

Addressing the Health Impacts of Sugar-Sweetened Beverages Beyond BMI

March 27, 2024

Center for Child and
Community Health



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Agriculture and Natural Resources

Community Nutrition and Health



Latinx Center
of Excellence

Land Acknowledgment

We acknowledge that this event is taking place throughout the unceded territory of California home to nearly 200 tribal nations.

As we begin this event, we acknowledge and honor the original inhabitants of our various regions. A land acknowledgement is a

critical step towards working with native communities to secure meaningful partnership and inclusion in the stewardship and protection of their cultural resources and homelands.

Let's take a moment to honor these ancestral grounds that we are collectively gathered upon and support the resilience and strength that all Indigenous people have shown worldwide.



Art: Darby Raymond-Overstreet, Diné, UCSF Office of Diversity and Outreach

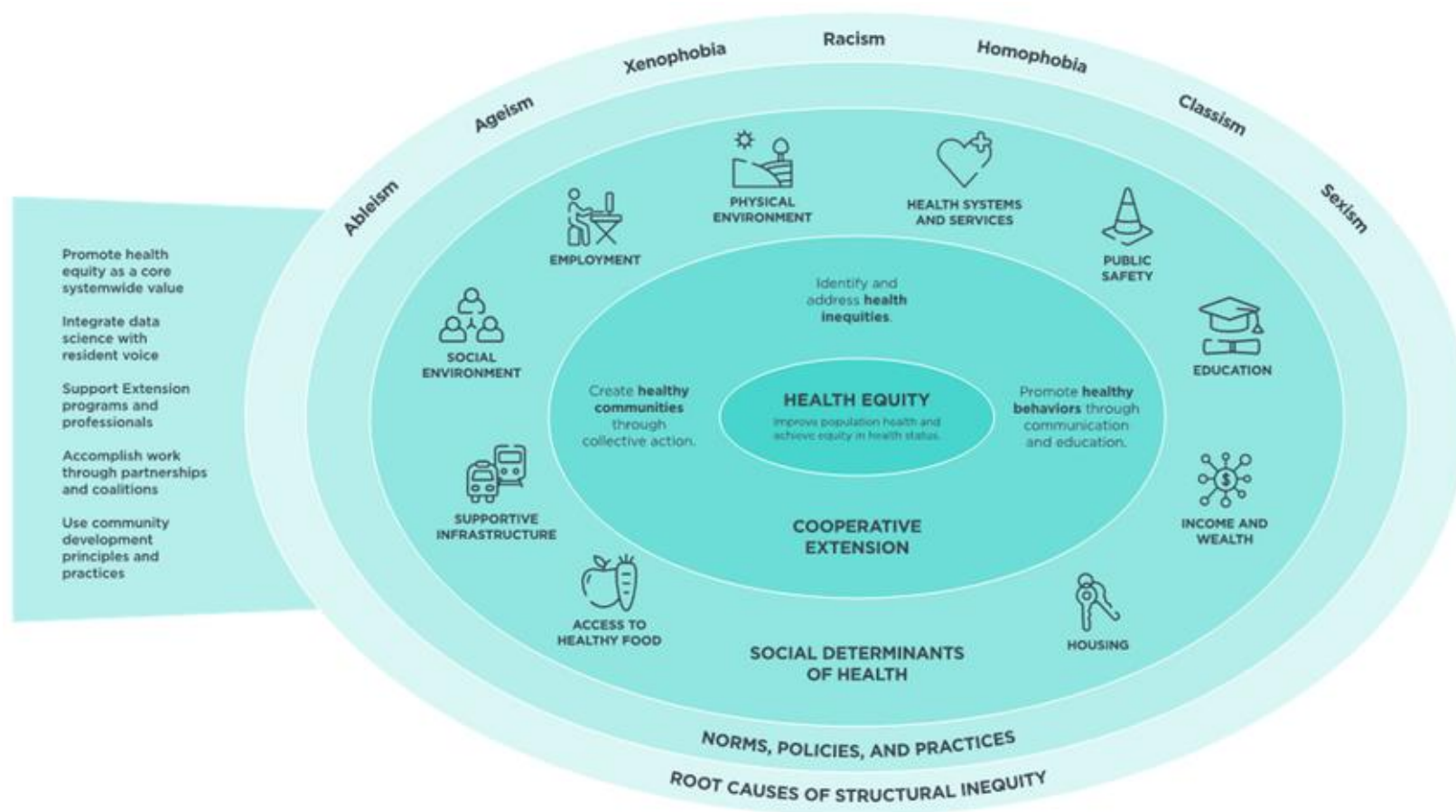
UC ANR/UCSF: A powerful collaboration for health equity

- UCANR connects the power of UC research with local communities to improve the lives of all Californians.
- UCSF is part of the 10-campus University of California, and the only of its campuses dedicated to graduate and professional education specifically through a singular focus on health.

UC ANR/UCSF: A Powerful Collaboration

Leveraging the strengths and expertise of UCANR and UCSF provides a potent and unique opportunity to bring these vital elements together with the **goal of improving health** in communities across California.

Cooperative Extension's National Framework for Health Equity and Well-Being



Advancing Health Equity Webinar Series:

- **Session 1 (April 2023):**
Created **common language** around health equity
- **Session 2 (May 2023):**
Identified how the work being done in UCANR fits in with UCANR and the Extension **health equity goals**
- **Session 3 (June 2023):**
Informed **new areas and approaches** UCANR can work in to advance health equity in the future.



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down page



Advancing Health Equity

April 5, 2023 | [Advancing health equity in California](#) Session 1 of 3 (Video), [Slide deck](#), with several speakers

May 2023 | [Advancing health equity in California](#) Session 2 of 3 (video), [Slide deck \(PDF\)](#) with several speakers

June 7, 2023 | [Advancing health equity in California](#) Session 3 of 3 (video) [Slide deck \(PDF\)](#)

Today's Speakers



Amy Beck, MD MPH

Associate Professor of Pediatrics
Division of General Pediatrics
University of California, San
Francisco



Alicia Fernandez, MD

Professor of Medicine
Director of the Latinx Center of
Excellence
University of California, San
Francisco

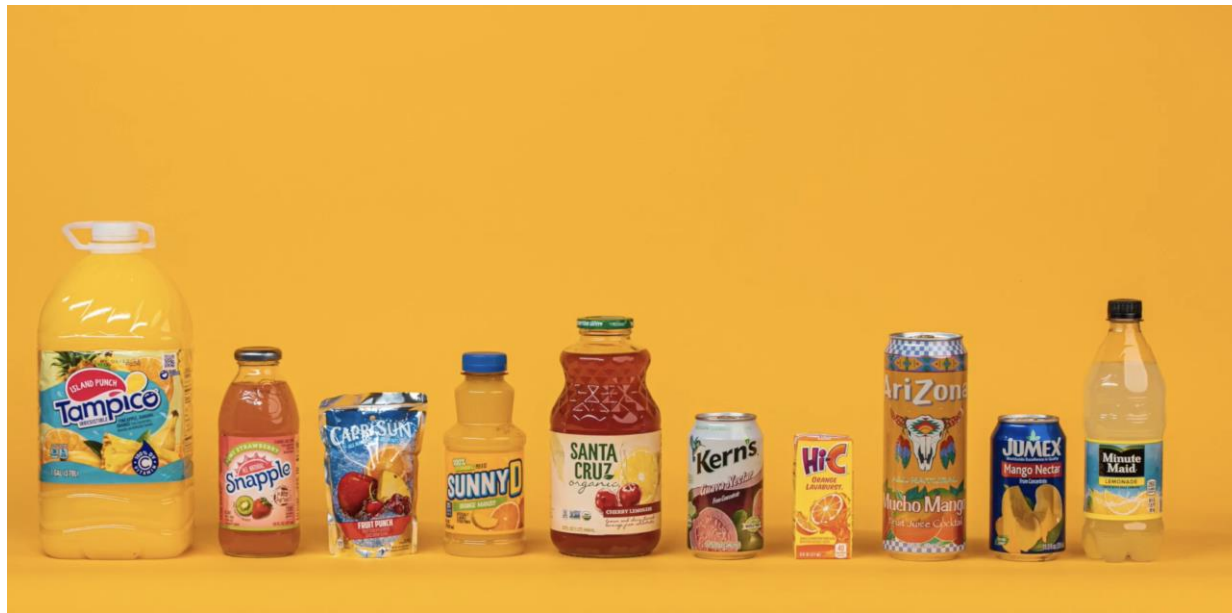
Objectives

- Describe the current evidence linking sugar-sweetened beverage intake to health outcomes beyond BMI
- Explain how pediatric and adult practitioners incorporate this evidence into clinical care
- Identify implications of the evidence on sugar-sweetened beverage intake for nutrition education and public policy

Definition of Sugar-Sweetened Beverages (SSB)

Liquids sweetened with various forms of added sugars, like brown sugar, corn sweetener, corn syrup, dextrose, fructose, glucose, high-fructose corn syrup, lactose, malt syrup, maltose, molasses, raw sugar, and sucrose

- Centers for Disease Control and Prevention

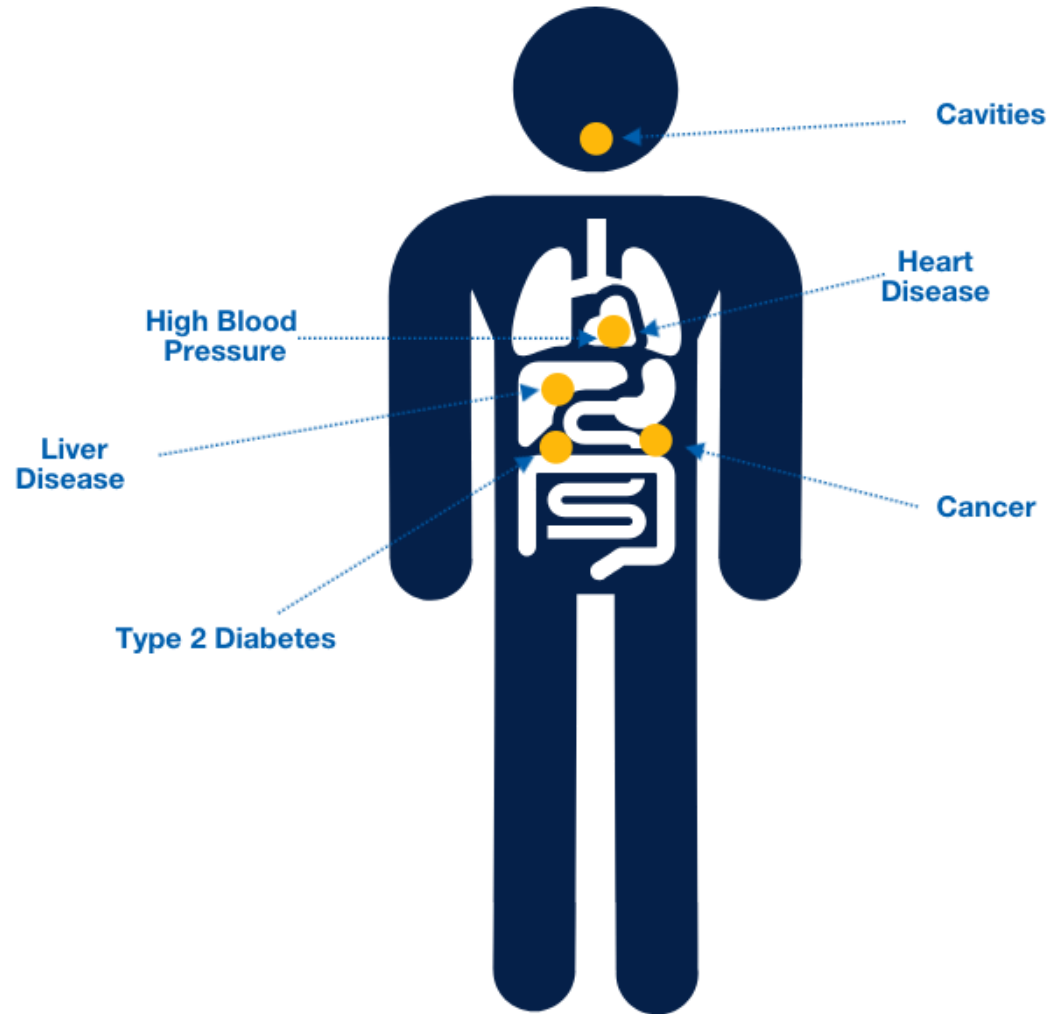


In What Ways Do Sugar-Sweetened Beverages Impact Health?

SSB can impact all of us over the long term, regardless of BMI.

Health Impacts of Sugar-Sweetened Beverages Go Beyond Weight Gain

In fact, negative health effects also are seen among people at normal BMI. Conditions linked to sugar-sweetened beverage intake include the following:



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Type 2 Diabetes, Coronary Heart Disease, Stroke

These are findings from a systematic review and meta-analysis of prospective cohort studies

Condition	Number of Studies	Number of Participants	Number of Events
Diabetes	17	566,178	30,666
Coronary Heart Disease	7	590,466	16,814
Stroke	7	302,669	13,793

Li et al. paper. Li B, Yan N, Jiang H, Cui M, Wu M, Wang L, Mi B, Li Z, Shi J, Fan Y, Azalati MM, Li C, Chen F, Ma M, Wang D, Ma L. Consumption of sugar sweetened beverages, artificially sweetened beverages and fruit juices and risk of type 2 diabetes, hypertension, cardiovascular disease, and mortality: A meta-analysis. *Front Nutr.* 2023 Mar 15;10:1019534.

Type 2 Diabetes, Coronary Heart Disease, Stroke

Findings from this study:

Each additional daily serving of a sugar-sweetened beverage **increased the risk of type 2 diabetes, coronary heart disease and stroke.**

Condition	Increased Risk from Each Daily Serving of an SSB
Diabetes	20%
Coronary Heart Disease	20%
Stroke	17%

Li B, Yan N, Jiang H, Cui M, Wu M, Wang L, Mi B, Li Z, Shi J, Fan Y, Azalati MM, Li C, Chen F, Ma M, Wang D, Ma L. Consumption of sugar sweetened beverages, artificially sweetened beverages and fruit juices and risk of type 2 diabetes, hypertension, cardiovascular disease, and mortality: A meta-analysis. *Front Nutr.* 2023 Mar 15;10:1019534.

Metabolic dysfunction associated steatotic liver disease (MASLD)

Findings from a systematic review and meta-analysis of 12 studies enrolling 35,705 participants:

Any SSB consumption is associated with a 1.39 increase in odds of MASLD.

Dose Response Seen	Increases Relative Risk
Low dose (less than 8 ounces per week)	14%
Medium dose (8-48 ounces/week)	26%
High dose (56 ounces or more/week)	53%

Chen H, Wang J, Li Z, Lam CWK, Xiao Y, Wu Q, Zhang W. Consumption of Sugar-Sweetened Beverages Has a Dose-Dependent Effect on the Risk of Non-Alcoholic Fatty Liver Disease: An Updated Systematic Review and Dose-Response Meta-Analysis. *Int J Environ Res Public Health*. 2019 Jun 21;16(12):2192.

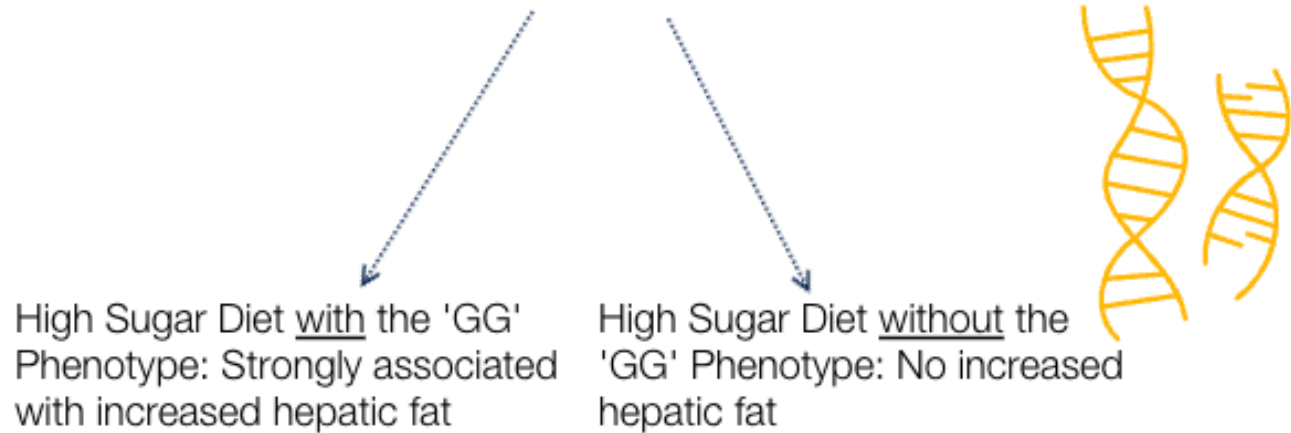


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Interaction of Genetic Risk + Dietary Risk Leads to MASLD

Nearly 40% of Latino children and adolescents with obesity have MASLD. This is much more prevalent than other populations – even with similar dietary intake.

The 'GG' Genetic Variation in the PNPLA3 Gene



Davis JN, Lê KA, Walker RW, Vikman S, Spruijt-Metz D, Weigensberg MJ, AllayeeH, Goran MI. Increased hepatic fat in overweight Hispanic youth influenced by interaction between genetic variation in PNPLA3 and high dietary carbohydrate and sugar consumption. Am J Clin Nutr. 2010 Dec;92(6):1522-7



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Hypertension

- In **adults**, each additional daily serving of **SSB increased hypertension risk by 10%**
- **Children and adolescents:** High SSB consumers were **36% more likely to have hypertension** than low SSB consumers

Li B, Yan N, Jiang H, Cui M, Wu M, Wang L, Mi B, Li Z, Shi J, Fan Y, Azalati MM, Li C, Chen F, Ma M, Wang D, Ma L. Consumption of sugar sweetened beverages, artificially sweetened beverages and fruit juices and risk of type 2 diabetes, hypertension, cardiovascular disease, and mortality: A meta-analysis. *Front Nutr.* 2023 Mar 15;10:1019534.

Farhangi MA, Nikniaz L, Khodarahmi M. Sugar-sweetened beverages increases the risk of hypertension among children and adolescence: a systematic review and dose-response meta-analysis. *J Transl Med.* 2020 Sep 5;18(1):344.

Cancer

SSB intake is associated with **increased risk for breast and prostate cancer**, according to a narrative review of 27 articles.

Arroyo-Quiroz C, Brunauer R, Alavez S. Sugar-Sweetened Beverages and Cancer Risk: A Narrative Review. *Nutr Cancer*. 2022;74(9):3077-3095.

Cancer

While SSB intake in *adulthood* is not associated with **colon cancer**, high intake of SSB in *adolescence* is associated with **increased risk for colorectal adenoma** (precursors to colon cancer).

Joh HK, Lee DH, Hur J, Nimptsch K, Chang Y, Joung H, Zhang X, Rezende LFM, Lee JE, Ng K, Yuan C, Tabung FK, Meyerhardt JA, Chan AT, Pischon T, Song M, Fuchs CS, Willett WC, Cao Y, Ogino S, Giovannucci E, Wu K. Simple Sugar and Sugar-Sweetened Beverage Intake During Adolescence and Risk of Colorectal Cancer Precursors. *Gastroenterology*. 2021 Jul;161(1):128-142.e20.

Experimental Evidence from a 10-Day Study

In this study, 43 youth with obesity who were high-sugar consumers, **SSB were eliminated for 9 days**, and calories were replaced in the diet with starch.

Overall, **dietary sugar was reduced** from 28% of total calories to 10%.



Lustig RH, Mulligan K, Noworolski SM, et al. Isocaloric fructose restriction and metabolic improvement in children with obesity and metabolic syndrome. *Obes Silver Spring Md.* 2016;24(2):453-460.

Schwarz JM, Noworolski SM, Erkin-Cakmak A, et al. Effects of Dietary Fructose Restriction on Liver Fat, De Novo Lipogenesis, and Insulin Kinetics in Children With Obesity. *Gastroenterology.* 2017;153(3):743-752.

Experimental Evidence from a 10-Day Study

Significant Decrease in:

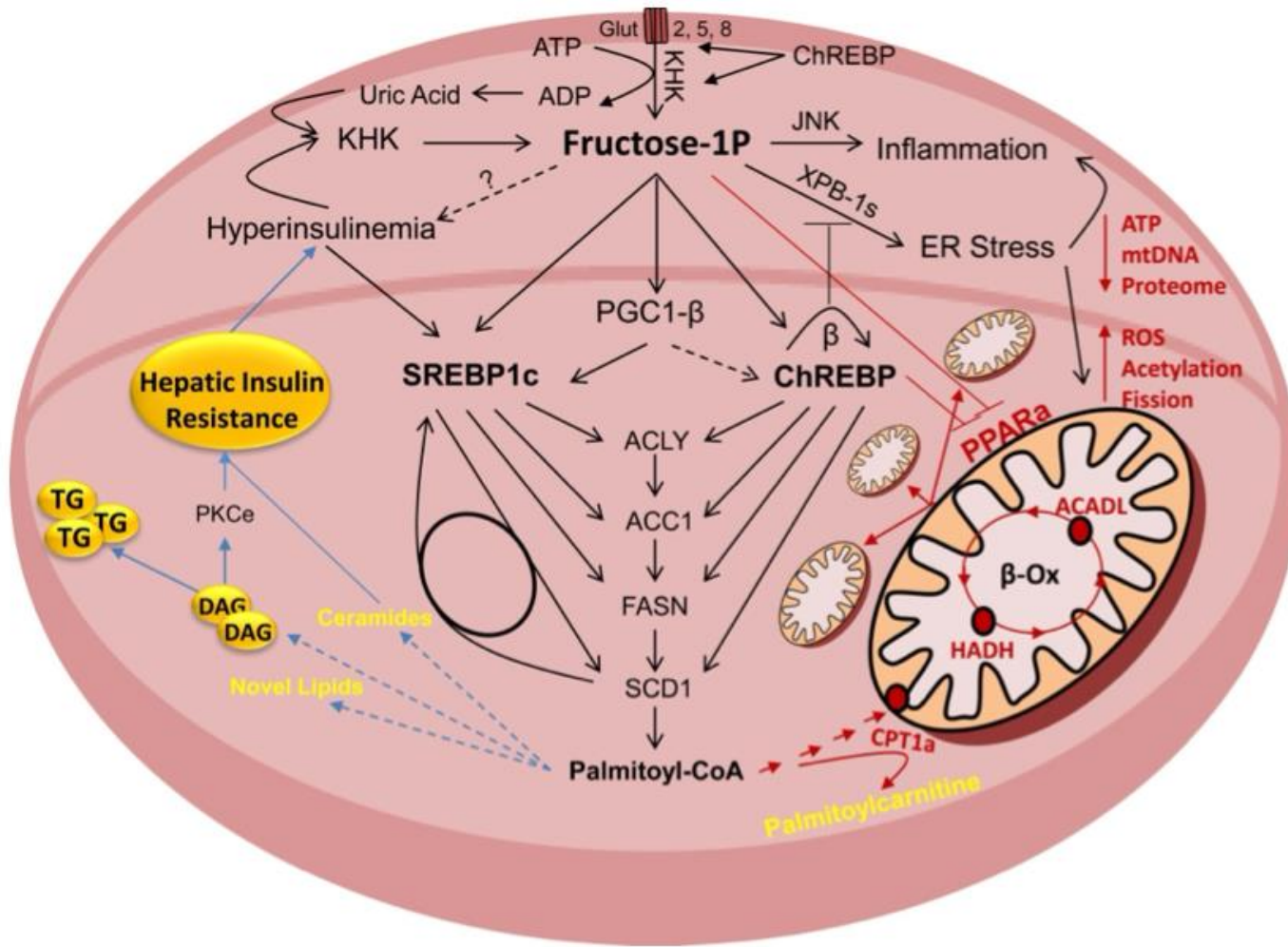
- Insulin resistance (58% reduction)
- Fasting triglycerides (46% reduction)
- Diastolic blood pressure (-4.9)
- Liver fat (7.2% to 3.8%)
- Visceral fat (123 cm³ to 110 cm³)

Lustig RH, Mulligan K, Noworolski SM, et al. Isocaloric fructose restriction and metabolic improvement in children with obesity and metabolic syndrome. *Obes Silver Spring Md.* 2016;24(2):453-460.

Schwarz JM, Noworolski SM, Erkin-Cakmak A, et al. Effects of Dietary Fructose Restriction on Liver Fat, De Novo Lipogenesis, and Insulin Kinetics in Children With Obesity. *Gastroenterology.* 2017;153(3):743-752.

How Do SSB Contribute to These Negative Health Outcomes?

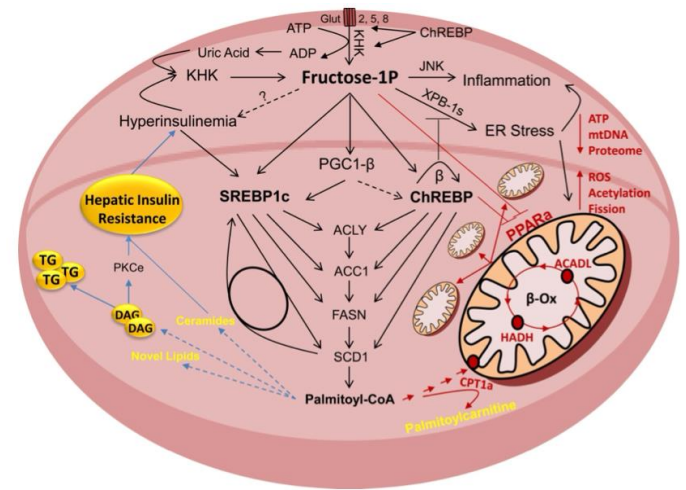
How Fructose May Contribute to Insulin Resistance



How Fructose May Contribute to Insulin Resistance

“Dietary fructose intake strongly promotes hepatic insulin resistance via complex interplay of several metabolic pathways, at least some of which are independent of increased weight gain and caloric intake.

The current evidence shows that the fructose, but not glucose, component of dietary sugar drives metabolic complications and contradicts the notion that fructose is merely a source of palatable calories that leads to increased weight gain and insulin resistance.”

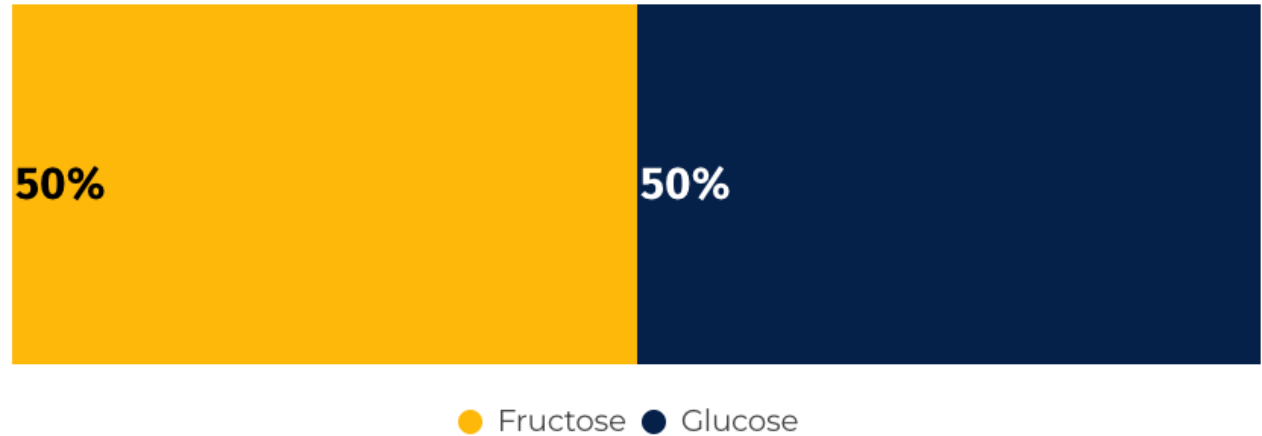


Softic S, Stanhope KL, Boucher J, Divanovic S, Lanaspa MA, Johnson RJ, Kahn CR. Fructose and hepatic insulin resistance. *Crit Rev Clin Lab Sci*. 2020 Aug;57(5):308-322.

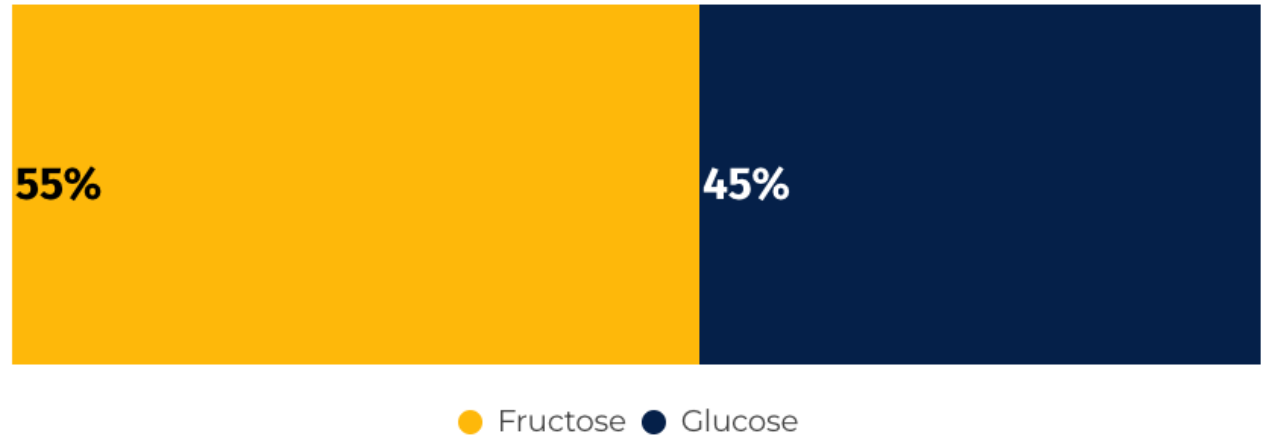
Sucrose vs. High Fructose Corn Syrup

Both sucrose and high fructose corn syrup are high in fructose.

Sucrose (Table Sugar)



High Fructose Corn Syrup



Artificial Sweeteners

What about diet soda and other artificially sweetened beverages?

- Artificially sweetened beverages associated w/**increased risk of type 2 diabetes, hypertension and stroke**
- Intake of artificially sweetened beverages associated with **higher risk of MASLD**
- Artificially sweetened beverages may be a **better alternative, but they are not risk free**

Li B, Yan N, Jiang H, Cui M, Wu M, Wang L, Mi B, Li Z, Shi J, Fan Y, Azalati MM, Li C, Chen F, Ma M, Wang D, Ma L. Consumption of sugar sweetened beverages, artificially sweetened beverages and fruit juices and risk of type 2 diabetes, hypertension, cardiovascular disease, and mortality: A meta-analysis. *Front Nutr.* 2023 Mar 15;10:1019534.

Tseng TS, Lin WT, Ting PS, Huang CK, Chen PH, Gonzalez GV, Lin HY. Sugar-Sweetened Beverages and Artificially Sweetened Beverages Consumption and the Risk of Nonalcoholic Fatty Liver (NAFLD) and Nonalcoholic Steatohepatitis (NASH). *Nutrients.* 2023 Sep 15;15(18):3997.

Pediatric Case Study

About This Patient

- 10-year-old boy who **immigrated from Central America** at age 4
- BMI always somewhat elevated, but **sharply increased during the pandemic** related to school closures
- Seen by his PCP and found to have **high blood pressure and MASLD**
- Referred to Healthy Lifestyles Clinic at San Francisco General Hospital

Diet & Physical Activity

- Daily intake of **sugary beverages** (1-2/day)
homemade lemonade, agua fresca, Capri Sun
- Daily intake of **sugary cereal**
at breakfast and often as a bedtime snack
- Daily intake of **sweets**
ice cream, cookies, candy, pan dulce
- Consumes **fruits and vegetables** daily
- **Minimal physical activity**



Our Approach

- Education and supported goal setting around **reduction of sugary beverages**
Goal of one sugary beverage per week (otherwise water or plain milk)
- Education and supported goal setting for **physical activity**
Goal of 60 minutes of physical activity per day
- Case management and community linkage to **assist with enrollment in structured physical activity**

The American Heart Association recommends that children drink no more than **one eight-ounce serving** of a sugar-sweetened beverage **each week**.



Eight Ounces
(About 2/3 of a Coke can)

Vos MB, Kaar JL, Welsh JA, et al. Added Sugars and Cardiovascular Disease Risk in Children: A Scientific Statement From the American Heart Association. *Circulation*. 2017;135(19):e1017-e1034.



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Behavioral/Lifestyle Outcomes

- **Eliminated all sugary beverages**
- **Reduced intake of sweets** by about half
still consuming ice cream, cookies, candy, pan dulce 3-4 days per week
- No change in intake of **sugary cereals**
- **Enrolled in swimming and karate**
facilitated by our physical activity case manager who helped obtain a scholarship and assisted w/registration
- **Parents supported physical activity** through park outings on other days of the week



Health Outcomes

- **Modest decrease in BMI** from 28.8 to 26.8
remained in the range of obesity by pediatric growth standards
- **Resolution of high blood pressure**
- **Complete normalization of liver enzymes**
indicates resolution of, or at a minimum, significant improvement in MASLD

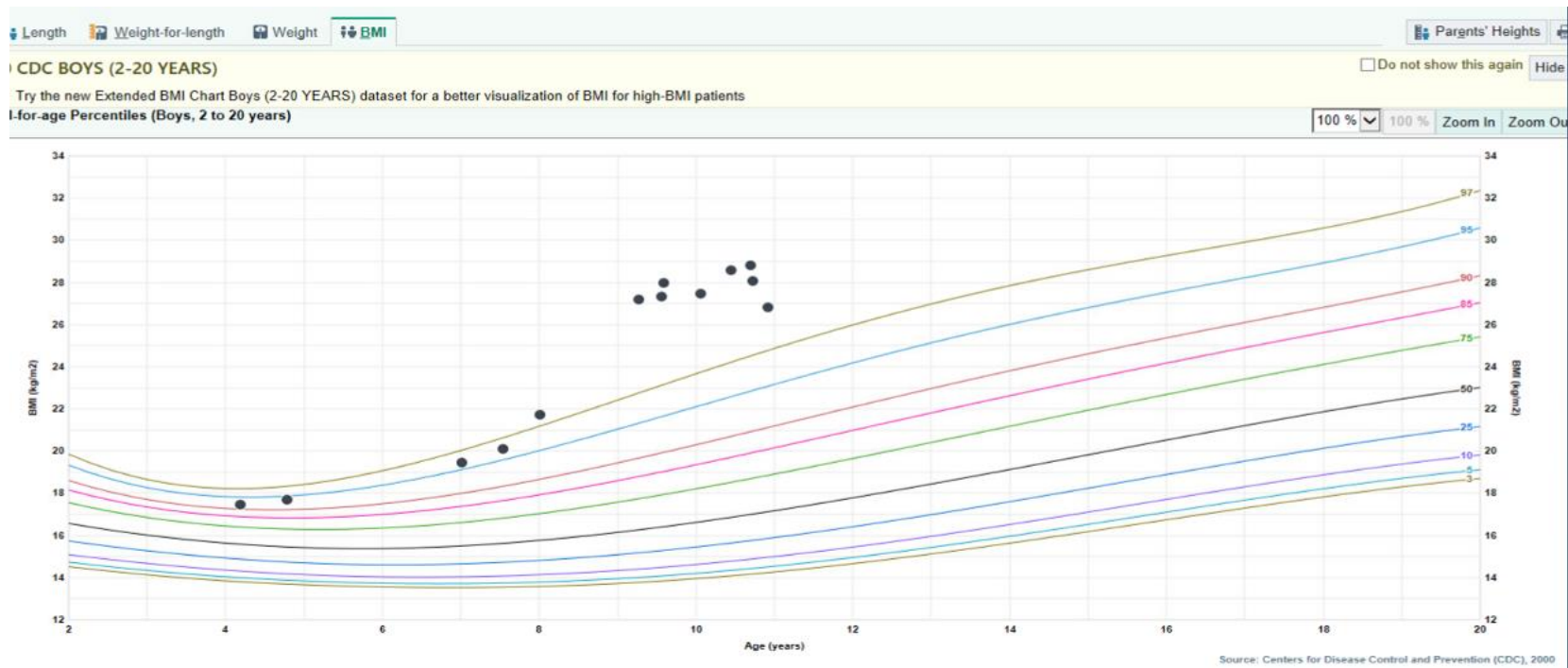
Impact of Lifestyle Changes

ALT

Status: Final result Visible to patient: No (inaccessible in MyChart) Dx: Elevated liver transaminase level

0 Result Notes | 1 Follow-up Encounter

Component	Ref Range & Units	3 wk ago	6 mo ago	1 yr ago
ALT	10 - 40 U/L	22	73 [▲]	138 [▲]
Resulting Agency		ZSFG Lab	ZSFG Lab	ZSFG Lab



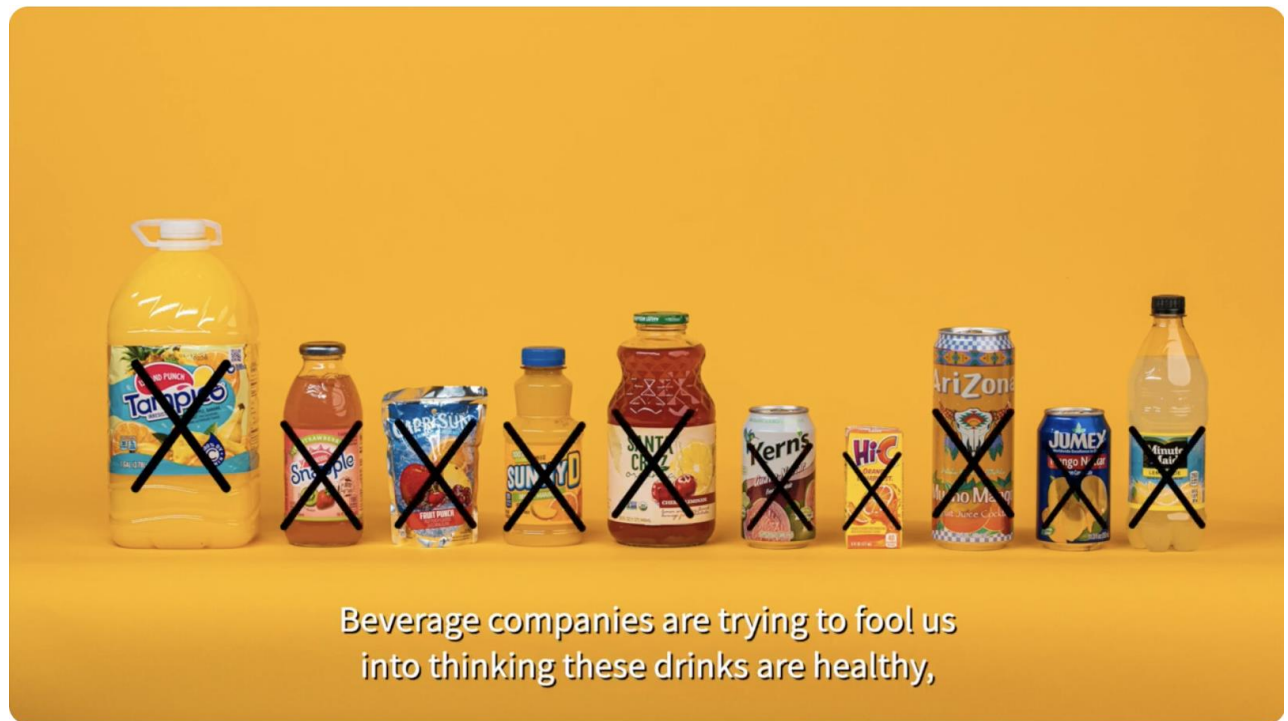
Update

Seen for follow-up:

- **BMI has partially rebounded (27.5)**
- **Still avoiding sugary beverages**
- **Still doing physical activity** on most days of the week
- **Blood pressure** remains **normal**
- **Liver** function remains **normal**

Curtailing the intake of sugary beverages from the diet is the **most powerful tool** in the pediatric healthy lifestyle toolbox.

Increasing physical activity is a close second.



Beverage companies are trying to fool us into thinking these drinks are healthy,

Adult Scenario

About This Patient

- Patient has **type 2 diabetes with poor control** (A1c=9.5, normal A1c is less than 5.7)
- She also has **obesity** (BMI=38), **osteoarthritis** and **depression**
- Works as cleaner in hotel, has two school-age children, husband working two jobs
- Yesterday's **drink consumption**: 1 SSB with lunch (at work) and another at 4pm (for energy)

How to Counsel This Patient?

- Ask why SSB?
- Educate about the impact on diabetes, liver disease
- Inquire about other family member's health and risks
- Recommend to stop buying SSB
- Recommend to enlist husband's help and explain the situation to the children
- Can you do this? When? How? Measure.
- Recommend diet SSB if the above doesn't work

Marketing of SSB

Marketing Tactics

The SSB industry spends **\$1 billion per year** on marketing



Marketing Tactics

When SSB are marketed as health – e.g. "all natural" – people view these drinks as healthy, even if they're not.

“This is better because it’s natural. It says that it’s all juice.”

“I think that it’s healthy, because it has fruit and vitamins. One bases oneself in that it looks like it’s all natural. Supposedly it has natural fruit or something natural.”



Beck AL, Takayama JI, Halpern-Felsher B, Badiner N, Barker JC. Understanding how Latino parents choose beverages to serve to infants and toddlers. *Matern Child Health J.* 2014 Aug; 18(6):1308-15.

Marketing Tactics

Similarly, SSB marketed as organic are viewed as healthy, even if they're not.

“[What’s healthy in the vending machine] is these crackers and Pop-Tarts...It's all organics. Everything in the vending machines is organic. Even the sodas are organic.”



Beck AL, Iturralde EM, Haya-Fisher J, Kim S, Keeton V, Fernandez A. Barriers and facilitators to healthy eating among low-income Latino adolescents. *Appetite*. 2019 Apr 04; 138:215-222.

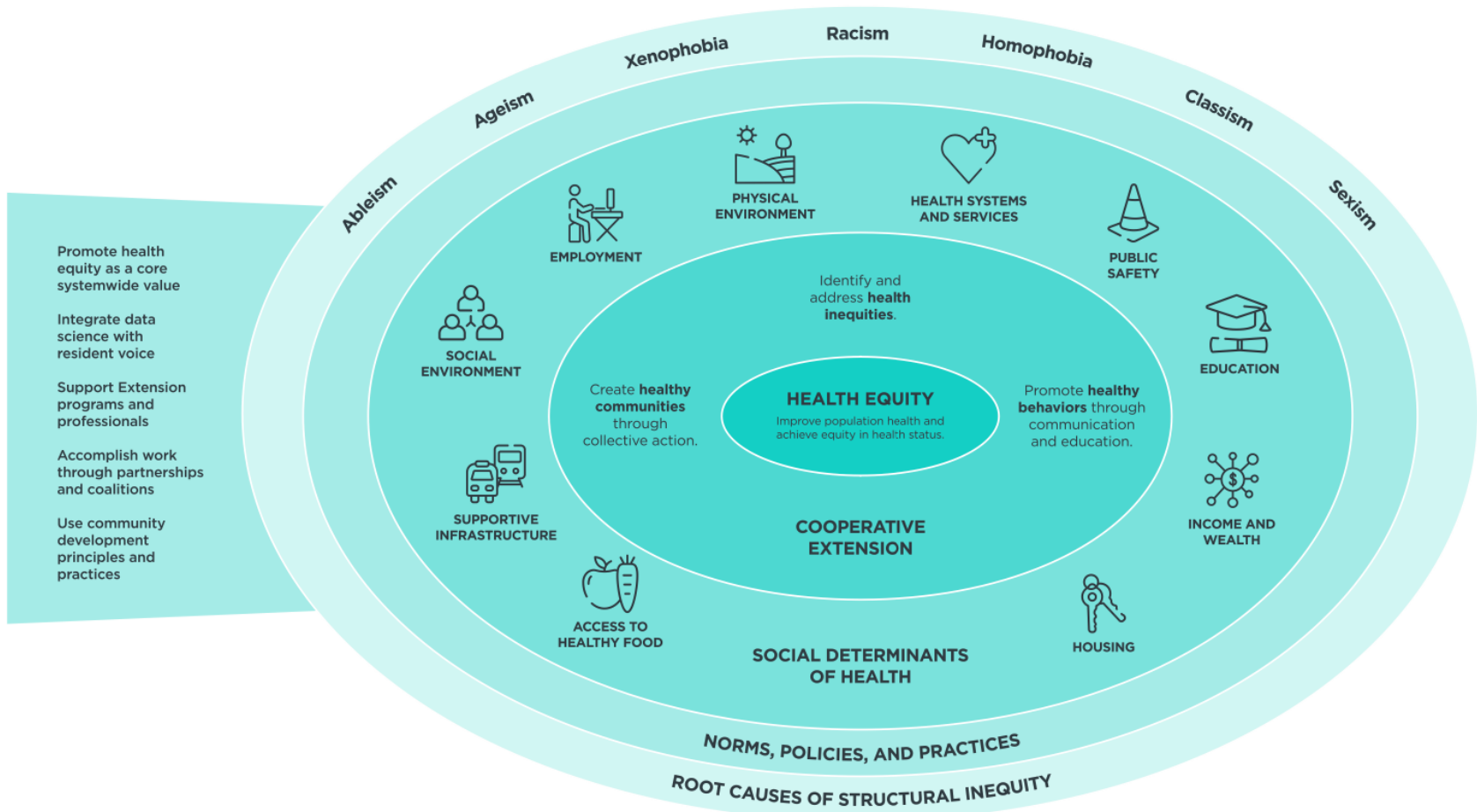
Marketing Tactics

- Beverage companies disproportionately **target Black and Latino youth** with their marketing
- Black and Latino youth **consume significantly more SSB** and are more likely to suffer from associated health problems

Harris J, Fleming-Milici F, Kibwana-Jaff A, Phaneuf L. *Sugary Drink Advertising to Youth: Continued Barrier to Public Health Progress*. UCONN Rudd Center for Food Policy and Obesity

Policy Options: Moving Beyond Individual Education

Framework for Health Equity and Well Being



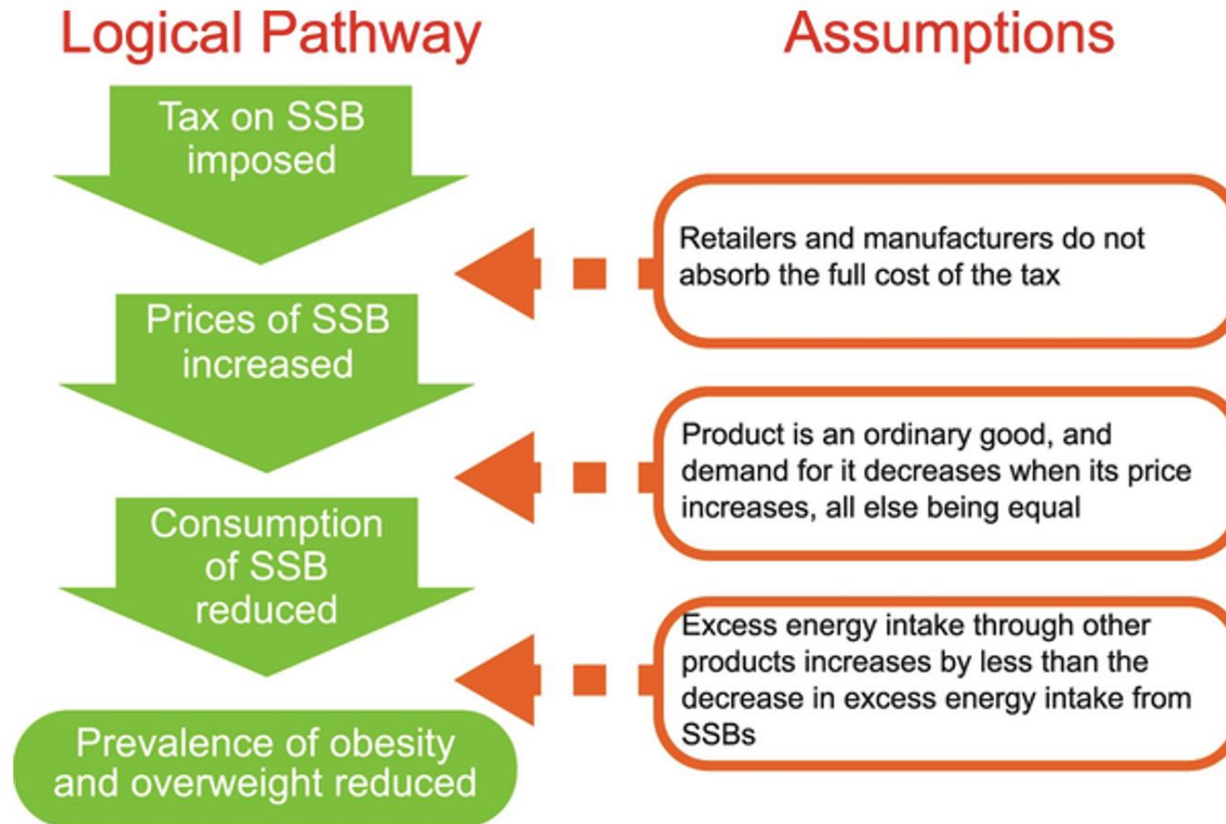
Cooperative Extension's National Framework for Health Equity and Well-Being, July 2021

Taxes on SSB

- Implemented in **45+ countries** and **endorsed by WHO**
- In California, implemented in **Berkeley, Oakland, SF, Albany**
- \$0.01 tax per fluid ounce. Imposed on distributors
- Estimated to have **cut local sales** in Oakland by **27%**
- Generates **revenue for public health** interventions
- New **CA SSB taxes have been prohibited** since 2017

Taxes on SSB

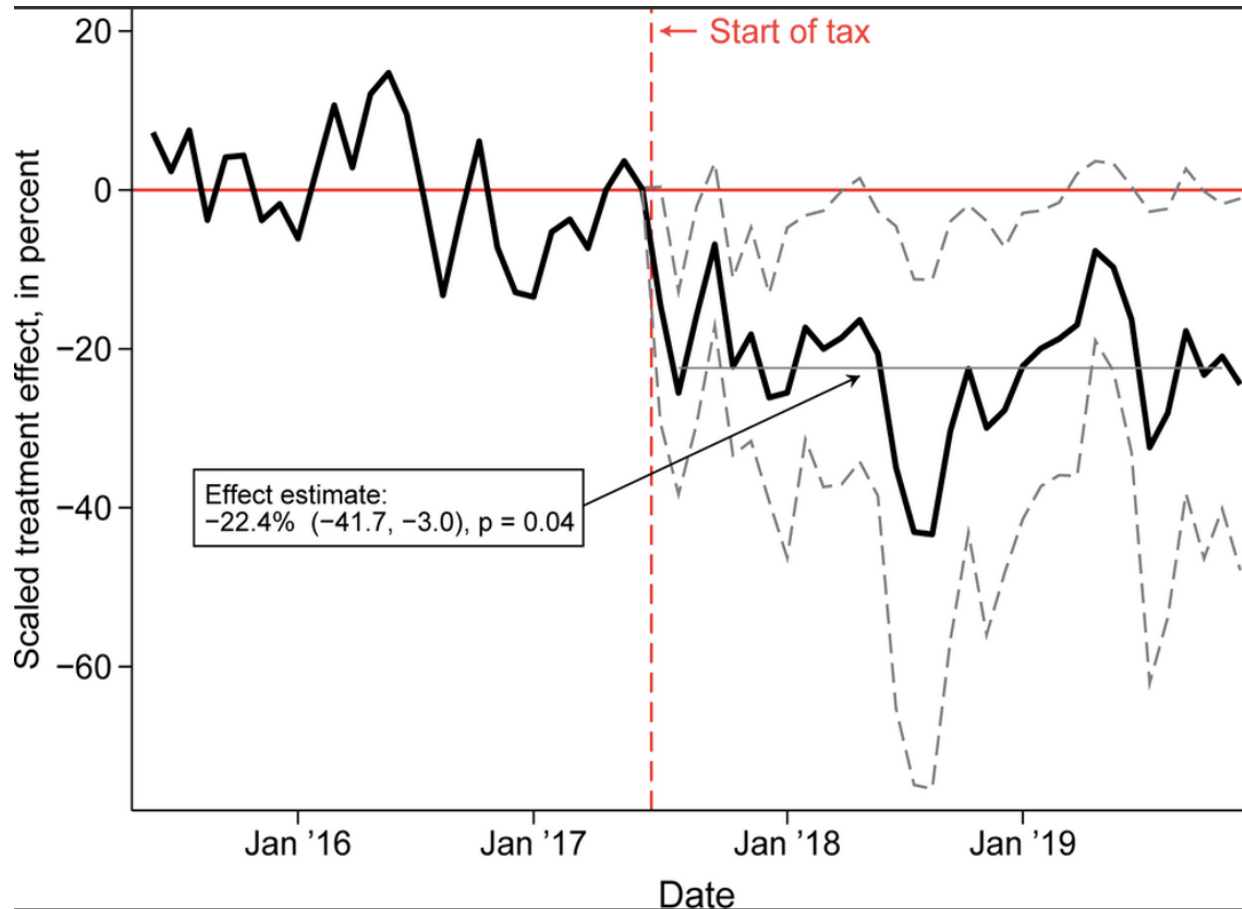
Fig 1. Logical Pathway from Taxing SSBs to Public Health Impact.



Nakhimovsky SS, Feigl AB, Avila C, O'Sullivan G, Macgregor-Skinner E, et al. (2016) Taxes on Sugar-Sweetened Beverages to Reduce Overweight and Obesity in Middle-Income Countries: A Systematic Review. PLOS ONE 11(9): e0163358.

<https://doi.org/10.1371/journal.pone.0163358>, <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0163358>

Taxes on SSB



Evaluation of the sugar-sweetened beverage tax in Oakland, United States, 2015–2019: A quasi-experimental and cost-effectiveness study. White JS et al, PLOS Medicine 04/18/2023 <https://doi.org/10.1371/journal.pmed.1004212>

Environmental Design

- **Removed SSB** from some hospitals, all schools, daycare and some programs serving children
- Some local governments also banning sale of SSB on government sites
- Changes environment and **decreases SSB consumption**
- **Change in norms**

Reducing Children's Exposure to Marketing

- Since 2017, CA bans marketing unhealthy food to children within schools
- Concern about look-alike marketing that actually boost brand recognition among children
- WHO Guidelines ban marketing to children under 18

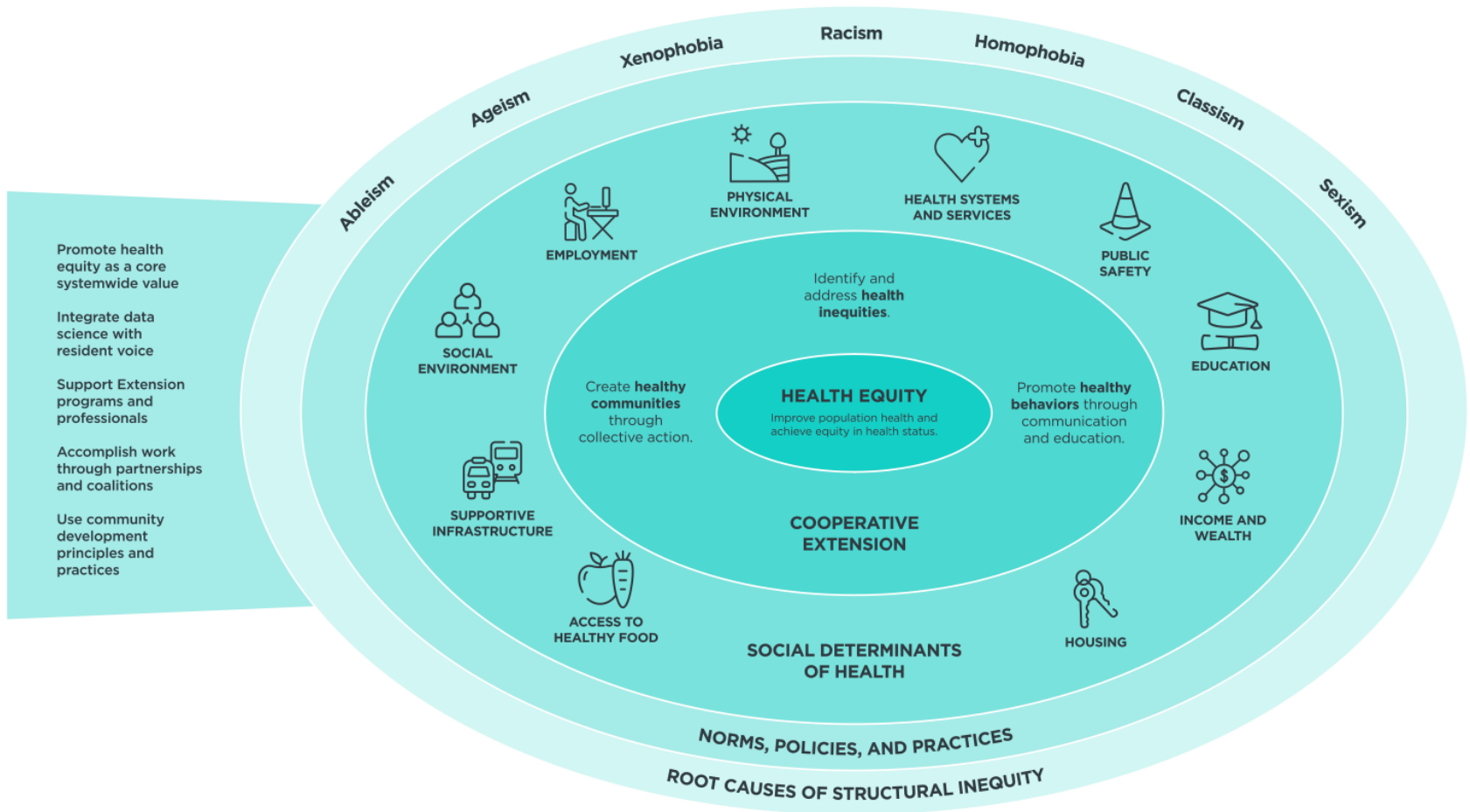


Mass Education to Address SSB Marketing

- Front-of-the-package labeling
- Increasingly common in Latin America
- Evaluations in progress
- Endorsed by White House 2022



Framework for Health Equity and Well Being



Cooperative Extension's National Framework for Health Equity and Well-Being, July 2021

Evidence-Informed Behavior Change Tactics

Parent Preferences for SSB Messaging

- Information on health effects is important
- Visualization of sugar content is important
- Expert messengers are preferred (nutritionists and doctors)



Beck AL, Takayama JI, Halpern-Felsher B, Badiner N, Barker JC. Understanding how Latino parents choose beverages to serve to infants and toddlers. *Matern Child Health J.* 2014 Aug; 18(6):1308-15.

Morel K, Nichols K, Nong Y, et al. Parental and Provider Perceptions of Sugar-Sweetened Beverage Interventions in the First 1000 Days: A Qualitative Study. *Acad Pediatr.* 2019;19(7):748-755.

Sugary Drink Messaging for Policy Change: A Resource for Advocacy Campaigns. American Heart Association; 2021.

UCSF-Created Video that Incorporates the Above Information



To help communicate information about the health effects of sugar-sweetened beverages to parents/caregivers, UCSF's Latinx Center of Excellence created a short, culturally relevant video in English and Spanish about one family's experience.



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Video



English



Spanish

Resources

Rudd Center for Food Policy Health

<http://www.uconnruddcenter.org/>

SugarScience UCSF

<http://sugarscience.ucsf.edu/>

Obesity Prevention Source, Harvard

<https://www.hsph.harvard.edu/obesity-prevention-source/>

Next Steps

- Please complete the webinar evaluation
- Contact Cassandra Vega cassandra.vega@ucsf.edu if you have questions



Scan here for
Webinar Evaluation

How Fructose May Contribute to Hypertension

Additional Slides



Chirag Bavishi. Hypertension. Serum Uric Acid in Primary Hypertension, Volume: 67, Issue: 5, Pages: 845-847, DOI: (10.1161/HYPERTENSIONAHA.116.07056)

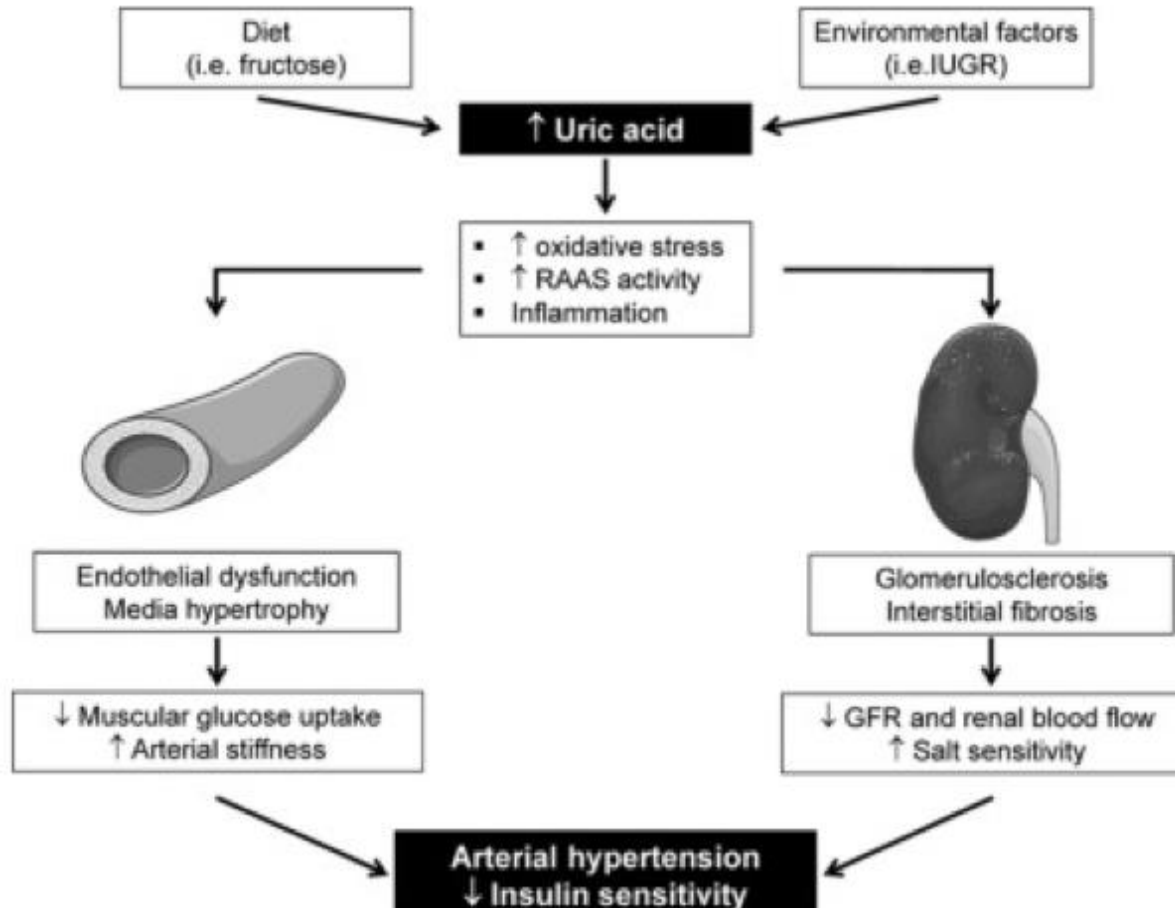
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How Fructose May Contribute to Hypertension

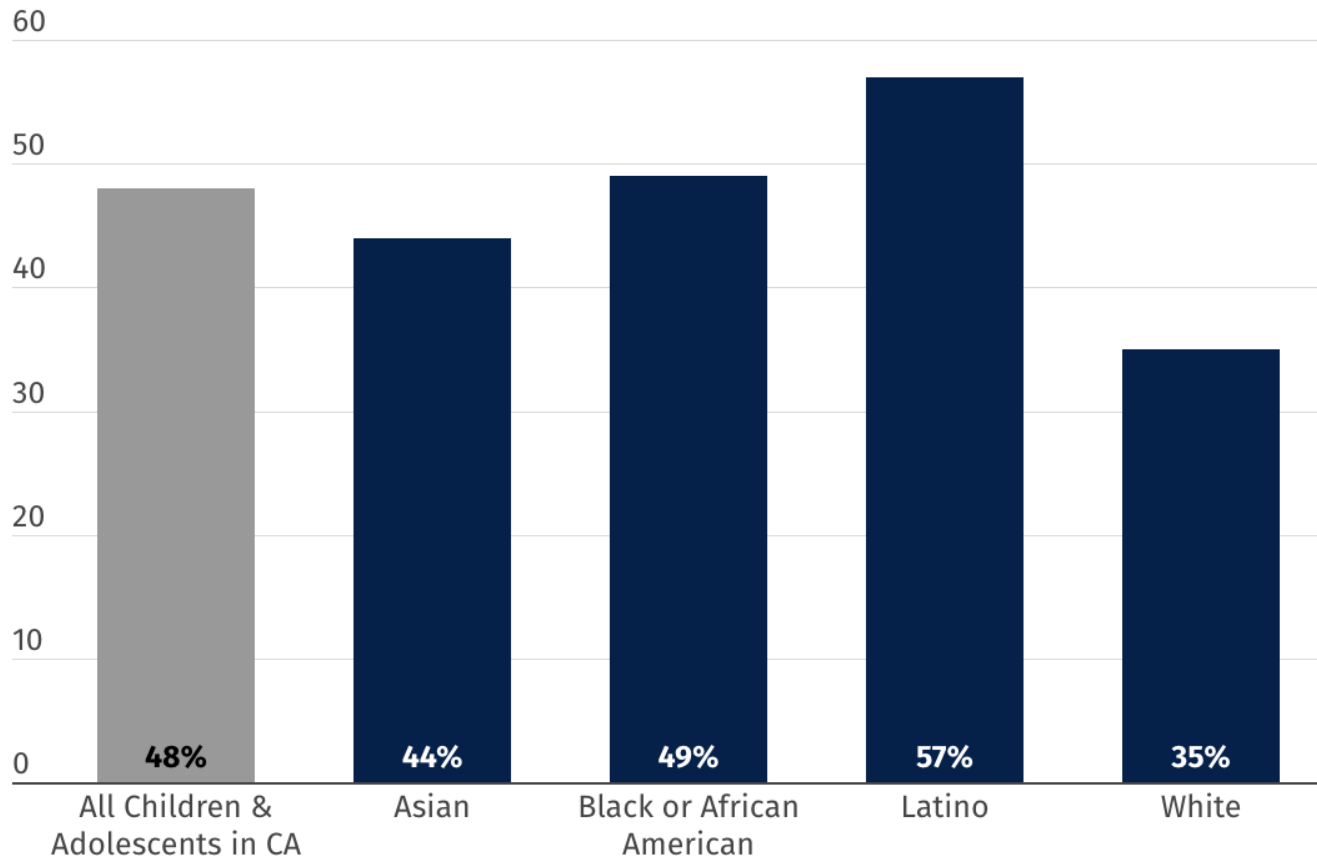


Chirag Bavishi. Hypertension. Serum Uric Acid in Primary Hypertension, Volume: 67, Issue: 5, Pages: 845-847, DOI: (10.1161/HYPERTENSIONAHA.116.07056)

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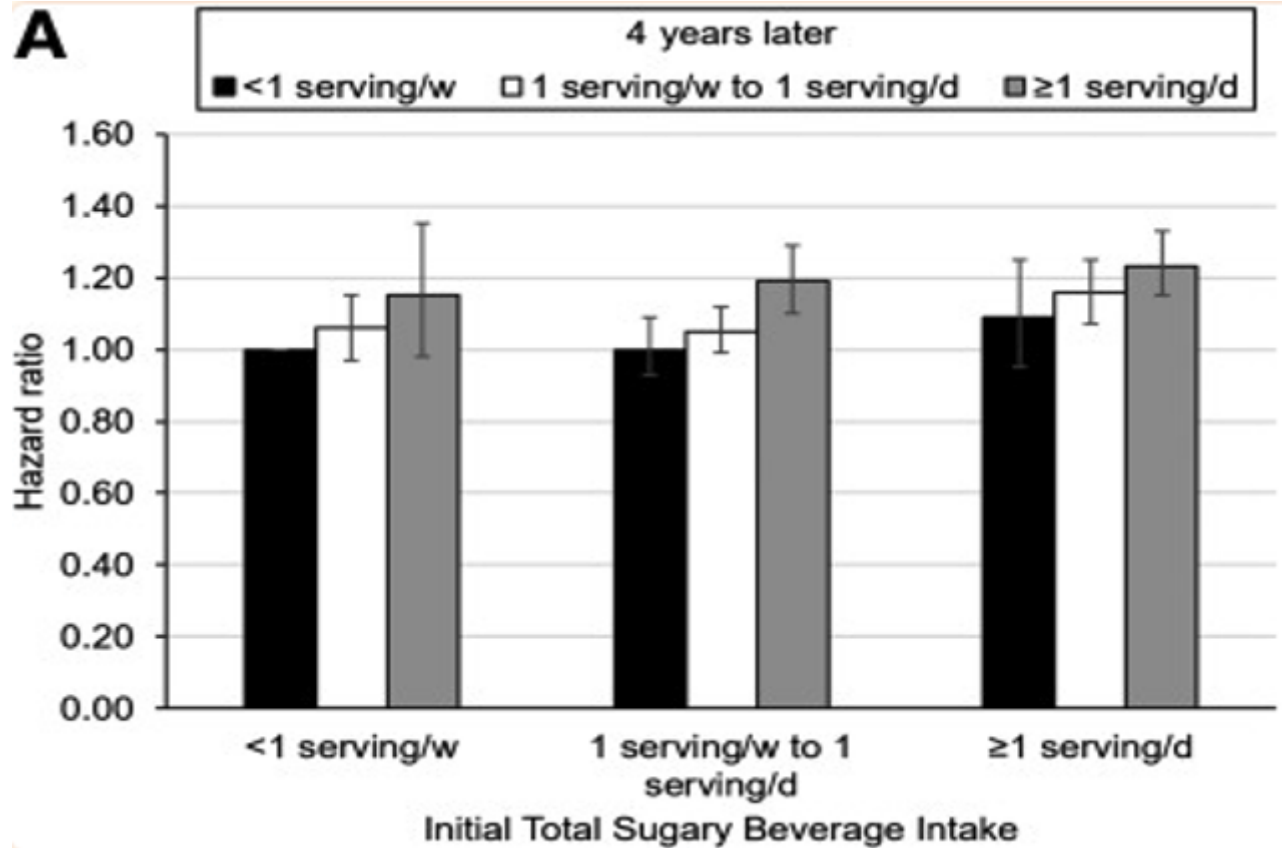
California Data on SSB

Percent of Youth and Adolescents Who Consumed SSB Yesterday (Other Than Soda)



Adding or Decreasing SSB Changes Diabetes Risk

- 192,000 nurses and health professionals
- Diet survey every four years
- Diabetes confirmed by chart review
- Diabetes risk changes, regardless of starting point of consumption



Drouin-Chartier JP, Zheng Y, Li Y, Malik V, Pan A, Bhupathiraju SN, Tobias DK, Manson JE, Willett WC, Hu FB. Changes in Consumption of Sugary Beverages and Artificially Sweetened Beverages and Subsequent Risk of Type 2 Diabetes: Results From Three Large Prospective U.S. Cohorts of Women and Men. *Diabetes Care*. 2019 Dec;42(12):2181-2189. doi: 10.2337/dc19-0734. Epub 2019 Oct 3. PMID: 31582428; PMCID: PMC6868459.



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