Flint, Michigan, the same feedback loop also tells the opposite story. Less political will and policy-maker support leads to less funding to support park initiatives, resulting in less awareness and education of the benefits of parks on physical activity in the community. Without this awareness and education, fewer partners are likely to collaborate to support park design and improvements.

Reinforcing Loop and Notation

These stories represent a reinforcing loop, and the notation in the feedback loop identifies it as a reinforcing loop (see "R1 — Resident Input and Political Will" 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.

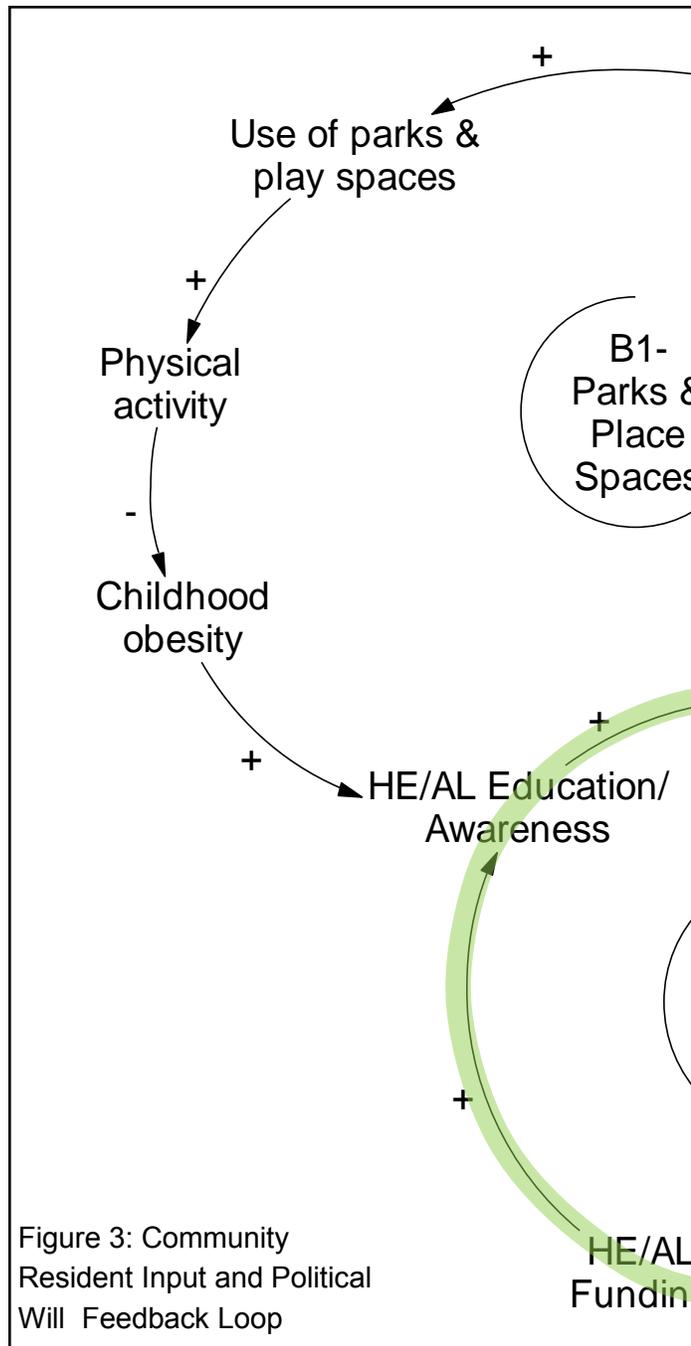
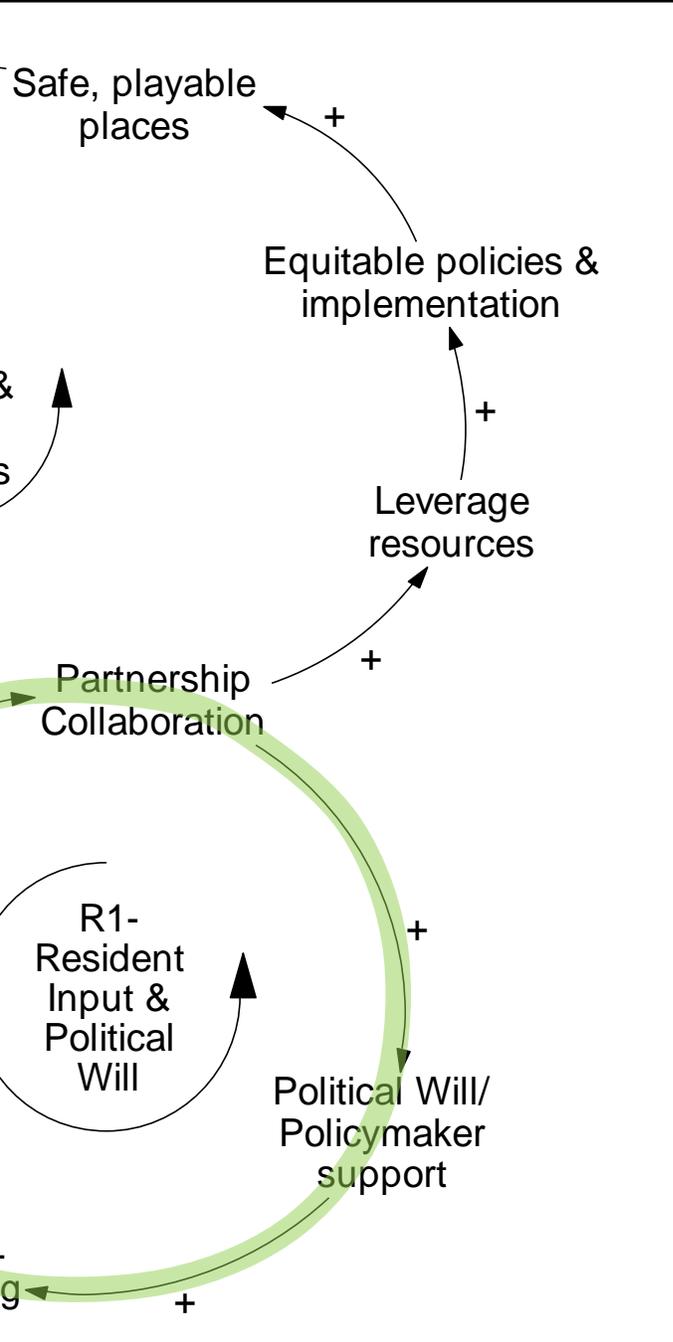


Figure 3: Community Resident Input and Political Will Feedback Loop

"There's a lot of really good things... changing because of the grassroots efforts, and I think that's partnership collaboration; it's not relying on traditional government entities but on community leadership. It's Edible Flint. It's the people stepping out. It's Salem Housing. It's those of us that get together, that collaborate, that see something that needs to get done, and we figure out a way to get it done, to make it happen, almost without asking for permission first but apologizing afterwards." (Participant)

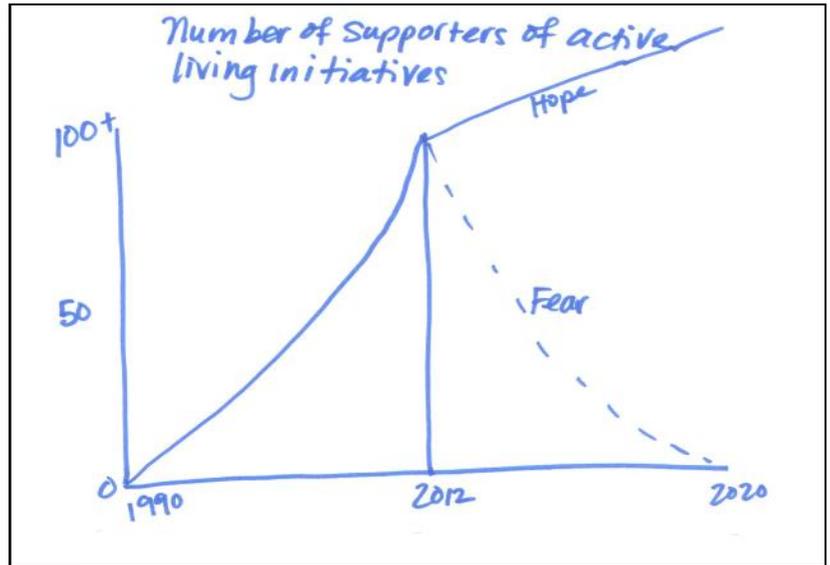
Looking specifically at the “+” or “-” notation, a feedback loop that has zero or an even number of “-” signs, or polarities, is considered a reinforcing loop. Balancing loops, with an odd number of “-” signs in the loop, are another type of feedback loop.

In isolation, this reinforcing loop represents a



will. For instance, reaching out to new partners can generate greater political will.

In addition to these insights, systems thinking can also help to pose key questions for assessment and evaluation, including methods to assess political will.

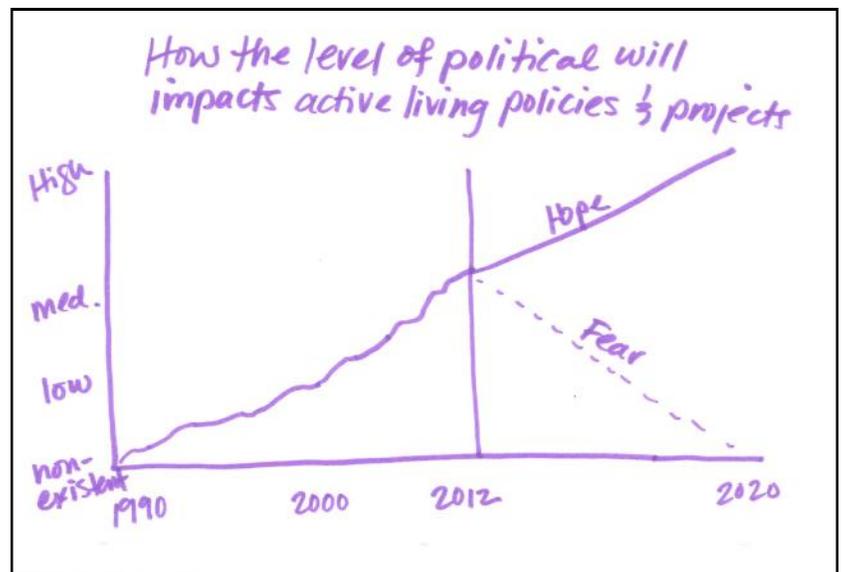


virtuous cycle in Story A as these assets positively support one another, or a vicious cycle in Story B as these challenges perpetuate a downward spiral. Yet, the influence of resident input and political will likely levels off at some point when policy-makers have responded to the concerns of the community. To understand what specifically leads to the leveling off of resident input and political will, it may be helpful for the partners in Flint, Michigan to consider other variables that influence or are influenced by this input and political will. 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.

System Insights for *Where Do Flint’s Children Play?*

Participants identified a tremendous increase in support and political will for active living policies and projects since 1990 in Flint, Michigan (see behavior over time graphs).

From the systems thinking exercises, several insights can inform efforts to increase community resident input and political



Parks and Play Spaces 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 parks and play spaces.

Causal Story for Feedback Loop

Story A: In this case, the story is about how equitable policies affect safe, playable places to increase use of these places. Flint partners had several strategies to engage residents and involve them in improving park features, safety, and maintenance. A five year parks plan lays the foundation for efforts to create safe, playable parks throughout the 83 parks in Flint, Michigan. In turn, residents and youth are more likely to use these parks and play spaces for recreation, increasing their overall physical activity throughout the day. Increases in physical activity help to contribute to lower rates of childhood obesity. As these rates decline, fewer future efforts are needed to create awareness and education about parks and play spaces, requiring less time and resources from partners to build political will for these initiatives as the policies and environments are already in place.

Story B: Alternatively, without safe, playable places, there is less outdoor recreation and, likely, less physical activity, contributing to sustained or increasing rates of childhood obesity. As a result, more efforts to increase awareness, education, and collaboration are needed to leverage partners' resources to advocate for equitable policies to increase and maintain safe, playable spaces in Flint.

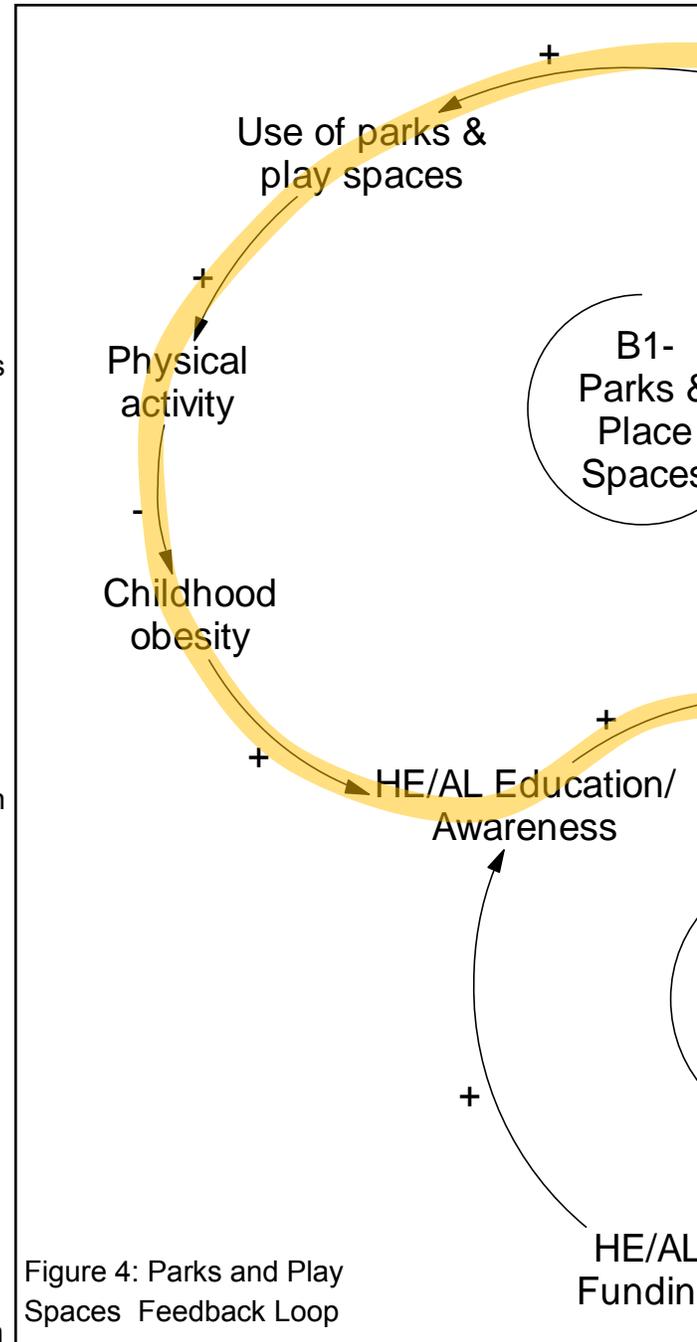
Reinforcing Loop and Notation

Unlike the community resident input and political will loop in Figure 3, this loop has one “-” sign or polarity; because this is an odd number, it is a balancing loop (see B2—Parks and Play Spaces in Figure 4).

Some of these causal relationships may have more immediate effects (e.g., existence of safe, playable places increasing use of these places) and other relationships may have delayed effects (e.g., partnership collaboration and resources leading to equitable policies). This delayed effect is noted using two hash marks through the middle of the arrow line (not included in Figure 4).

System Insights for *Where Do Flint's Children Play?*

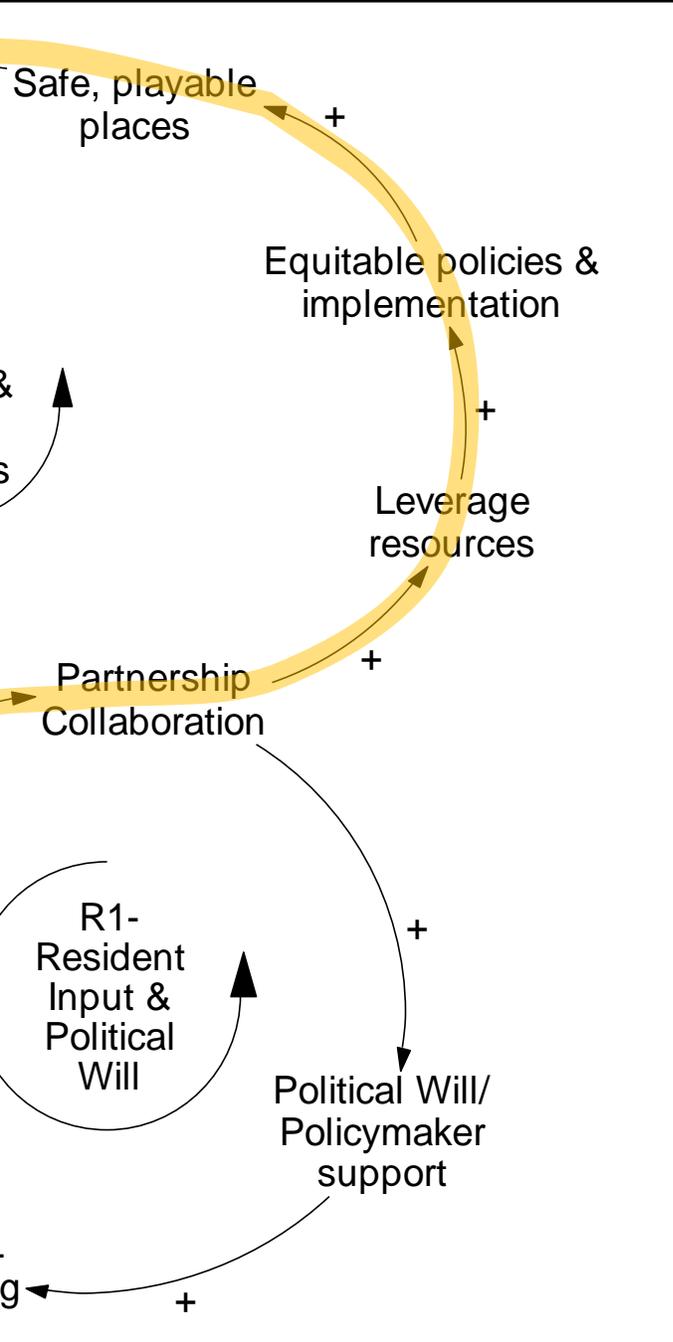
In the behavior over time graphs, participants identified how the number of parks available to residents has declined since 1980. Despite the increase in bike lanes, sidewalks, and trails during this same time period, residents hope to see an increase in both of these facilities to support physical activity for recreation and



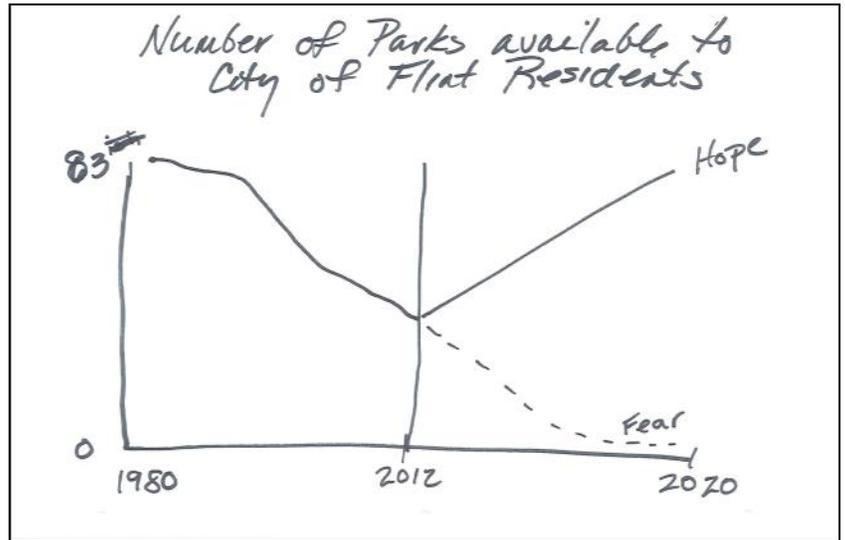
“The public safety budget for the city of Flint has decreased and my hope is that it increases [in order to] amend for people who are actually getting out of their houses and becoming more active. If it increases, I’m pretty sure things will be a little different and feel a little bit safer so you’ll have people going to the parks, riding their bikes, etc. Right now I don’t think people feel as safe, so they don’t go out and they’re not as active in the community as much.” (Participant)

transportation into the future (see illustrations). At the same time, residents expressed the need to address spending for public safety resources in order to make these facilities more accessible to residents.

System insights can inform the partnership's next steps with parks and play spaces,



contributing to success in changing policies and environments (as well as factors that posed challenges to the partnership in these areas).

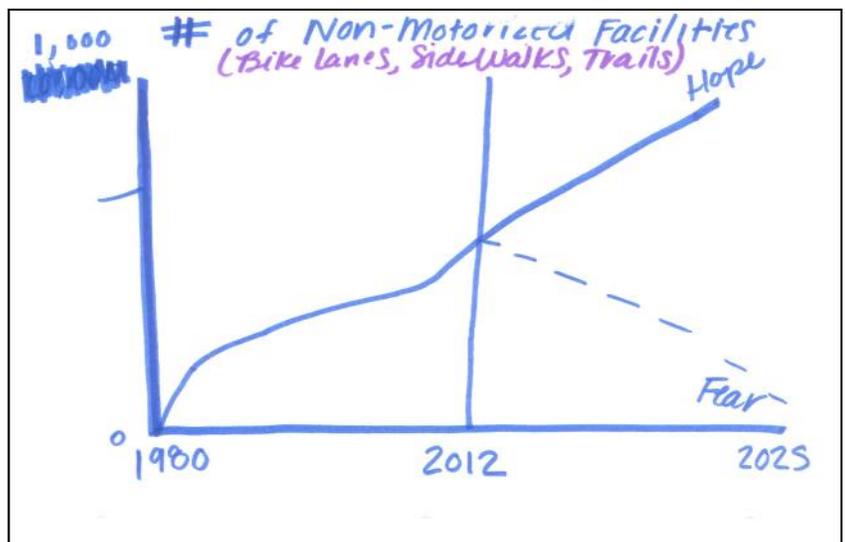


including:

- engaging law enforcement officials in the partnership and collaboration efforts in order to leverage existing resources for improving policies and environments affecting residents' safety in outdoor recreation and transportation that supports physical activity;
- capitalizing on the momentum of efforts to increase the number of non-motorized facilities in Flint to build support for improvements to parks and play spaces; and
- integrating efforts to generate awareness and education of the benefits of physical activity and the harms associated with childhood obesity with strategies to increase demand for safe, quality parks and play spaces.

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

- ways to assess and evaluate new or modified policies and practices associated with increasing equitable access to parks and play spaces;
- Documentation of the partners, processes, and resources



Opportunities for Systems Thinking in Flint, Michigan

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 *Where Do Flint's Children Play?*

partners, this storybook also summarized the healthy eating, active living, partnership and community capacity, social determinants, and health and health behaviors subsystems in the Flint causal loop diagram as well as two specific feedback loops 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.

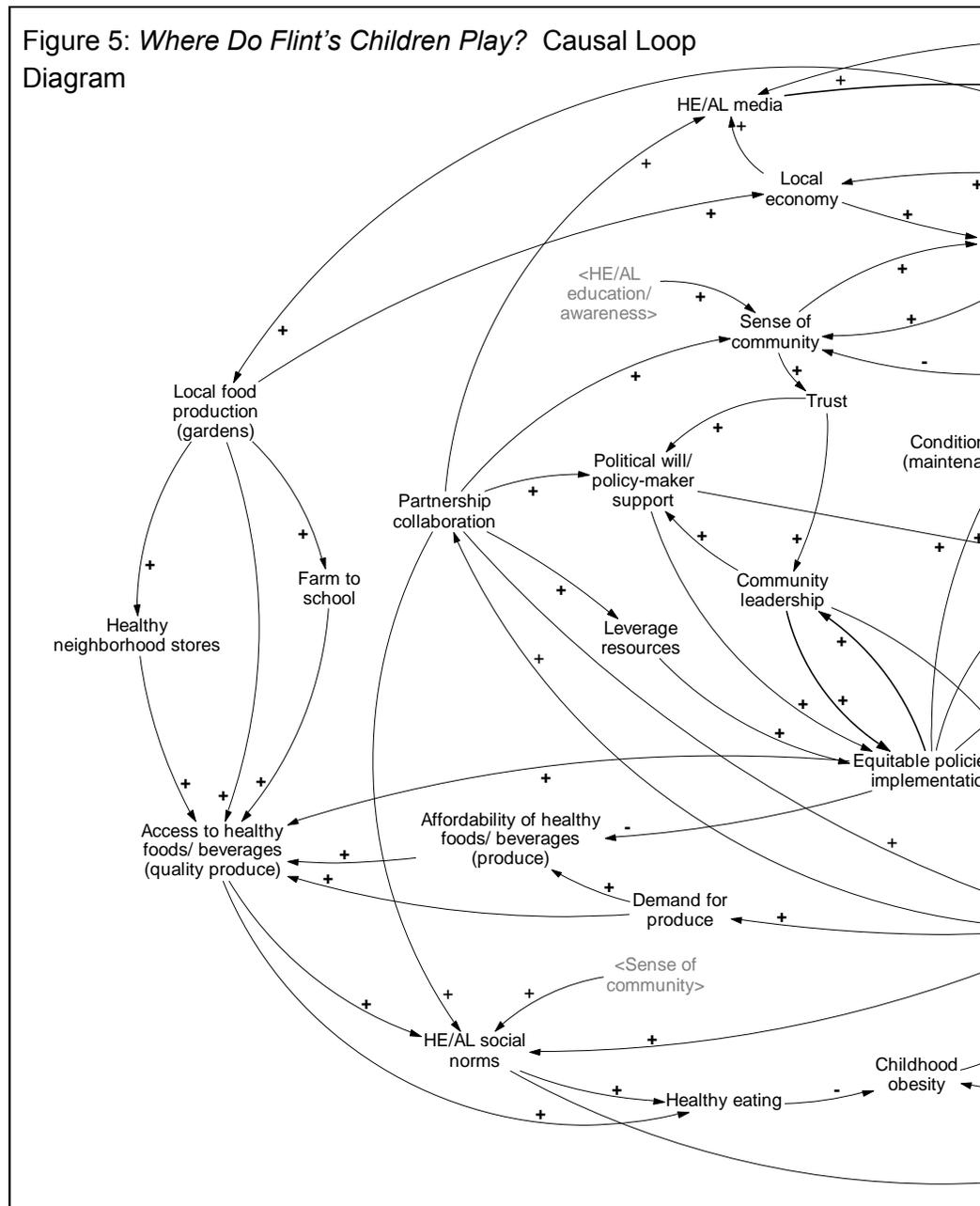
This represented a first attempt to collectively examine the range of things that affect or are affected by policy, system, and environmental changes in Flint, Michigan to promote healthy eating and active living as well as preventing childhood overweight and obesity.

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

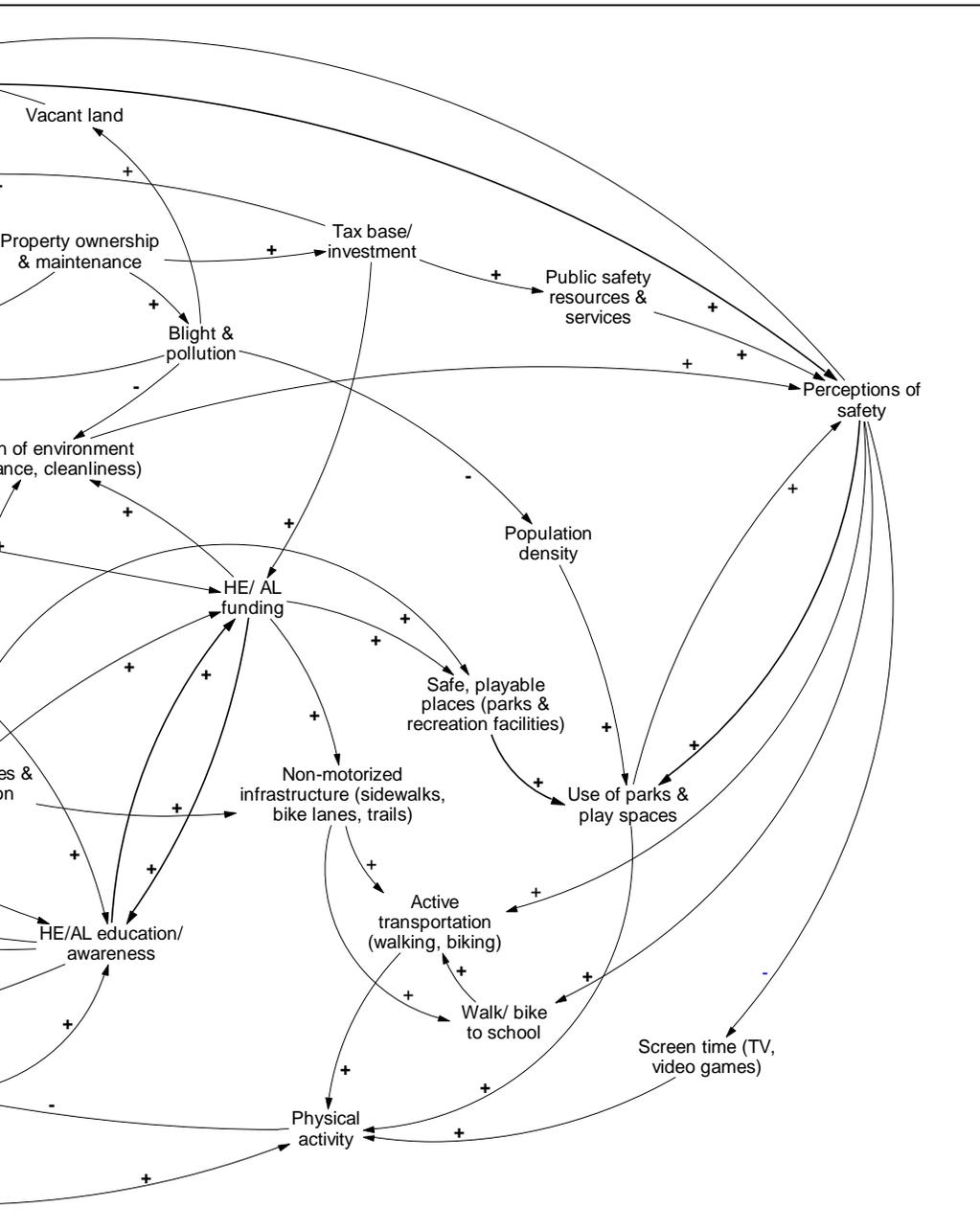
- the participants represent a sample of the *Where Do Flint's Children Play?* partners (organizations and residents) as opposed to a representative snapshot of government agencies, community organizations, businesses, and community residents;
- the behavior over time graphs and the causal loop diagram 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:

Figure 5: *Where Do Flint's Children Play?* Causal Loop Diagram



- 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 air, water, and soil quality; employment; education; depression and anxiety; government nutrition assistance (SNAP); racism; crime and violence; 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 Flint 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 *Where Do Flint's Children Play?* 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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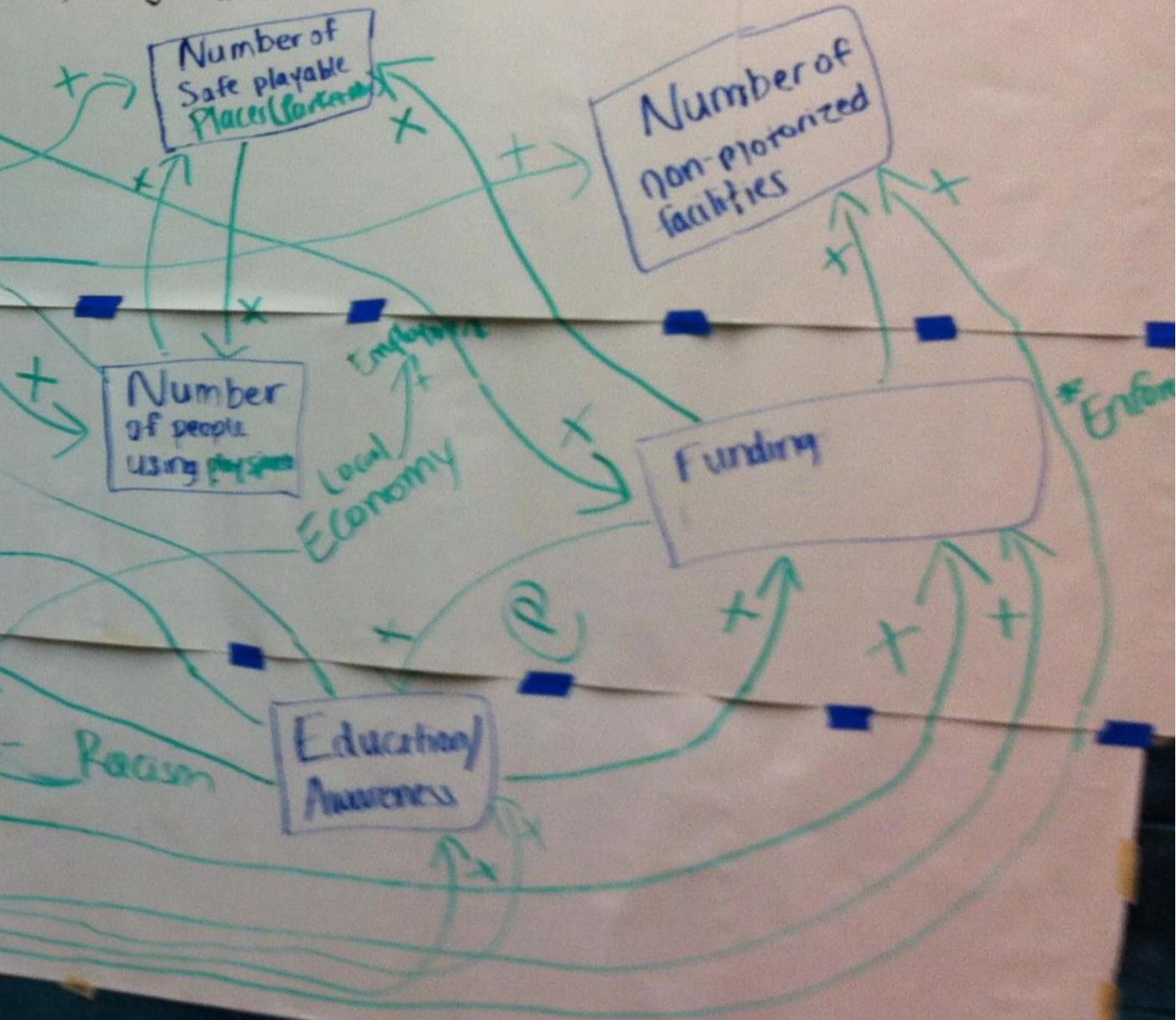
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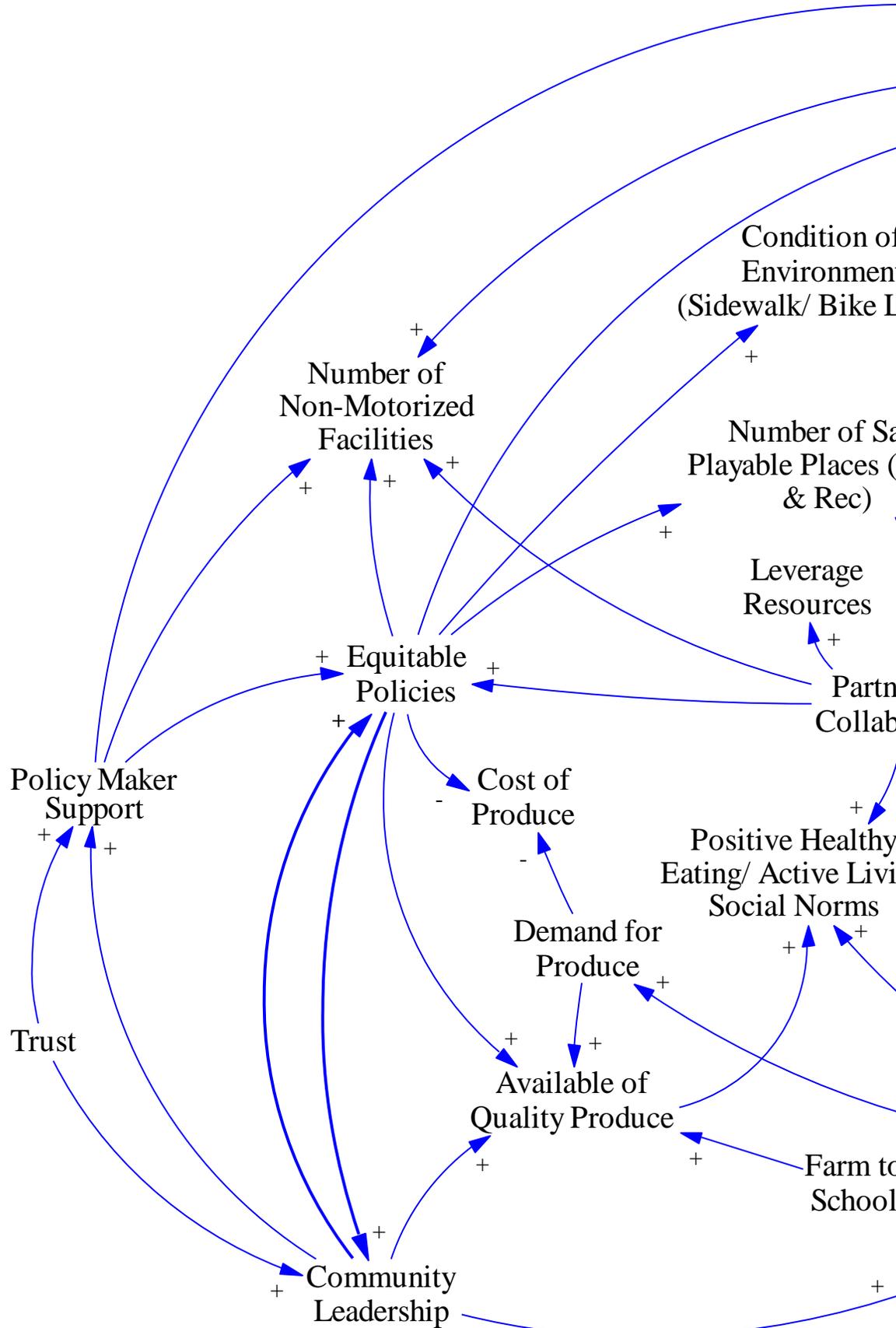
Appendix A: Behavior Over Time Graphs Generated during Site Visit

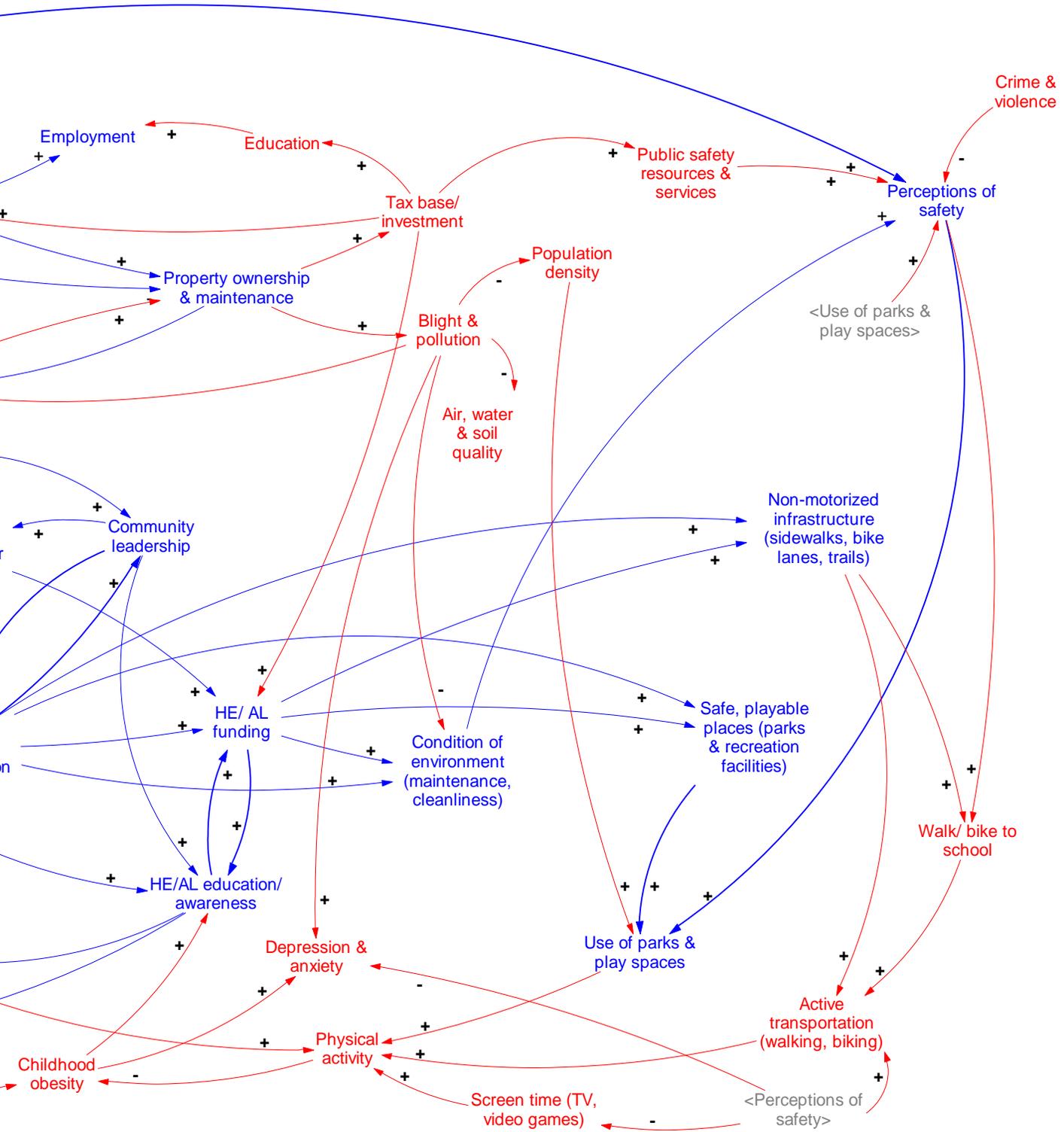
Flint, Michigan: <i>Where Do Flint's Children Play?</i>	
Categories	Number of Graphs
Active Living Behavior	7
Active Living Environments	5
Funding	3
Healthy Eating Behavior	2
Healthy Eating Environments	6
Marketing and Media Coverage	0
Obesity and Long Term Outcomes	1
Partnership & Community Capacity	3
Policies	0
Programs & Promotions (Education and Awareness)	2
Social Determinants of Health	7
Total Graphs	37

by policy, system, and
resilience, healthy eating, active living

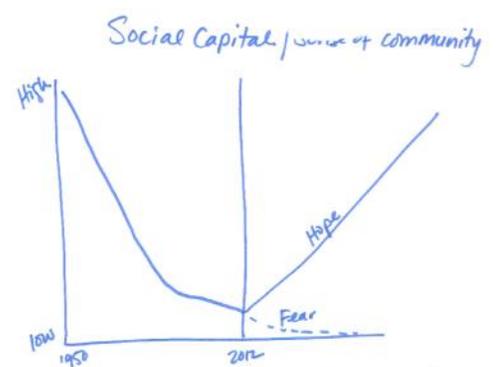
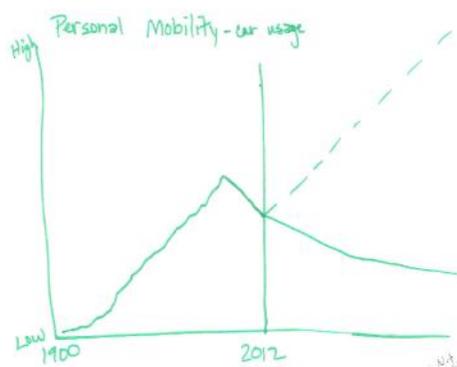
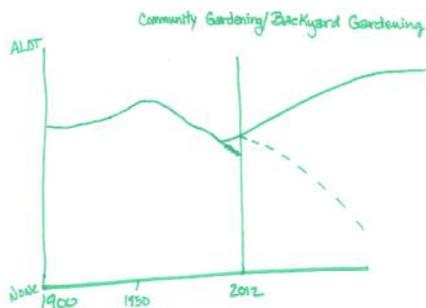
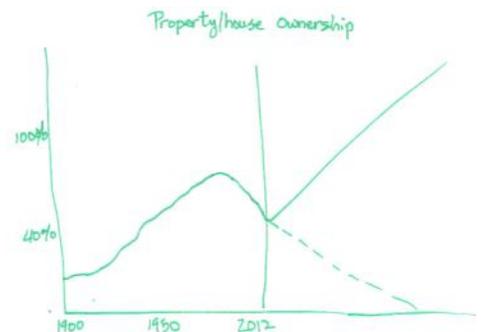
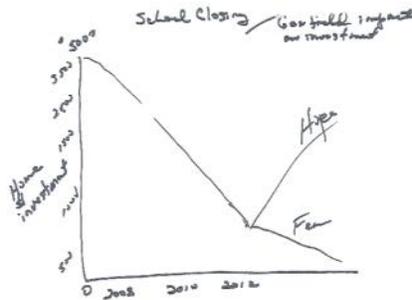
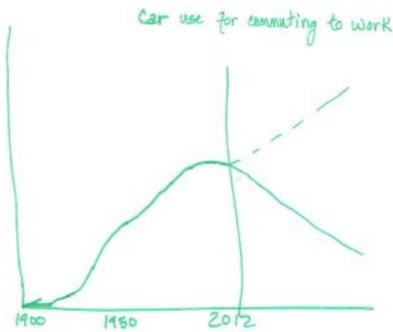
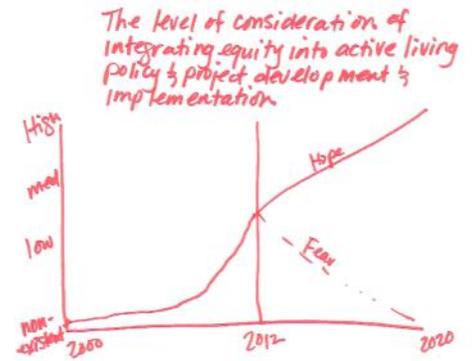
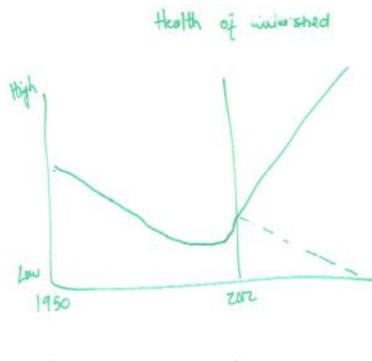
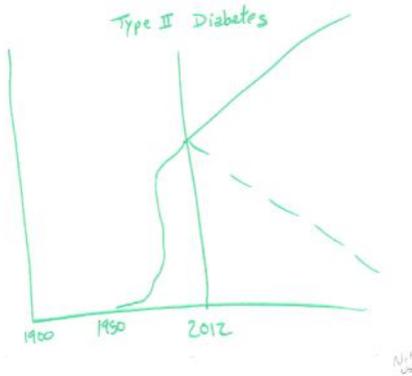
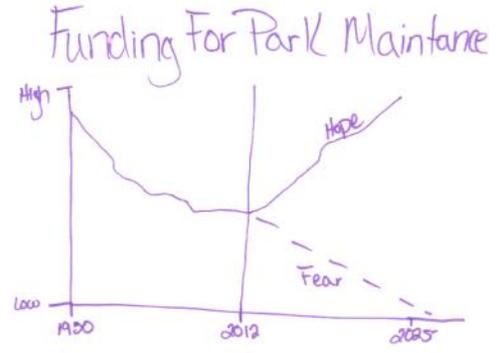
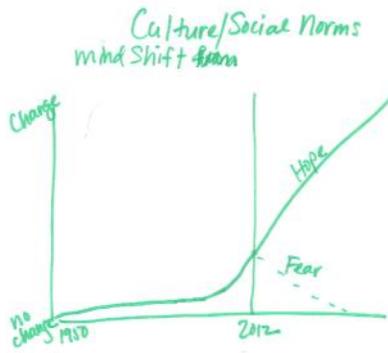
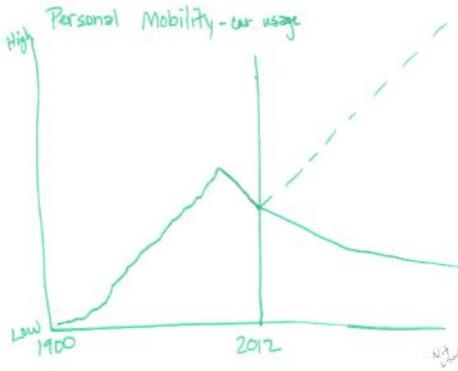


Appendix C: Original Translation of the Causal Loop Diagram into Vensim PLE

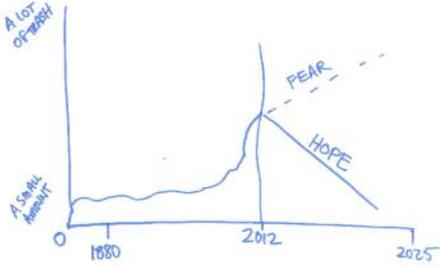




Appendix E: Behavior Over Time Graphs not Represented in the Storybook



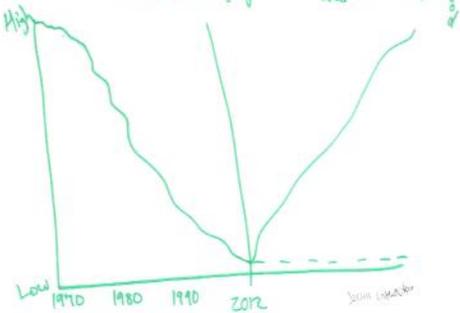
LEVEL OF TRASH ON THE STREETS (e.g. NORTH SIDE OF FLINT)



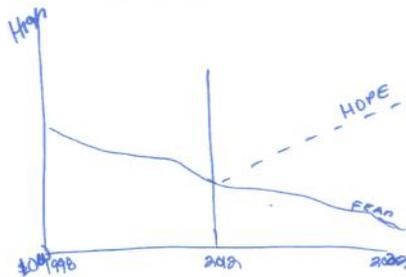
Public Safety Budget for the City of Flint



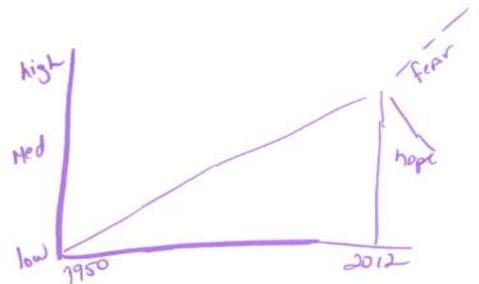
Children Playing in their street area w/in neighborhood



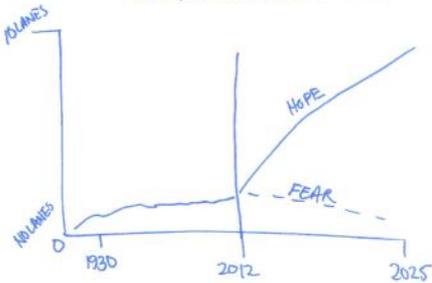
Availability of Produce in urban areas



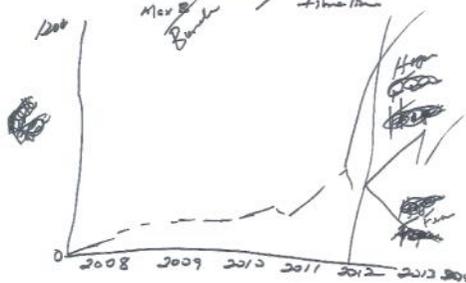
fear/anxious



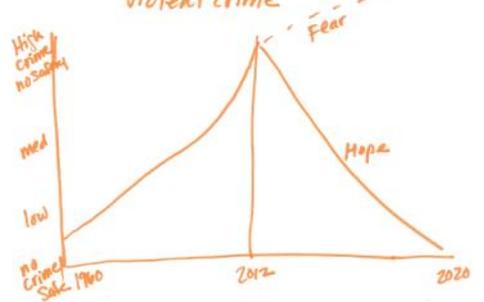
NUMBER OF BICYCLE LANES ON THE NORTH SIDE OF FLINT



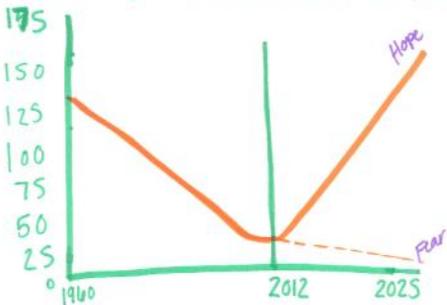
School Closing / Impact situation



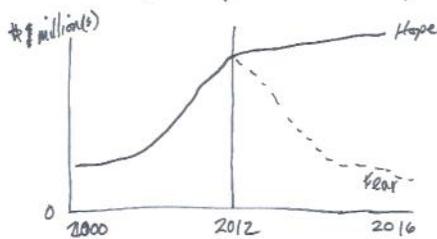
Perception of Safety and Violent crime



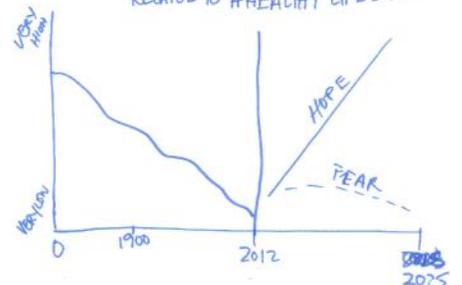
Availability of SAFE Places for play



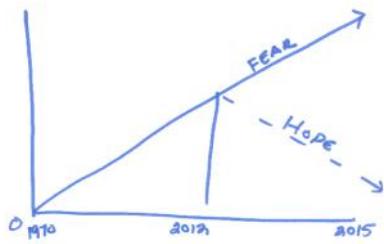
Availability of funding to address childhood obesity, healthy eating & active living



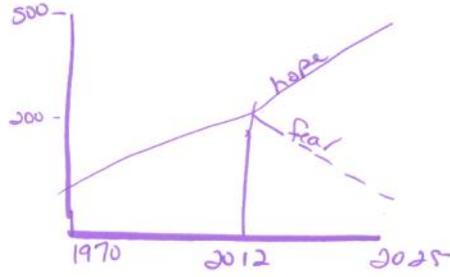
LEVEL OF PRACTICAL EDUCATION OPERATIONAL REAL-LIFE RELATED TO A HEALTHY LIFESTYLE



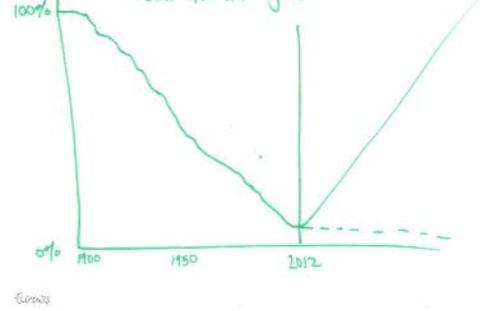
NUMBER OF VIDEO GAMES/T.V.'s PER household



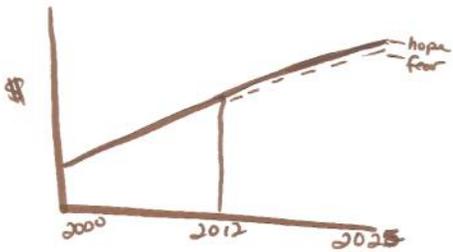
of gardens on vacant lots or back yards



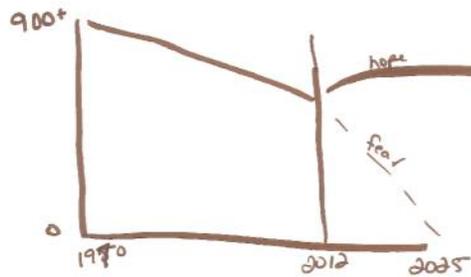
% of food consumed that was grown, processed + sold w/in the region



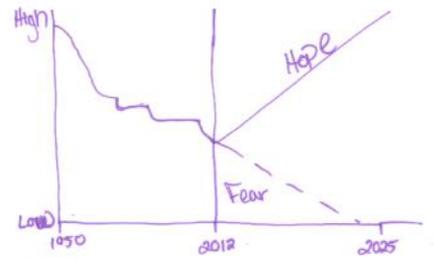
Cost of healthy, fair, locally produced food



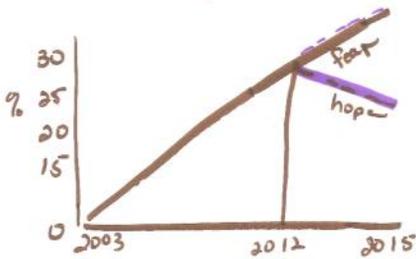
of park acres maintained



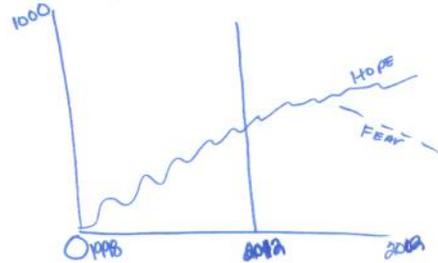
Number of People Using City of Flint Parks



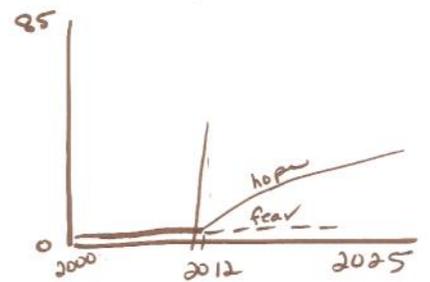
City of Flint land bank of city owned land



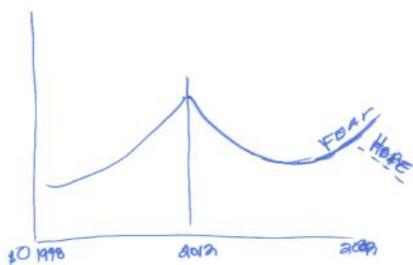
Number of people affected by Healthy Eating in urban areas



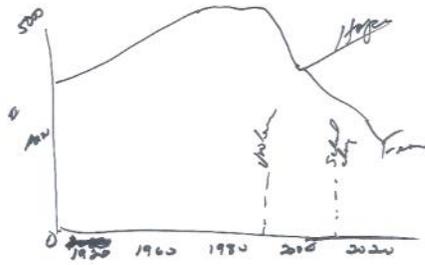
of Convenience Stores offering fresh produce



Cost of Produce



Max B use



of Kids Walking/Biking to School

