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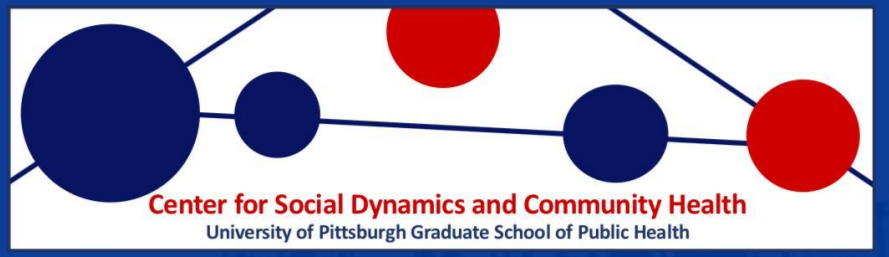

Harnessing systems science methods to improve the design and implementation of intervention strategies to reduce underage drinking and related problems

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As required by the Alcohol Policy 19 Conference,
I have signed a disclosure statement and note the following conflict(s) of interest:

None

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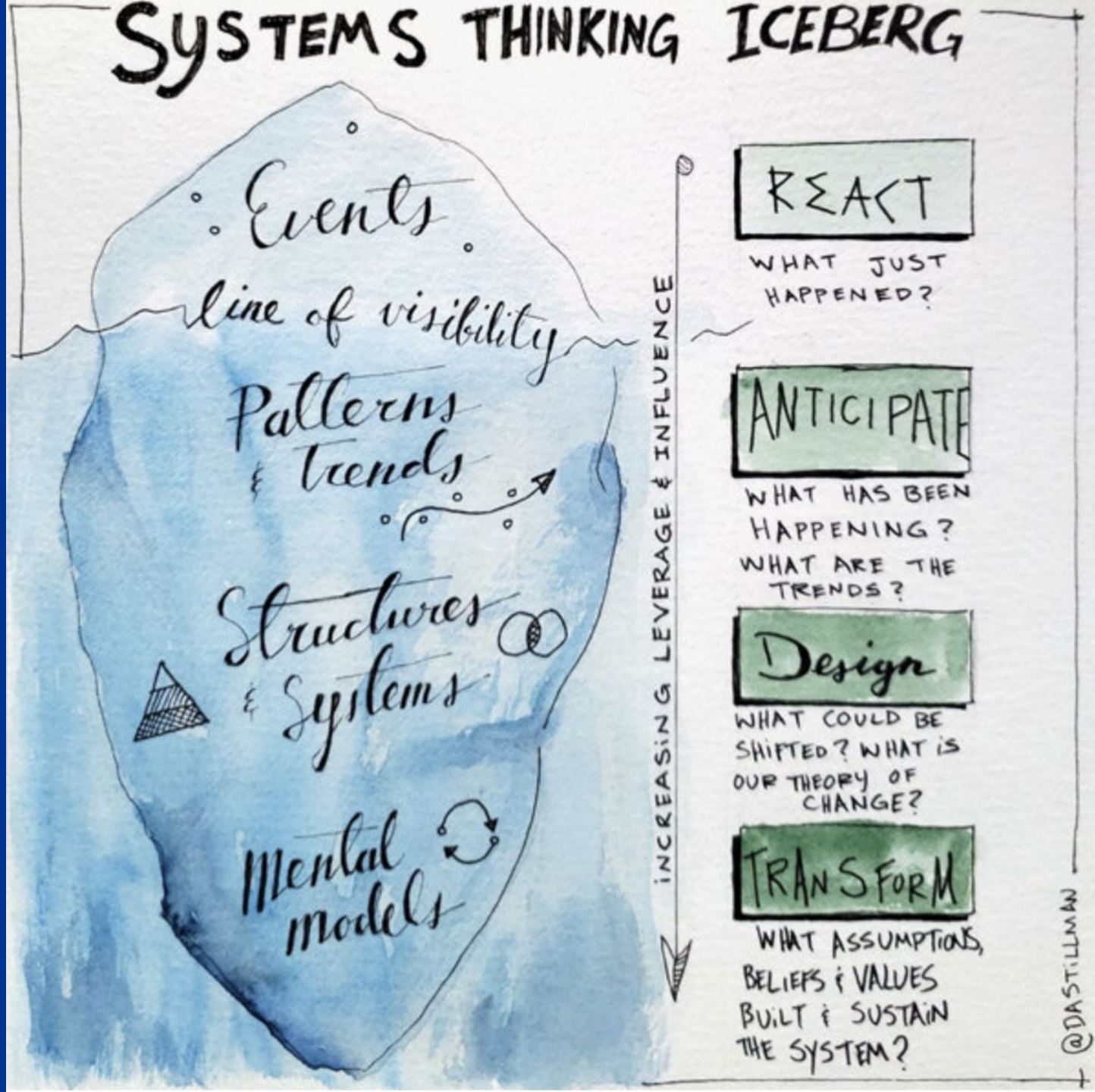
Alcohol Control Policies: Reducing Underage Drinking at Parties

- Party patrols
- Field patrols
- Social host laws (criminal, civil)

Alcohol Control Policies: Reducing Underage Drinking at Parties

- Limited evidence of effectiveness
- Variation in implementation? Threshold effects?
- Enforcement levels
- Best way to implement given limited resources?

Can Systems Science Help?



https://www.danielstillman.com/blog/systems-thinking-for-leadership-and-transformation

Systems Science: Agent-Based Models

- Illuminate underlying social mechanisms and develop theories
- Emphasize interactions between people & their environments
- Model changes in the environment and subsequent changes in behaviors
- Model community preventive interventions: change the “agent”, “environment”, “agent-environment interactions”

ABMs as Experiments

- Different runs of the model can act as counterfactuals by varying one parameter
- Can test alternative mechanisms through which manipulating exposures may influence health
- Can examine the effect of manipulations to different targets:
  - To improve overall health
  - To reduce inequities

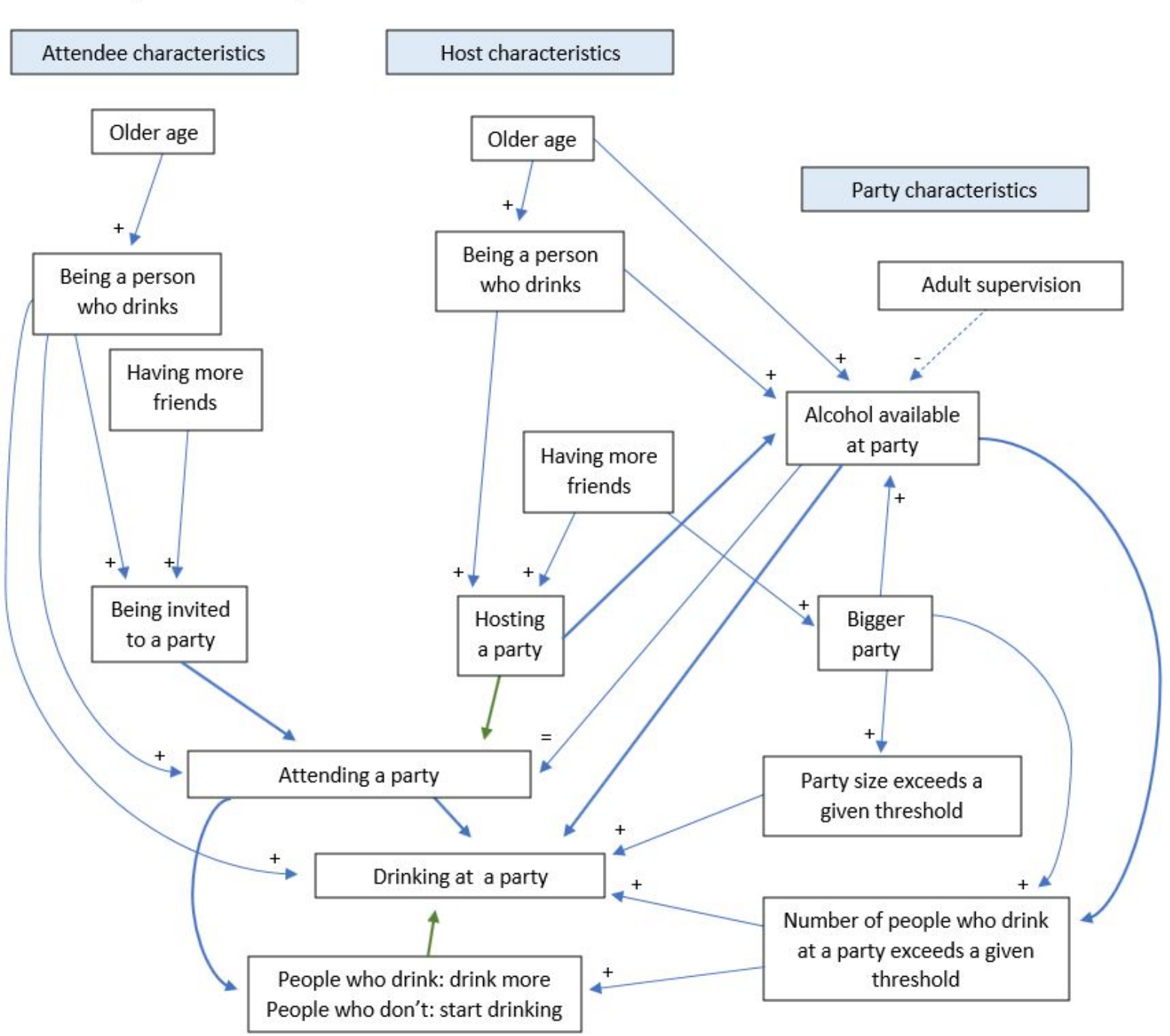
The Framework for Reconstructing Epidemiologic Dynamics (FRED)

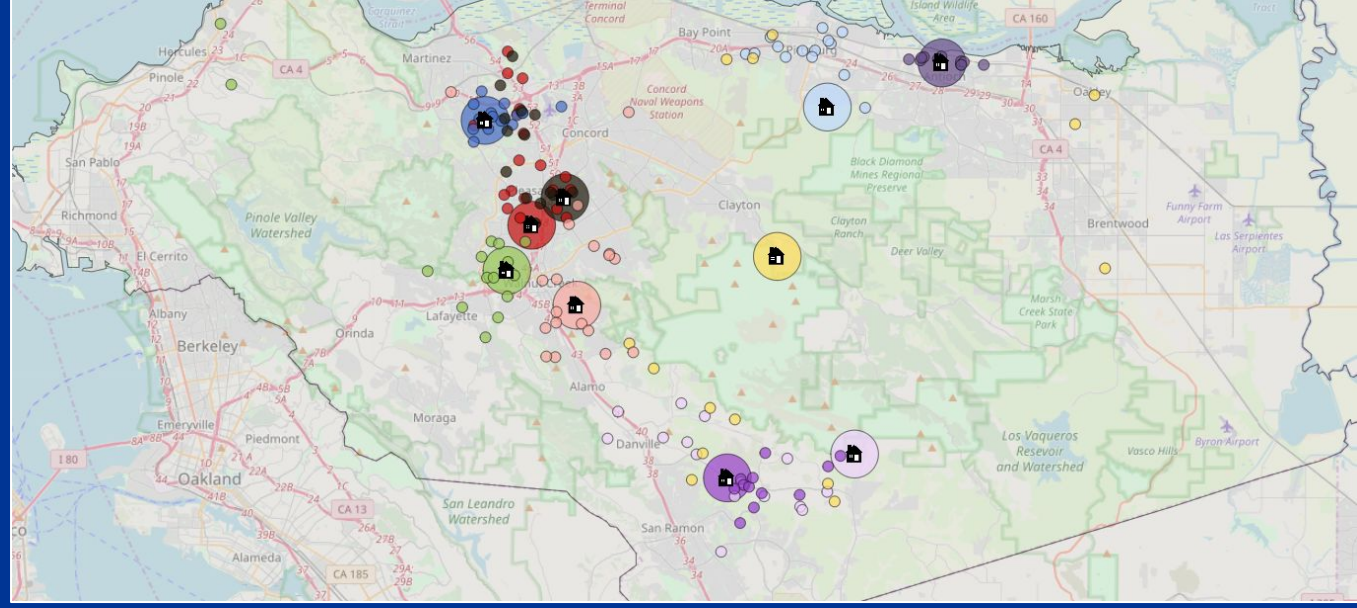
- Open source agent-based simulation platform
- Modular, flexible, extensible
- Agents co-evolve with physical and social environments
- Census-based pseudo-population, interacting within a specific environment (US Counties)
- **http://fred.publichealth.pitt.edu/**

Party Model

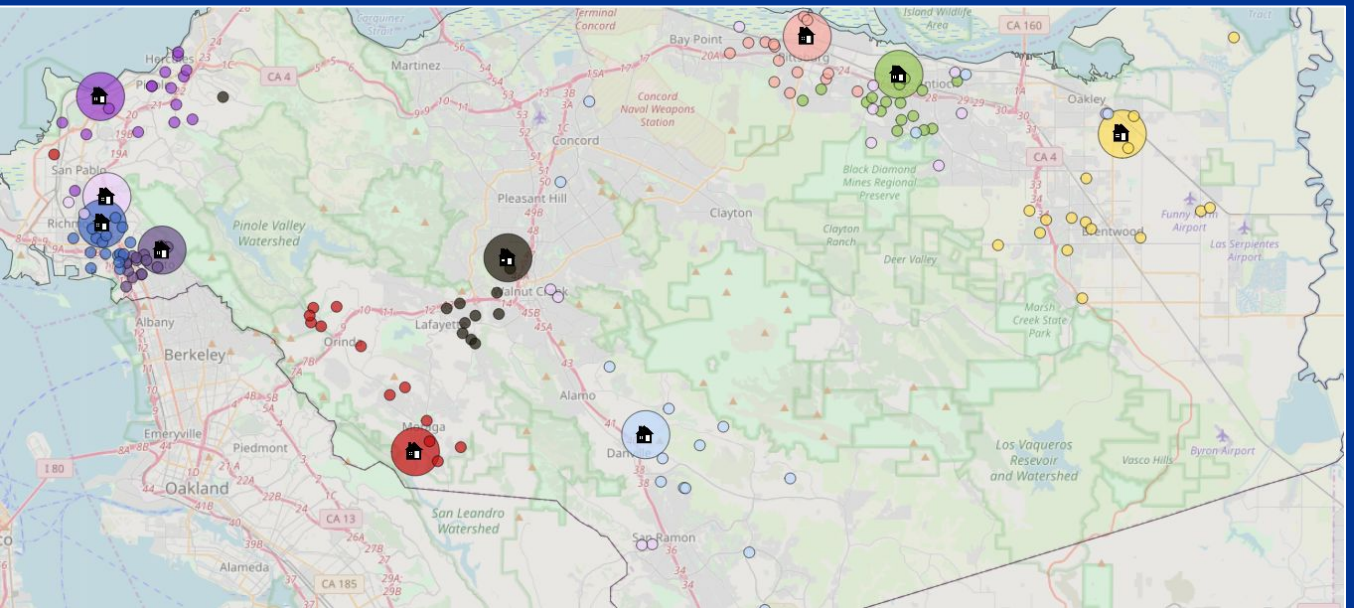
- Purpose: To understand the ways in which parties impact adolescents' alcohol use (number of drinks, number and proportion of attendees who drink)
- Focuses on drinking behaviors at parties in adolescents' homes
- Model defines an initial population of interest (adolescents aged 15-18), models attendance at parties at homes of hosts, and models the effect of drinking behaviors at parties on current and future drinking behaviors of all who attend the party

Party Model Overview



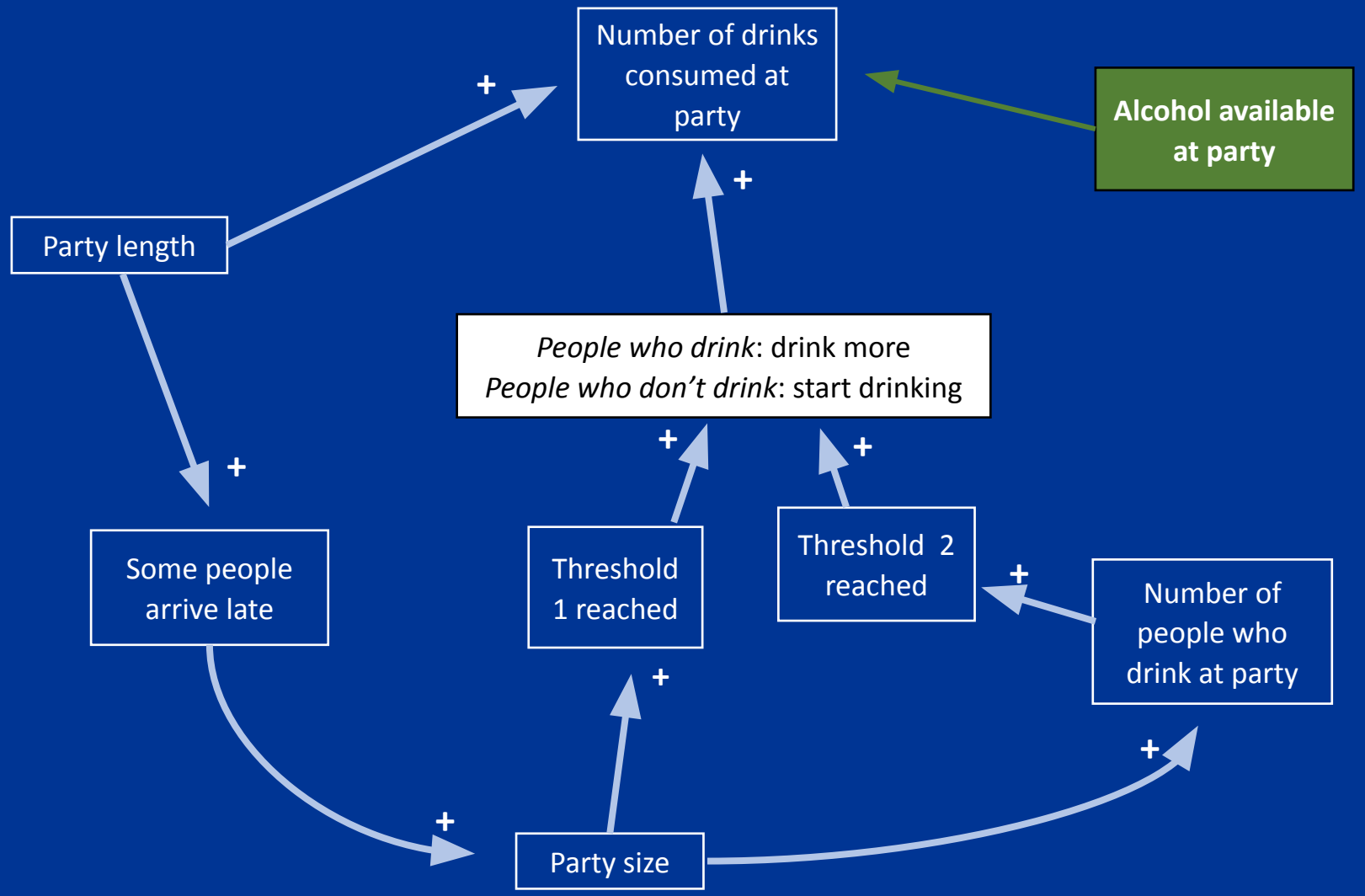


Each simulation starts with different hosts, party attendees



Social Host Policies/Party Patrols

- A specified (random) percent of parties are shut down 3 hours early (minimum length 1 hour)
- Range: 0% (original model) to 20%
- Examine changes in number of parties, proportion of parties with alcohol, party size, party length, number of drinkers, number who drank, total drinks consumed


Number of drinks consumed at party
Alcohol available at party
Party length
People who drink: drink more
People who don't drink: start drinking
Some people arrive late
Threshold 1 reached
Threshold 2 reached
Number of people who drink at party
Party size
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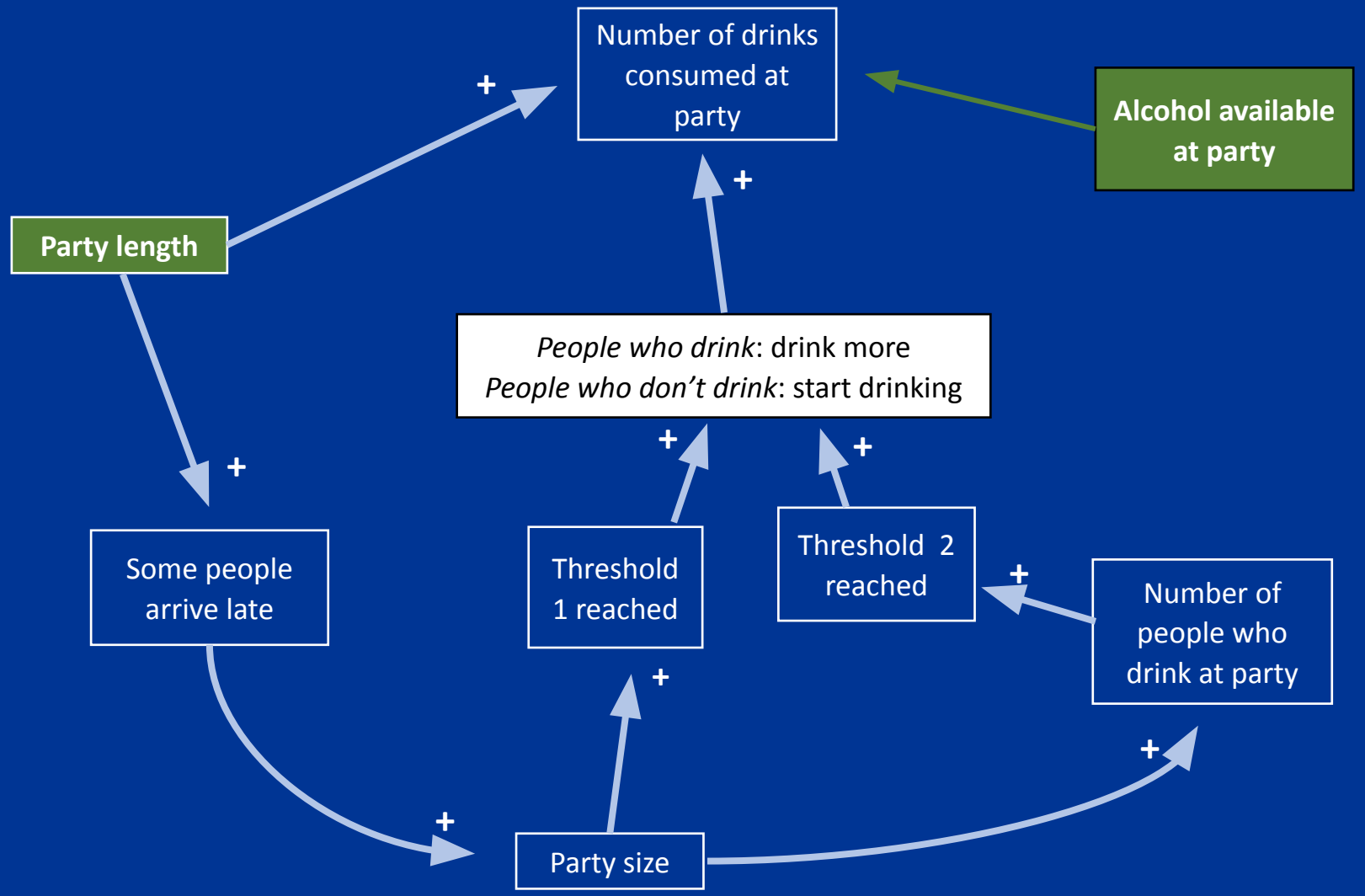
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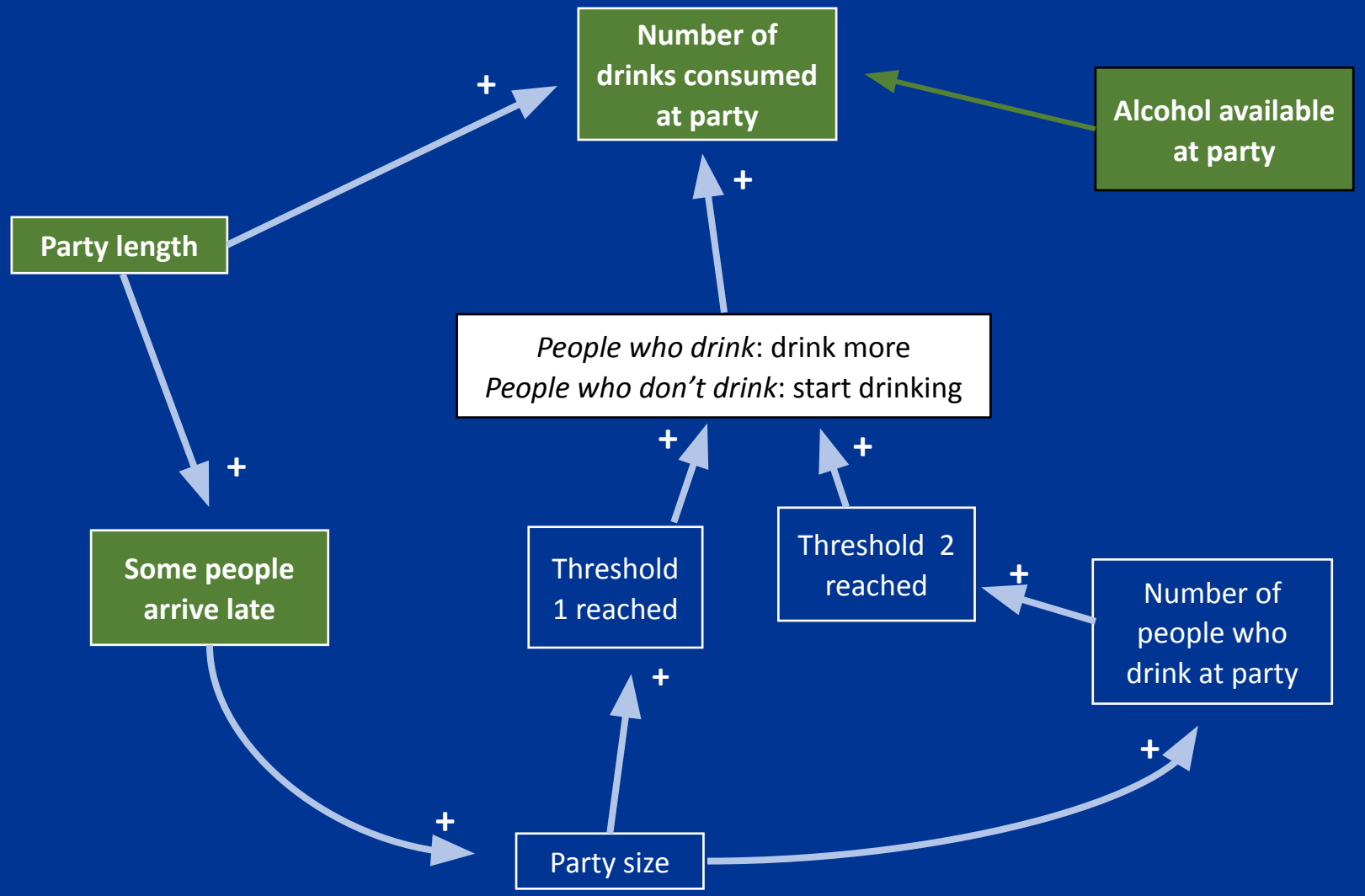
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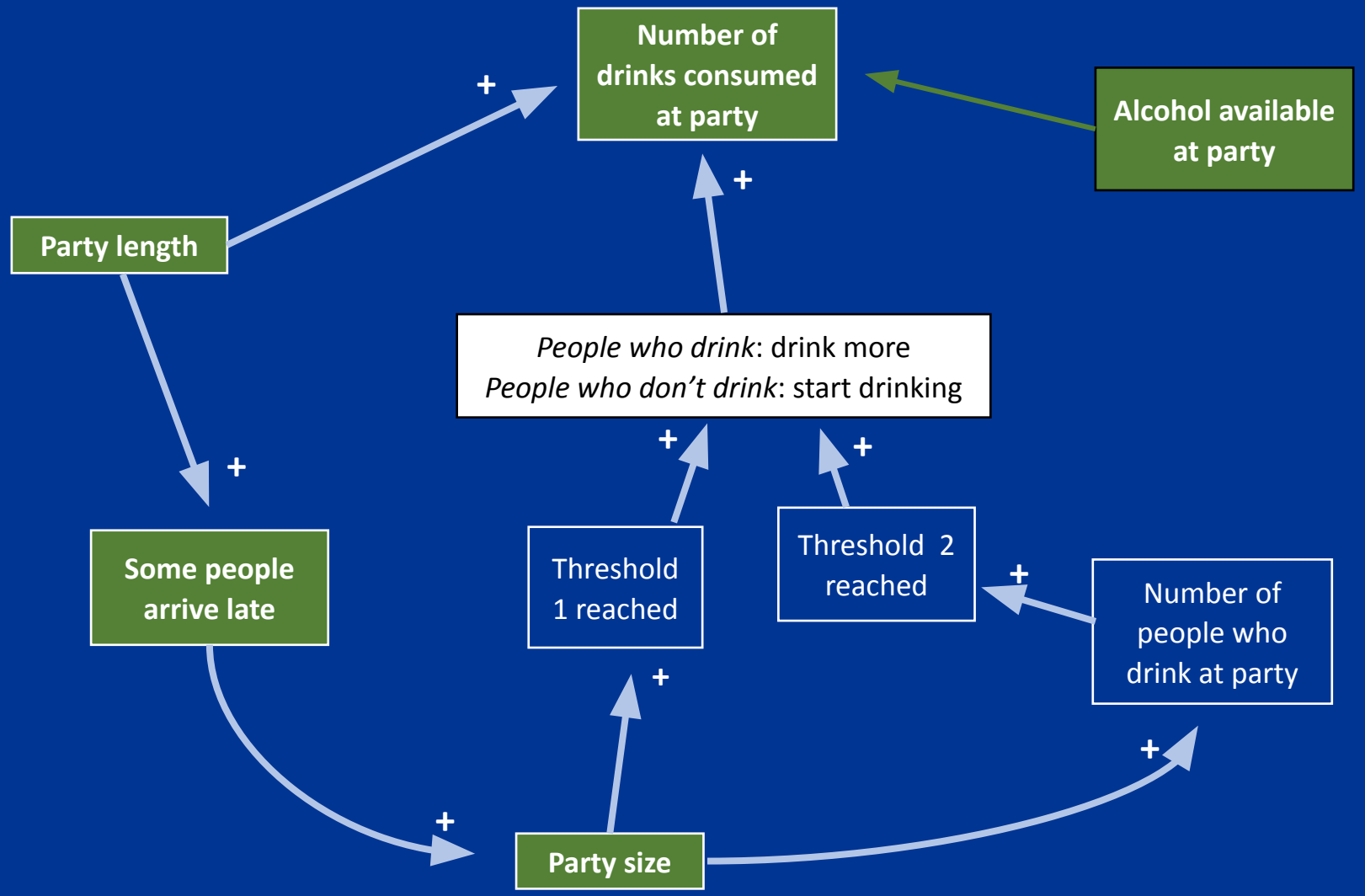
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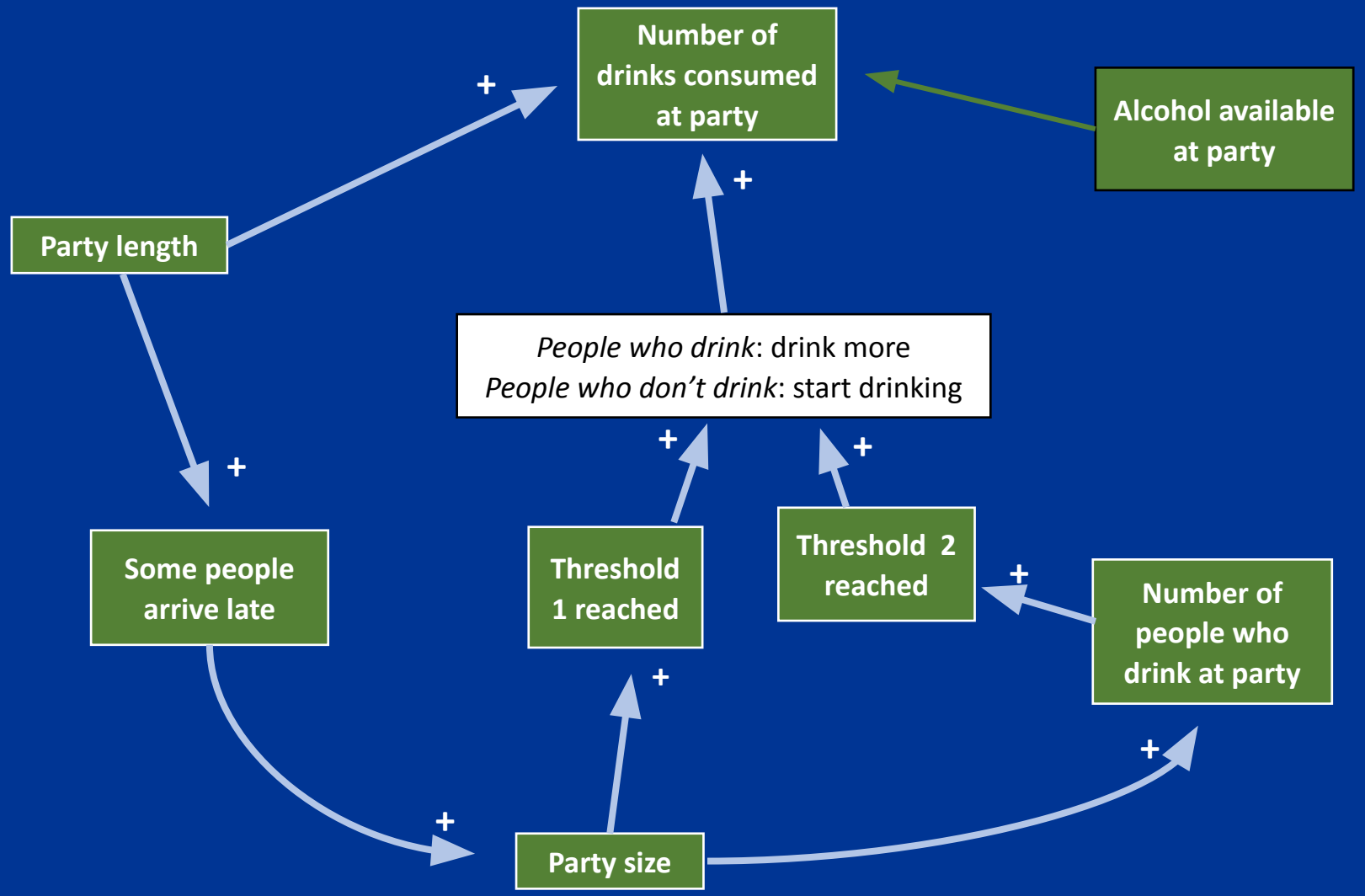
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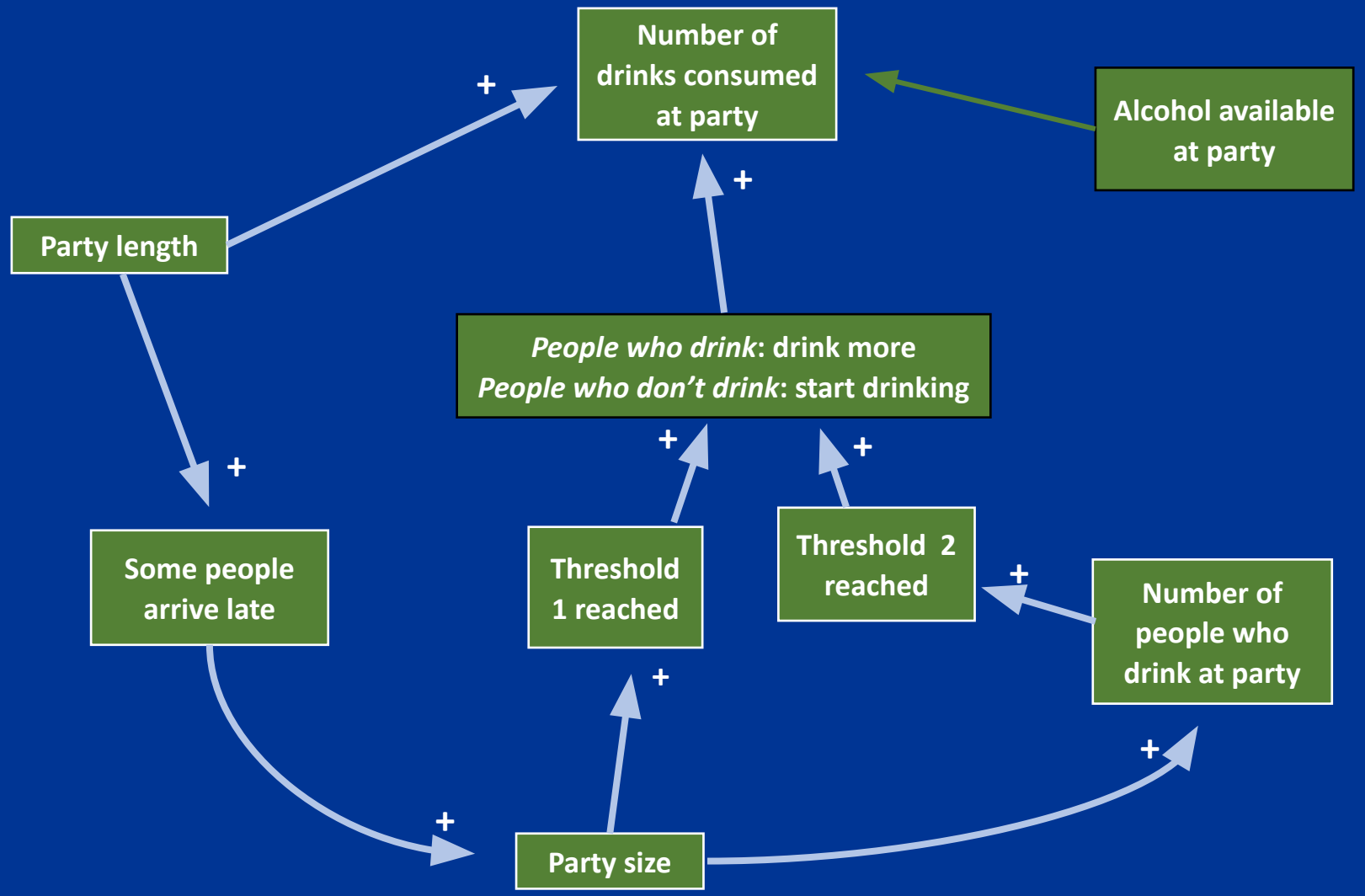
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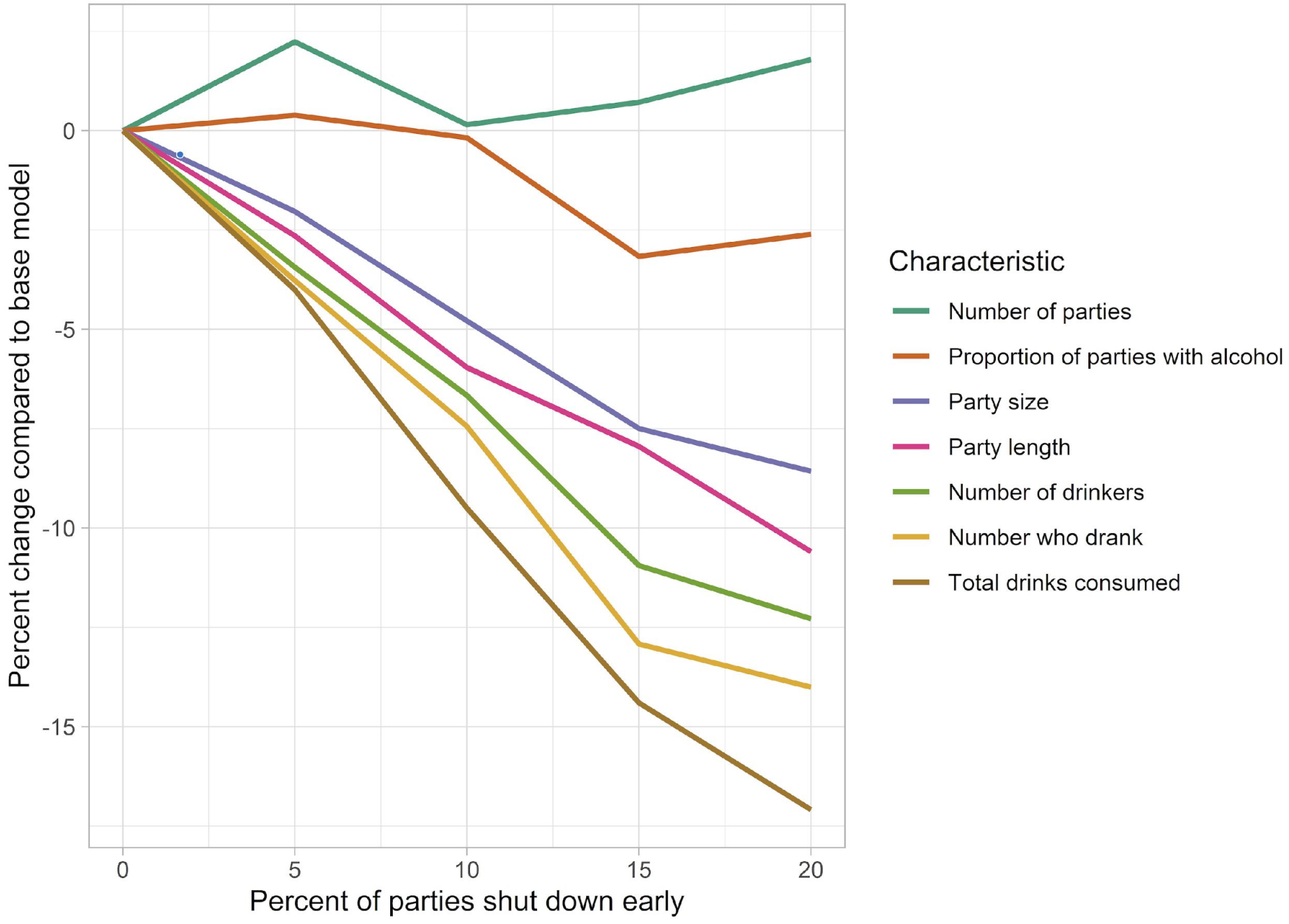
Results, by Intervention Intensity



Next Steps: Other Implementation Strategies

- By neighborhood/geographic area
- By “party history” (prior large parties)
- Permanent “shut down” of specific hosts

Next Steps: Other Intervention Points

- Enforcement strategies (social host laws)
- Just-in-time messaging to affect adolescent choices
- Information dissemination to reduce alcohol at parties (smaller % of parties with alcohol access)
- Alcohol availability: Reduced alcohol at a party (upper limits of consumption), smaller % of parties with any alcohol access
- Parents not allowing kids to attend once invited to a party

Conclusions

- Differential implementation led to varying (reduced) levels of overall alcohol consumption, heavy episodic drinking, and drinking initiation at parties, not all linear decreases
- Illustrates usefulness of ABMs to understanding mechanisms, comparing intervention strategies and implementation

Thanks!

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Party Model: Details

- Select all agents 15-18 in Contra Costa county CA, define as drinkers and non-drinkers (%s based on prior survey data)
- Specific agents selected as “hosts”. Hosts have the ability to host a party or not at the start of a week. If the host decides to host a party, which is set to happen on Saturday night, they send out invitations through a friendship network, through their neighborhood, and through friends of friends.
- Networks designed using Add Health data, with friendships both within the same school outside the school (Mean: 4.8 friends in school, 1.5 friends out of school)
- Invited agents can decide to go or decline the invitation. The decision is based upon the size of the party and whether the party attendees’ drinking status is similar to the agent’s drinking status.
- Party attendees can:
  1) Increase their drinking if they’re already people who drink (at that given party and eventually permanently once they increase their drinking enough times) or
  2) Initiate drinking if they’ve never consumed alcohol if the number of drinkers exceeds a specific threshold

Results, by Intervention Intensity

	0% (base; n=8,110)				5% (n=8,291)				10% (n=8,122)				15% (n=8,168)				20% (n=8,255)			
Party-level characteristic	mean	SD	min	max	mean	SD	min	max	mean	SD	min	max	mean	SD	min	max	mean	SD	min	max
Total drinks consumed	18.19	34.21	0	224	17.46	33.15	0	242	16.46	32.81	0	244	15.57	31.79	0	254	15.08	31.10	0	236
Number of drinkers	6.78	10.20	0	68	6.55	9.83	0	65	6.33	9.72	0	78	6.04	9.40	0	71	5.95	9.31	0	67
Number who drank	5.87	10.64	0	68	5.65	10.24	0	65	5.43	10.13	0	78	5.11	9.79	0	72	5.05	9.71	0	70
Proportion of parties with alcohol	0.41	0.49	0	1	0.41	0.49	0	1	0.41	0.49	0	1	0.40	0.49	0	1	0.40	0.49	0	1
Party size	20.14	21.10	5	126	19.73	20.54	5	132	19.18	20.14	5	145	18.63	19.56	5	125	18.41	19.30	5	133
Party length (hours)	3.02	1.41	1	6	2.94	1.43	1	6	2.84	1.47	1	6	2.78	1.47	1	6	2.70	1.46	1	6
Proportion of drinkers	0.27	0.22	0	1	0.26	0.21	0	1	0.26	0.22	0	1	0.26	0.22	0	1	0.26	0.22	0	1