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PURPOSE STATEMENT

To identify upstream variables and promising policy and intervention strategies to sustain healthy beverage choices among Early Head Start (EHS) families in the greater Washington DC metro area, we used a community-based systems dynamics approach that included diverse stakeholders who serve this demographic. The process unveiled how the systems currently work in this geographic and political context, and where are the key lever points to promote drinking water (primarily from tap) as a replacement of sugary drink consumption.

KEY FINDINGS

- Community food infrastructure and resources were perceived to be key upstream factors that influenced residents' beverage choice and consumption. Investing in improvements to the community food infrastructure and resources would impact sugary drink consumption via two pathways:
 - a) First, it could increase residents' trust in their community infrastructure, including the tap water infrastructure, which would increase the likelihood of tap water consumption.
 - i. As tap water consumption increases, this could contribute to a decrease in sugary drink consumption, which over time could decrease preference and demand for sugary drinks as well as their sales.
 - ii. As sales of sugary drinks decreases, the likelihood of sugary drink consumption decreases.
 - b) Second, improved community food resources (i.e. more retail and quality products) could contribute to a decrease easy access to sugary drinks in the community. This could eventually contribute to a decrease in sales of this product, and decrease sugary drink consumption, impacting over time the preference and demand for sugary drinks in the community.
- Marketing of sugary drinks was identified as a key factor that contributes to increased consumption of this product via three pathways:
 - c) Marketing leads to increased demand for, and sales of, sugary drinks and increased consumption.
 - d) Marketing of sugary drinks reinforces the cultural preferences and negative beliefs about tap water, contributing to decreased tap water consumption. Lower tap water consumption was associated with increased likelihood of sugary drink consumption.
 - e) Marketing reinforces a positive public opinion of sugary drinks, decreasing the political will for policy change, policies for healthy food and beverages, and eventually limiting or stalling public health spending.
- Finally, investing in education/interventions was perceived to affect sugary drink consumption via three pathways:
 - f) Educational campaigns could contribute to increased trust in community infrastructure, increasing the likelihood of tap water consumption and contribute to a decrease in sugary drink consumption.
 - g) Campaigns that promote tap water consumption by addressing beliefs around tap water could contribute to a decrease in sugary drink consumption.
 - h) Public health campaigns that directly or indirectly aim to change public opinion regarding sugary drinks, potentially leading to political will in the long run regarding regulation of sugary drinks and promotion of or subsidies to a healthier alternative (water).

BACKGROUND

Consumption of sugar-sweetened beverages (SSB) begins at an early age, especially among minority populations [1, 2] and its cumulative effect may have detrimental consequences in excess weight gain, obesity risk and type II diabetes mellitus (T2D) later in life [3-9][1]. Culturally-tailored interventions which combine SSB-reduction strategies with increased water promotion/access, especially in school and home environments, seem to be promising ways of reducing SSB consumption. However, these kinds of intervention trials tend to be intensive, costly, and unsustainable, thereby potentially increasing the health equity gap once the interventions end. This work underscores the urgent need to create a shared vision and plausible action agenda with upstream approaches in systems and policies to complement individual and household-level interventions.

A *knowledge gap* is the need to develop a collective understanding across stakeholders from different sectors about the value of upstream strategies that can address access to healthy beverages, based on their potential reach, feasibility, impact on health equity, effectiveness, and sustainability in communities. Upstream approaches, such as improving access to safe, palatable tap water while limiting the promotion and availability of juices and SSB in community settings or government assistance programs, can support sustained behavior change and bolster true equity in healthy beverage choice among racial and ethnic minority population. The proposed study addressed this knowledge gap by employing a systems science approach to identify upstream strategies that can support sustained changes in the consumption of SSB and water.

METHODOLOGY

Employing a community-based system dynamics approach, we conducted a group model building workshop as explained in detail below. Organizations, agencies, and sectors that serve and support families from Early Head Start (EHS) in DC and Maryland were identified via six focus group discussions with Latino parents from EHS. From these sectors, 21 stakeholders were invited to join a two-day participatory workshop in July 2022. The objective was to understand the interconnected factors that affect beverage choice among low-income Latino families in the greater DC metro area, and to identify lever points that would be high impact, and promote equity. Stakeholders represented the following sectors: local government, early childhood education, food and beverage retail, food assistance programs, and advocacy groups.

Through facilitated exercises, stakeholders developed a causal loop diagram (CLD) to map the system dynamics that influence water and SSB consumption in the context of the greater DC metro area. Stakeholders also discussed intervention and policy recommendations, taking into consideration whether they thought they were easy or hard to do, and whether they promoted equity (i.e. had higher or lower impact). The research team reviewed workshop notes to finalize the CLD visualization and the list of recommended actions according to sectors' perceived high and low impact. A refined CLD with intervention points was presented to workshop participants in November 2022 for member checking and additional comments and feedback from stakeholders. The research team compiled the information along with a table of recommended actions and perceived impact (to promote equity), and feasibility (easy vs. hard-to-do). This was discussed with an external Expert Advisory Board for additional insight. All actions were analyzed according to the feedback loops that they would affect, and categorized according to their descriptions following Donella Meadows' reflection on places to intervene in a system (<https://donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/>): intervening in buffer stocks, structuring the systems, structuring information flow, slowing up reinforcing feedback loops, and weakening positive feedback loops.

FINDINGS

Stakeholders from diverse sectors in the greater DC metro area identified 29 factors interconnected via seven feedback loops to depict the dynamics of beverage choice (water [primarily tap] and SSB) among Hispanic families with low income that they serve in Metro DC, as depicted in **Figure 1**.

FINDINGS, CONT.

Figure 1. Causal Loop Diagram of What Affects Water and Sugar-Sweetened Beverage (SSB) Consumption among Early Head Start Latino Families in the Greater DC Metro Area. Reinforcing loops are depicted by 'R:' and balancing loops are depicted by 'B:'

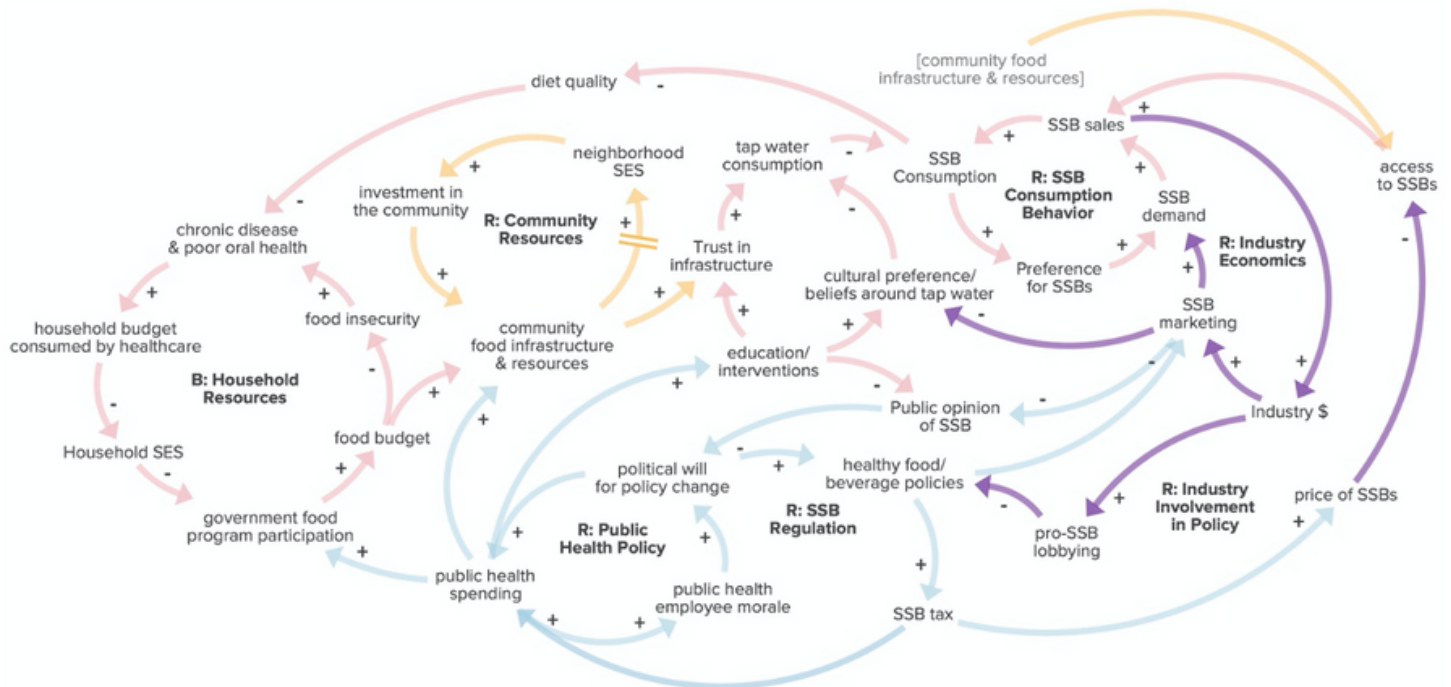


Figure 1 Legend

- Household-level Behaviors & Outcomes
- Built Environment
- Health Programs & Policy
- SSB Industry Characteristics

The seven feedback loops are explained in detail below:

- ① **SSB Consumption Behavior:** Individual SSB consumption leads to increased preference for SSBs, which then increases demand for and sales of SSBs, which feeds back into SSB consumption in a continuous reinforcing loop.
- ② **Industry Economics:** As SSB sales increase, this causes industry to profit more, leading to increases in marketing of the product, which causes greater demand for the product in a reinforcing loop. The SSB marketing also leads to decreased preference for tap water.
- ③ **Industry Involvement in Policy:** As the industry can maintain profit from sales, it gets more involved in pro-SSB lobbying. This stalls healthy food/beverage policies and restrictions and SSB tax, keeps down the price of SSB, and leads to fewer healthy food/beverage policies. In turn, the likelihood of SSB tax is decreased, keeping the price of SSB lower, which in turn leads to increased access to SSB in the community and increased sales of SSB. Higher sales feed back into industry profit in a reinforcing loop.
- ④ **SSB Regulation:** SSB tax can contribute to more public health spending, which can lead to more educational interventions about the negative health effects of SSB (as well as trust in water infrastructure, and benefits of drinking tap water). These educational interventions can negatively affect the public opinion of SSB, thereby increasing political will for policy change, eventually leading to more policies for healthy food/beverages, which can reinforce the leverage of an SSB tax in a reinforcing loop.

- ⑤ **Public Health Policy:** Political will for policy change can also contribute to increase public health spending. This in turn can improve the morale of public health employees and the likelihood of greater political will for policy change in a reinforcing loop for more public health spending.
- ⑥ **Community Resources:** Increased public health spending can contribute to more investment in the community food and infrastructure resources, which increases the neighborhoods' socioeconomic status, and in turn allows residents to invest more in their communities in a reinforcing loop. Investment in food and infrastructure can also increase residents' trust in the community's infrastructure (especially tap water infrastructure), leading to increased tap water consumption, which is causally linked to lower SSB consumption.
- ⑦ **Household Resources:** Public health spending is also linked to higher participation in government food programs, which is designed to increase the families' food budget, contributing over time to a decrease in food insecurity, decreasing rates of chronic disease and poor oral health. Eventually, this decreases the household budget consumed by healthcare, and over time it allows households' socioeconomic status (SES) to increase and rely less on government food program participation, in a balancing loop.

Actions and lever points to intervene in the system are summarized displayed in Table 1 according to lever points and from least to most effective.

Table 1. Places to Intervene in the System.

Workshop participants (n=21) in the Greater Washington DC metro area identified actions and ranked them as a group according to their perceived impact (high vs. low equity) and feasibility (easy vs. hard to do). Actions were grouped by lever points in the system. A description and reflection that combines insight from the member checking session as well as from Donella Meadows' reflection * was added by the research team.

Levers Identified By Participants	Perceived Feasibility and Impact	Description and Reflection *
<i>Increase Public Health Spending</i>	Hard to do High impact	Increasing public health spending would affect all 7 feedback loops, indirectly impacting sugary drink consumption. However, the decision to increase public health spending (the equivalent of increasing buffer stocks in a system according to D Meadows*) is politically-charged, difficult to maintain, and would require considerable time lag before seeing an effect on behavior, which is why it ranks as one of the least effective places to intervene *. Participants recommended a return on investment analysis and simulation of cost and benefits in order to justify the action they proposed.
<i>New & updated structures</i>	Hard to do High impact	This action, equivalent to 'structuring the system' in Donella Meadows' reflection *, would reinforce community resources (by investing in community food infrastructure and resources), and eventually impact the loop of SSB consumption. Donella Meadows reflects that the leverage comes from understanding the structures' limitations and bottlenecks, using it with maximum efficiency, and refraining from expansions that strain its capacity.* Participants suggested new structures, inclusion of public stations for drinking water, updates to tap water pipes.

Public health campaigns for water promotion

Easy to do
Low impact

The system intervention focuses on improving bidirectional information flow and feedback, impacting the SSB consumption behavior and SSB regulation loops. Currently, information flows from private industry (SSB marketing) to residents to influence their behavior. The leverage comes when public health can tackle SSB consumption via educational and promotional campaigns to consume fewer SSB and to promote water, and when the health sector join forces with other sectors to promote tap water as a viable option. This would contribute to flow of information from sources other than private industry. It could potentially affect negatively the public opinion of SSB, leading to more political will for policy change and healthy beverage policies. According to D. Meadow's reflection*, influencing the structure of information flow is relatively impactful and effective. Participants recommended that there be consistent messaging across diverse sectors and that the goal be shared clearly. Participants recommended that this campaign tap into other government programming from the sectors of nutrition, health care, environment, agriculture, parks and rec, water departments' perspectives.

Access to filtered tap water consumption.

Easy to do
Low impact

This leverage point aims to slow down the reinforcing feedback loop of SSB consumption by providing access to an alternative: filtered tap water directly to people, by tapping into local government programming motivations and budgeting. As these diverse sectors get involved to promote education about tap water, they can also include tap water promotion as a shared goal by improving access to tap water consumption everywhere. Slowing the reinforcing feedback loops is one of the most effective places to intervene in a system, according to D Meadow's reflection *. Depending on the assumption that water consumption contributes to decrease SSB consumption, and the timeline that it would require for that to happen, the results of this intervention on SSB consumption would be relatively easy to evaluate in a timeframe that is relatively shorter than changing the structure of the water piping. Participants recommended the use of subsidies or local government provision of water filters, fillable water bottles, water stations, public water faucets.

Limits on marketing of SSB.

Easy to do
High impact

Participants recommended limiting marketing of SSB, which would weaken the positive feedback loops that benefit food industry (food industry economics and food industry involvement in policy). If industry involvement in policy is weakened, political will for change would increase, leading to the establishment of healthy food and beverage policy. According to Donella Meadow's reflection*, intervening in the system by weakening the positive feedback loops is one of the most effective places to intervene in a system.

*Description and reflection combine insights from member checking and reflection about effectiveness based on Donella Meadows' Places to Intervene in a System available at: <https://donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/>.

RECOMMENDATIONS/POLICY INSIGHTS FOR GREATER DC METROPOLITAN AREA

Working across agencies and sectors, jurisdictions in the Metropolitan Washington area should bring together diverse sectors under one same goal: to slow the reinforcing feedback loops of SSB consumption by reinforcing water consumption. These sectors can include water utilities, health departments, and environmental agencies, among others.

Specific actions could include:

- 1 Celebrate drinking tap water as the safe and healthy beverage of choice conducting a joint public awareness campaign to increase consumption of tap water instead of SSB to reduce diet-related chronic disease, decrease plastic pollution, and reduce household spending among other benefits.
- 2 Pilot the provision of water filters for families participating in the WIC program to encourage water over SSB consumption in children and families, reduce household spending on bottled beverages, and decrease household waste.
 - a. Since mistrust in tap water is a complex phenomenon, this pilot should monitor effectiveness of providing water filters on the SSB consumption, household spending and household waste in order to calculate return on investment (ROI) of a long-term intervention of this kind.
- 3 Normalize drinking tap water as the beverage of choice in government facilities by providing appealing and accessible tap water infrastructure. Require water-filling stations at all community facilities including schools, recreation centers, and libraries, along with reusable cups and water bottles for students, as a way to build water consumption habits for students and displace consumption of SSB, save families on costs of buying beverages, and decrease school waste.

DISCLOSURE

Opinions stated in this brief and the analysis it draws from are those of authors and do not necessarily reflect the views of the funders.

FINDINGS STATEMENT

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SUGGESTED CITATION

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REFERENCES

- 1.
- 2.
3. Kumar, G.S., et al., Sugar-sweetened beverage consumption among adults -- 18 states, 2012. MMWR Morb Mortal Wkly Rep, 2014. 63(32): p. 686-90.
4. Park, S., et al., Prevalence of Sugar-Sweetened Beverage Intake Among Adults--23 States and the District of Columbia, 2013. MMWR Morb Mortal Wkly Rep, 2016. 65(7): p. 169-74.
5. Xi, B., et al., Sugar-sweetened beverages and risk of hypertension and CVD: a dose-response meta-analysis. Br J Nutr, 2015. 113(5): p. 709-17.
6. Wang, M., et al., Association between sugar-sweetened beverages and type 2 diabetes: A meta-analysis. J Diabetes Investig, 2015. 6(3): p. 360-6.
7. Hu, F.B., Resolved: there is sufficient scientific evidence that decreasing sugar-sweetened beverage consumption will reduce the prevalence of obesity and obesity-related diseases. Obes Rev, 2013. 14(8): p. 606-19.
8. Cantoral, A., et al., Early introduction and cumulative consumption of sugar-sweetened beverages during the pre-school period and risk of obesity at 8-14 years of age. Pediatr Obes, 2016. 11(1): p. 68-74.
9. Pan, L., et al., A longitudinal analysis of sugar-sweetened beverage intake in infancy and obesity at 6 years. Pediatrics, 2014. 134 Suppl 1: p. S29-35.