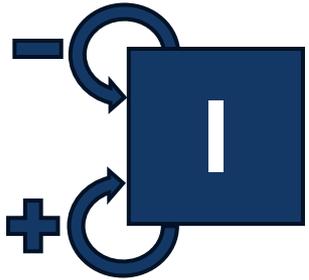


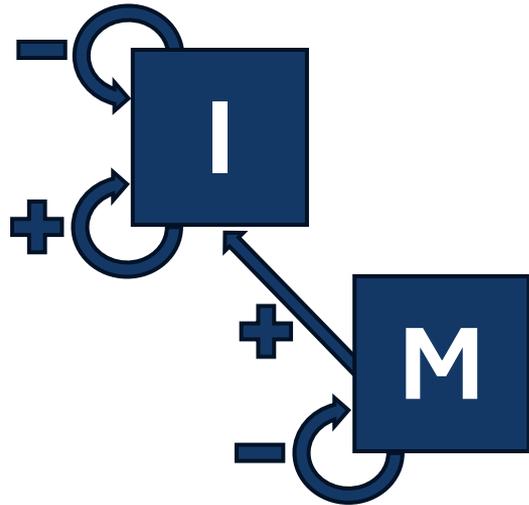
Three-way coupling of water, behavior, and disease in the dynamics of mosquito-borne disease systems



Alex Perkins (taperkins@nd.edu)

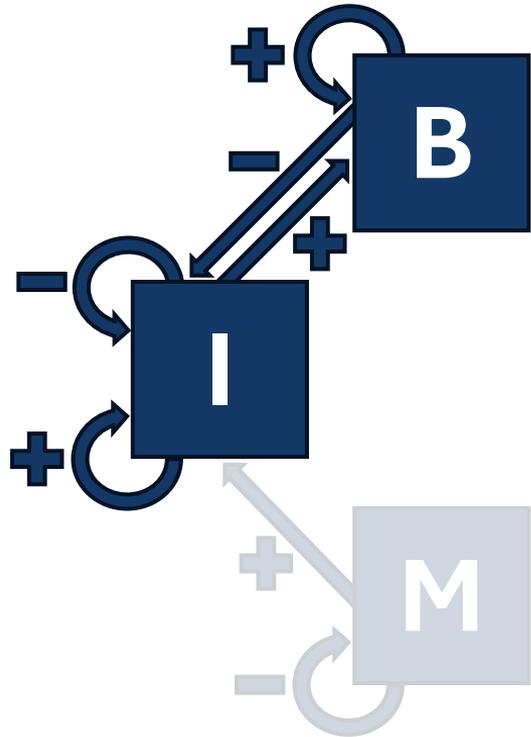


I = Infections



I = Infections

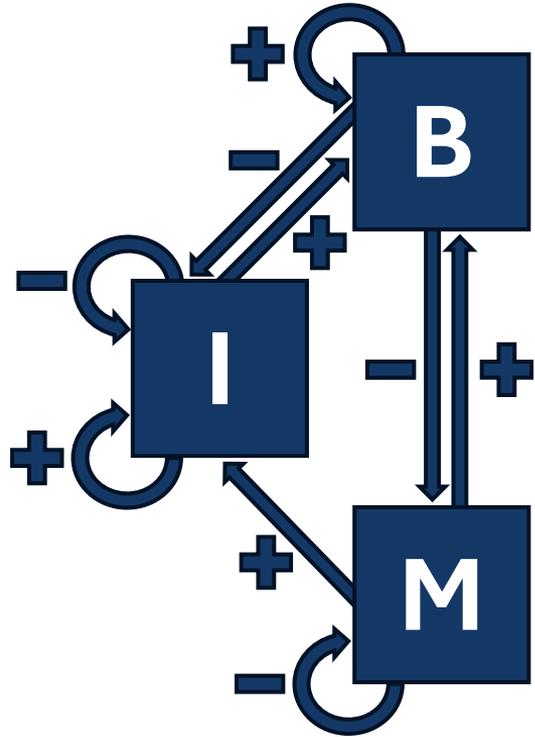
M = Mosquitoes



I = Infections

B = Behavior

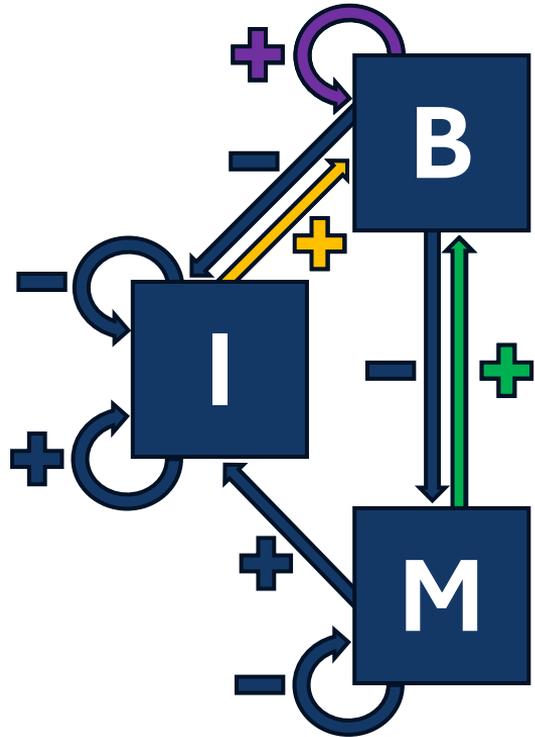
M = Mosquitoes



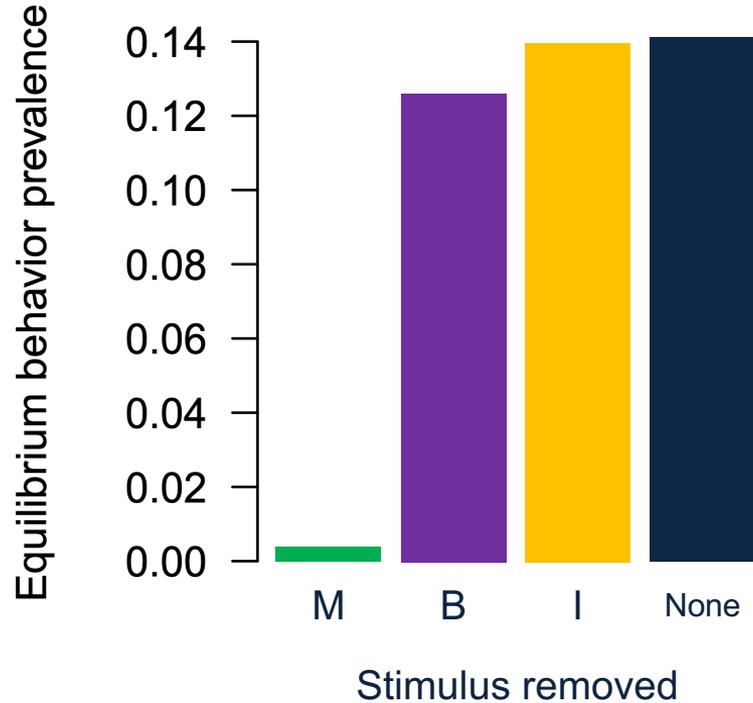
I = Infections

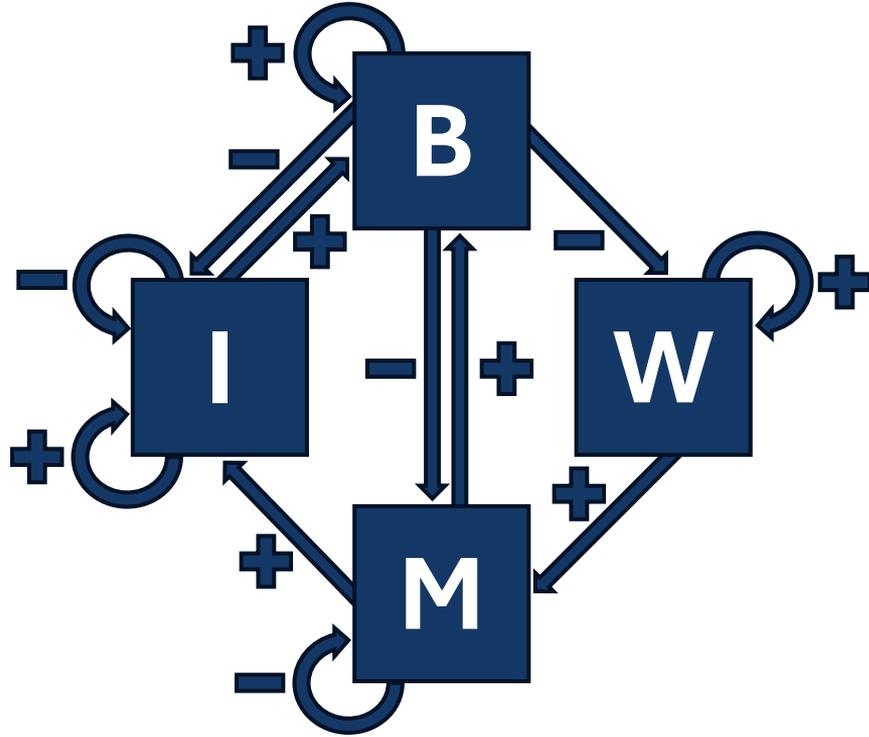
B = Behavior

M = Mosquitoes

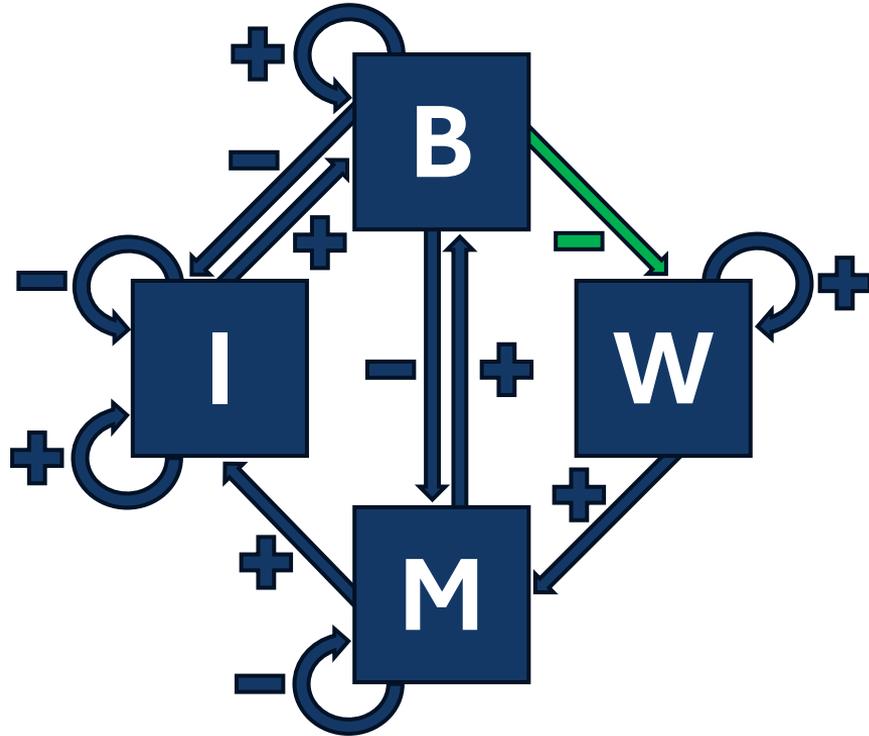


I = Infections B = Behavior
 M = Mosquitoes

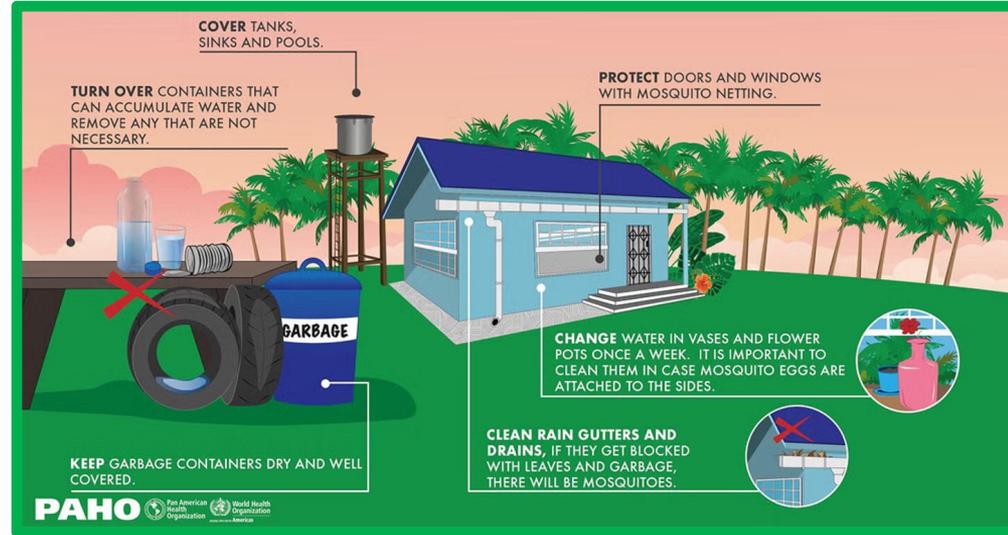


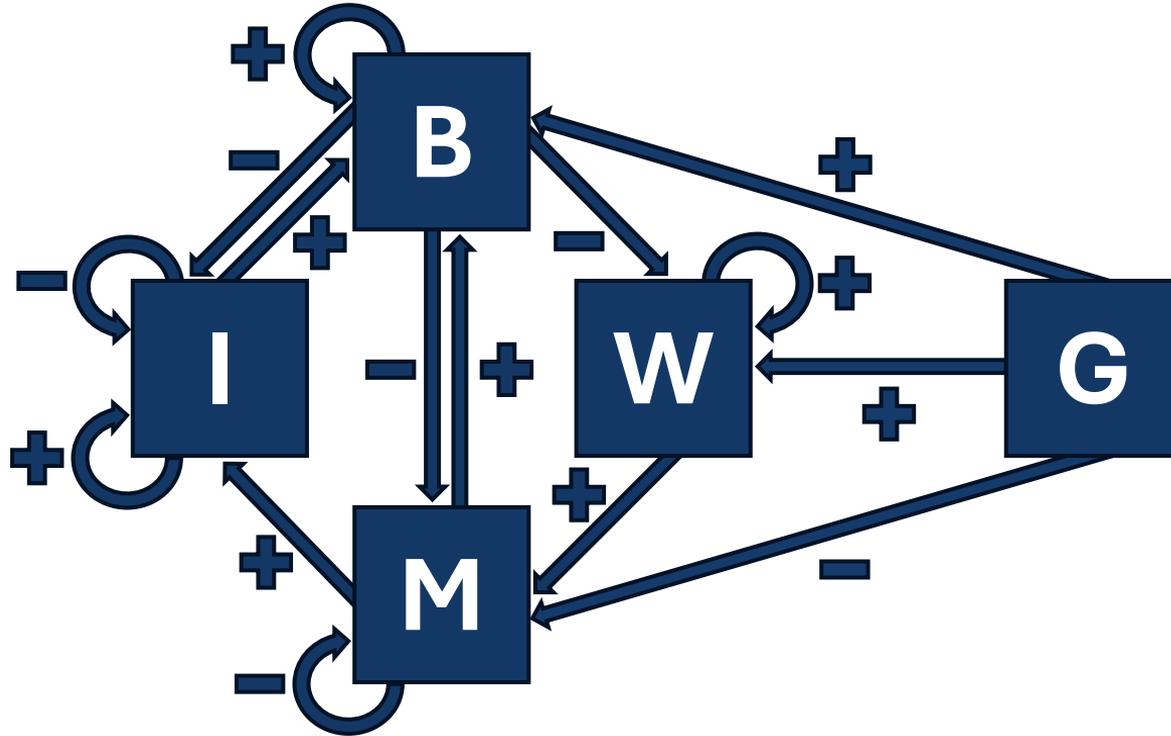


I = Infections B = Behavior
M = Mosquitoes W = Water



I = Infections B = Behavior
 M = Mosquitoes W = Water





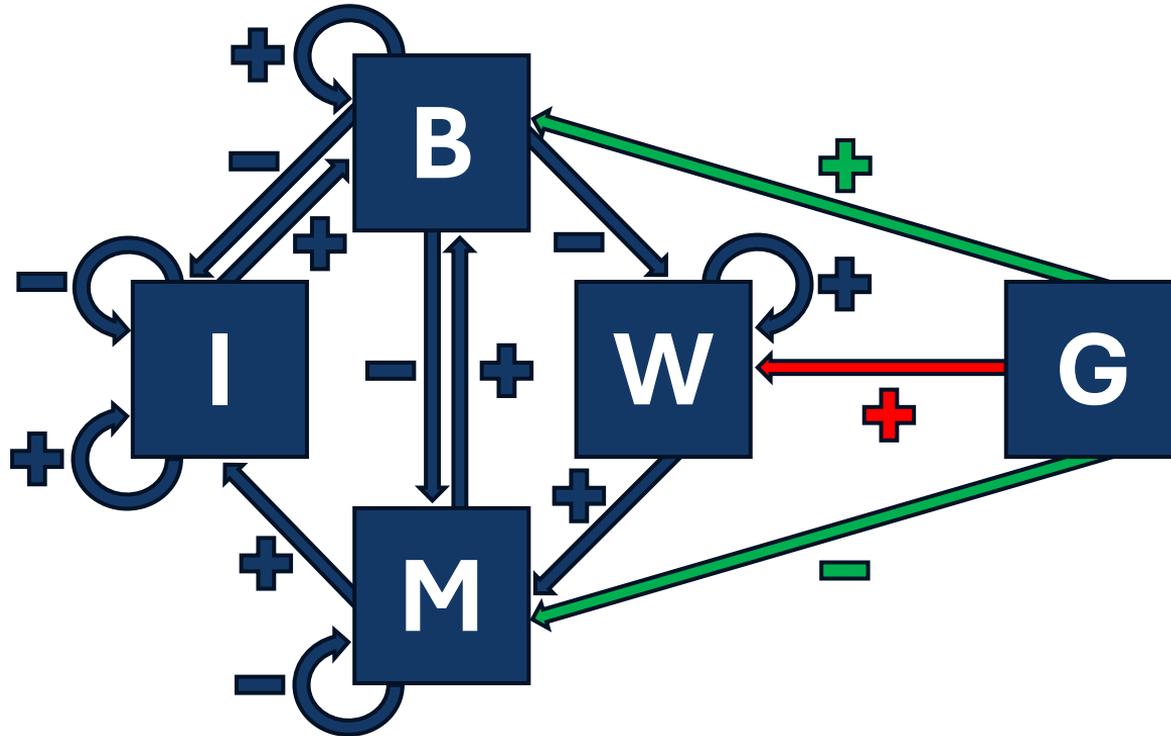
I = Infections

B = Behavior

M = Mosquitoes

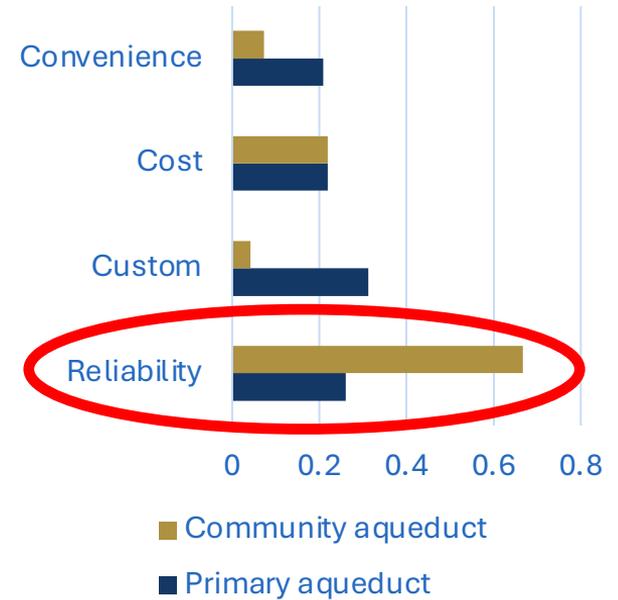
W = Water

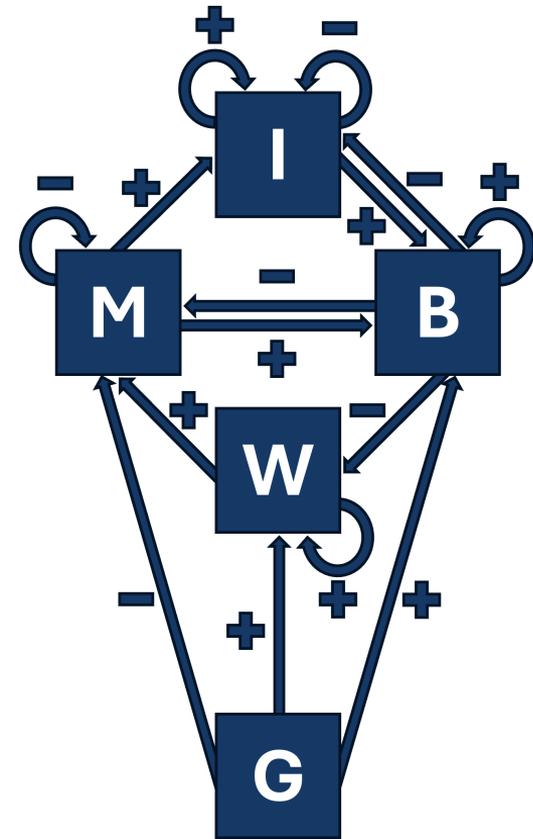
G = Government



I = Infections B = Behavior
 M = Mosquitoes W = Water G = Government

Primary reason for storing water





1. Behavioral responses have the potential to act as a stabilizing force on outbreaks ($\uparrow I \rightarrow \uparrow B \rightarrow \downarrow I$).
2. Successful behaviors could be difficult to maintain ($\uparrow B \rightarrow \downarrow W \rightarrow \downarrow M \rightarrow \downarrow B$).
3. Elimination could be made more difficult by deterioration of behaviors in response to low levels of infection ($\downarrow I \rightarrow \downarrow B \rightarrow \uparrow I$).
4. Failure to address unreliable water services means that more effort is required by governments to control mosquitoes ($G \rightarrow \uparrow W$ requires $G \rightarrow \uparrow M$ and $G \rightarrow \uparrow B$).

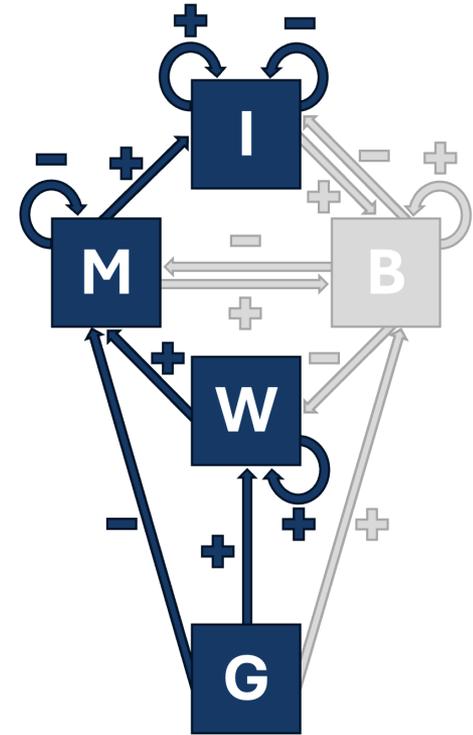
Is behavioral variation dynamic or static?

Dynamic

- B responds to I , B , M , and/or G .
- If this is true empirically, then the aforementioned predictions hold.

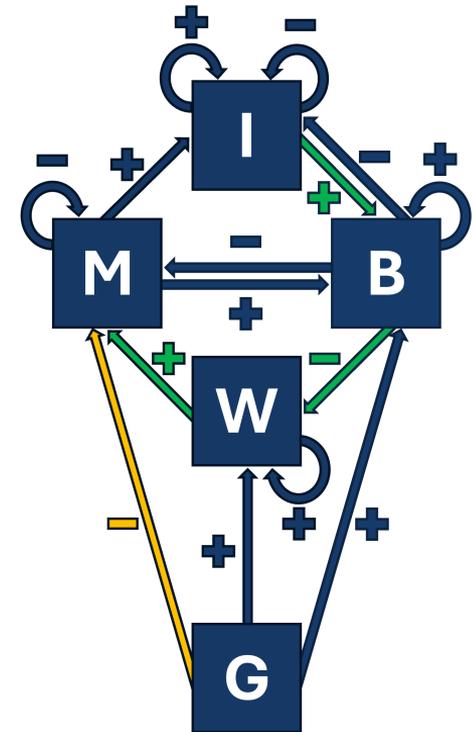
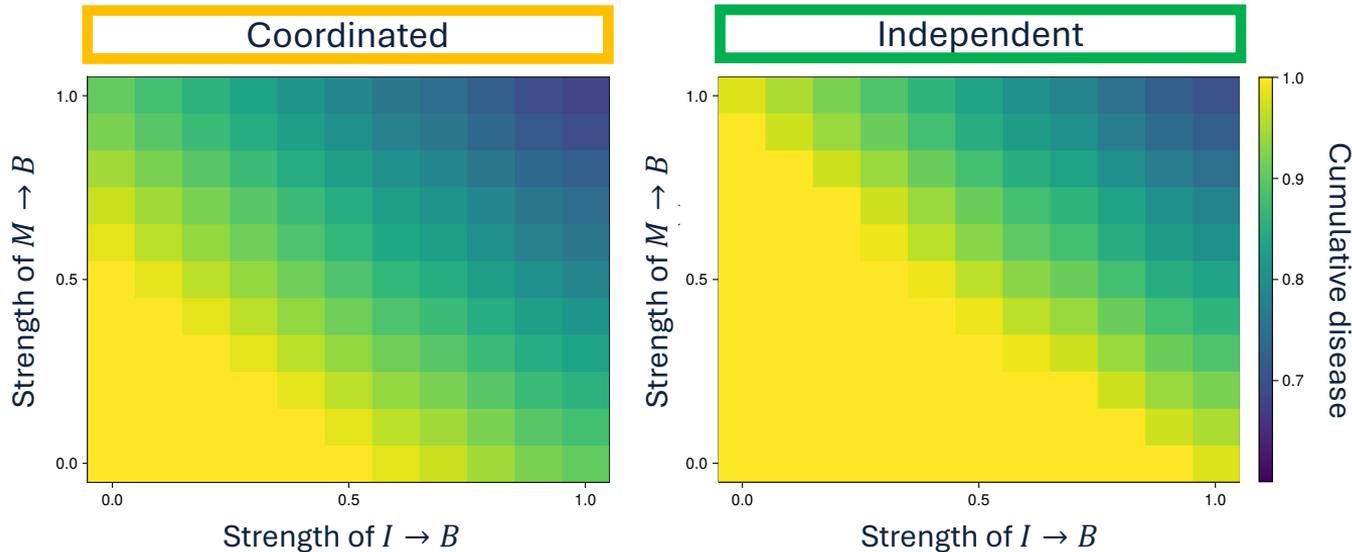
Static

- Individuals differ in B in ways that are not responsive to changes in I , B , M , and/or G .
- If this is the case empirically, then the implications are much different.



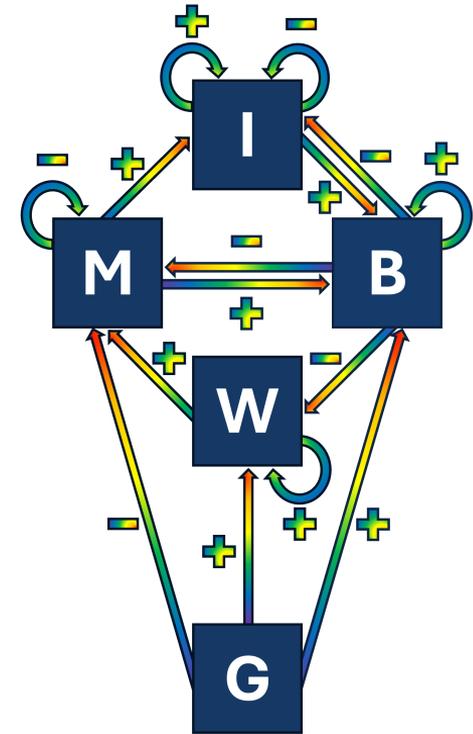
Does coordination matter?

Preliminary simulations suggest that, all else equal, impacts are greater when interventions are coordinated.



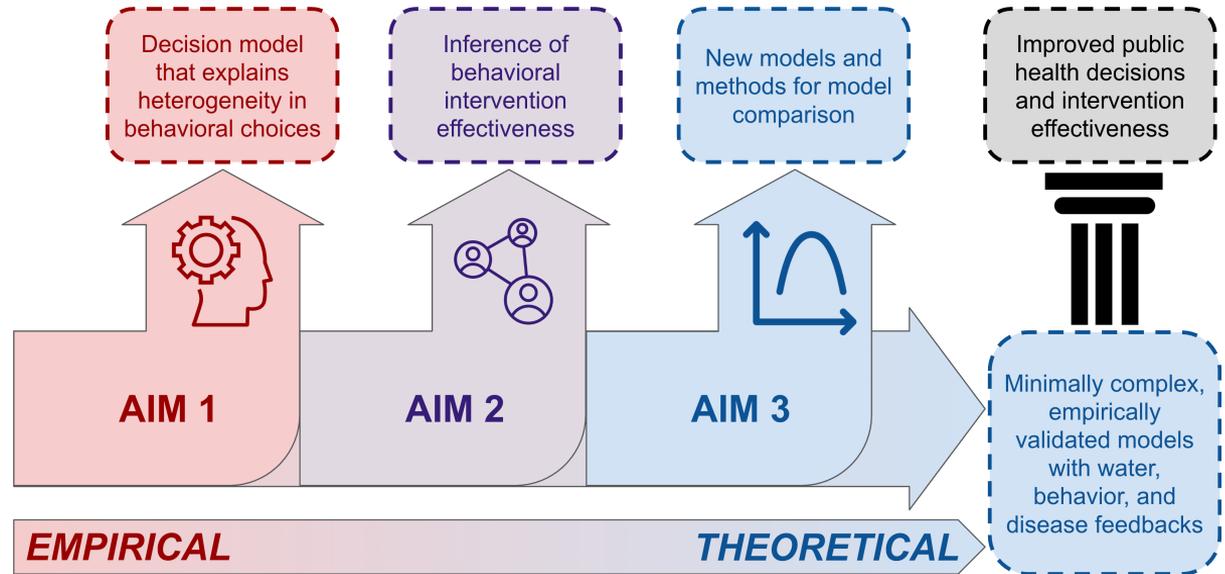
Do communities fundamentally differ?

- Social norms ($B \rightarrow B$)
- Disease awareness ($I \rightarrow B$)
- Water storage practices ($B \rightarrow W$)
- Piped water reliability ($G \rightarrow W$)
- Mosquito ecology ($W \rightarrow M$)
- Mosquito control ($G \rightarrow M$)
- Vector competence ($M \rightarrow I$)
- Government messaging ($G \rightarrow B$)
- Population immunity ($I \rightarrow I$)
- Other variables (e.g., climate)



How much of this complexity do models need to account for?

Ibagué, Colombia



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