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**Communities with Multiple Afflictions:
A System Dynamics Approach
to the Study and Prevention
of Syndemics**

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Abstract

The term syndemic was coined by the medical anthropologist Merrill Singer to describe the mutually reinforcing nature of health-related problems such as substance abuse, violence, and AIDS, that disproportionately impact inner city neighborhoods burdened by economic hardship, deteriorated infrastructure, social disruption, malnutrition, and inadequate health care.

Public health scholars agree that effective responses to the intertwined afflictions within communities throughout the world require comprehensive, system-wide interventions. To strengthen the scientific foundation for such initiatives, the CDC is supporting research on syndemics, including the use of system dynamics modeling to investigate how and why syndemics develop, and to evaluate alternative approaches to intervention for particular community contexts.

At present, a generic (not yet case-specific) model has been developed based on the literature and expert observations. This preliminary model is available as a web-based game at: <http://broadcast.forio.com/sims/syndemic>. We present the model and some results, and outline plans for carrying the work forward.

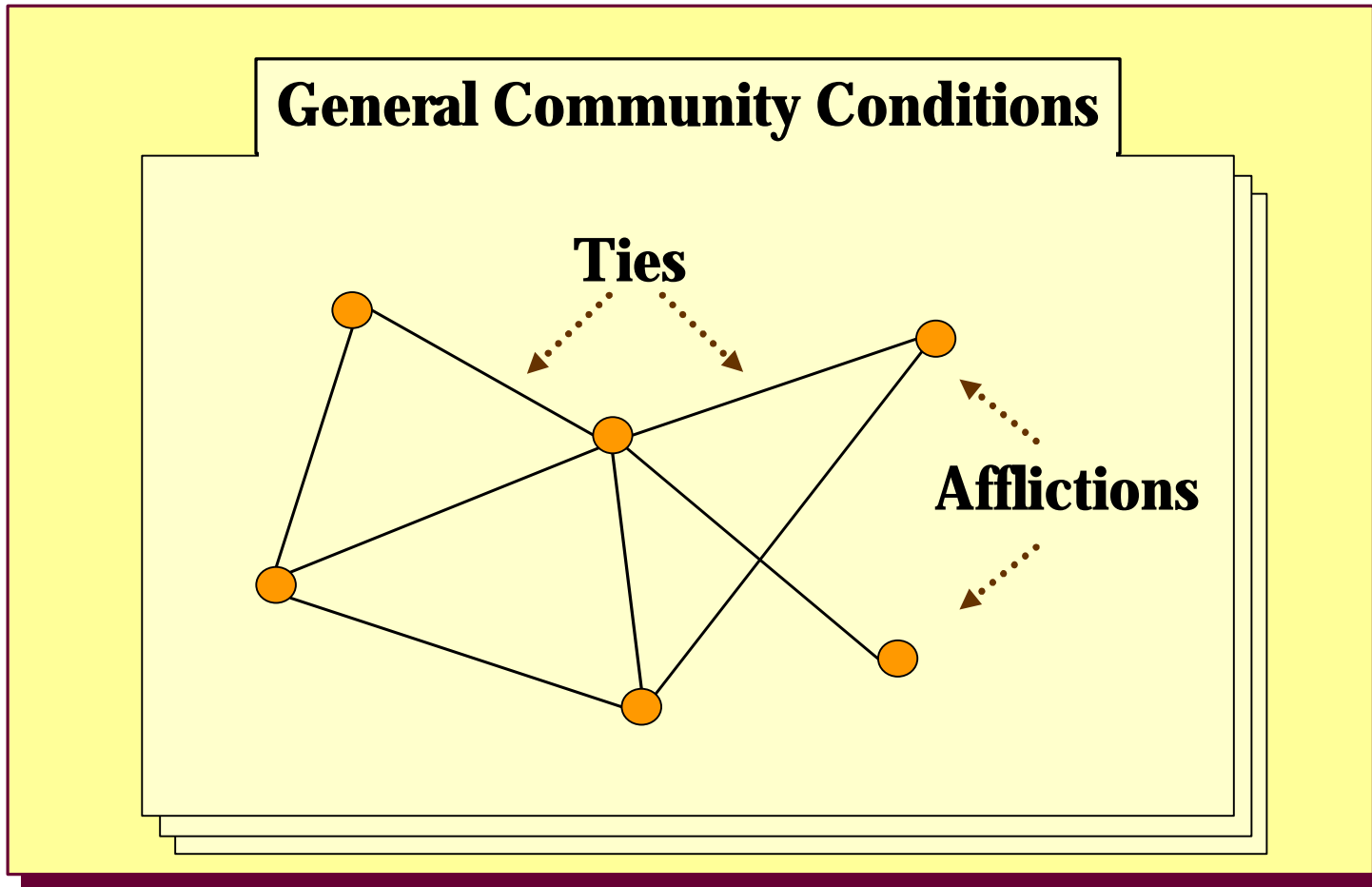
A Syndemic is...

The spread and persistence of mutually reinforcing health-related problems such as substance abuse, violence, and AIDS, typically found in inner city neighborhoods burdened by economic hardship, deteriorated infrastructure, social disruption, malnutrition, and inadequate health care.

Singer M. 1994. AIDS and the health crisis of the US urban poor: The perspective of critical medical anthropology. *Social Science and Medicine* 39(7): 931-948.

Singer M. 1996. A dose of drugs, a touch of violence, a case of AIDS: Conceptualizing the SAVA syndemic. *Free Inquiry in Creative Sociology* 24(2): 99-110.

A Web of Afflictions



Public Health Goals

- Preventing disease and injury
- Prolonging life
- Reducing overall burden of illness
- Avoiding activity limitation
- Maintaining emotional balance
- Eliminating health disparities
- Enhancing life satisfaction

Standard Practice Falls Short

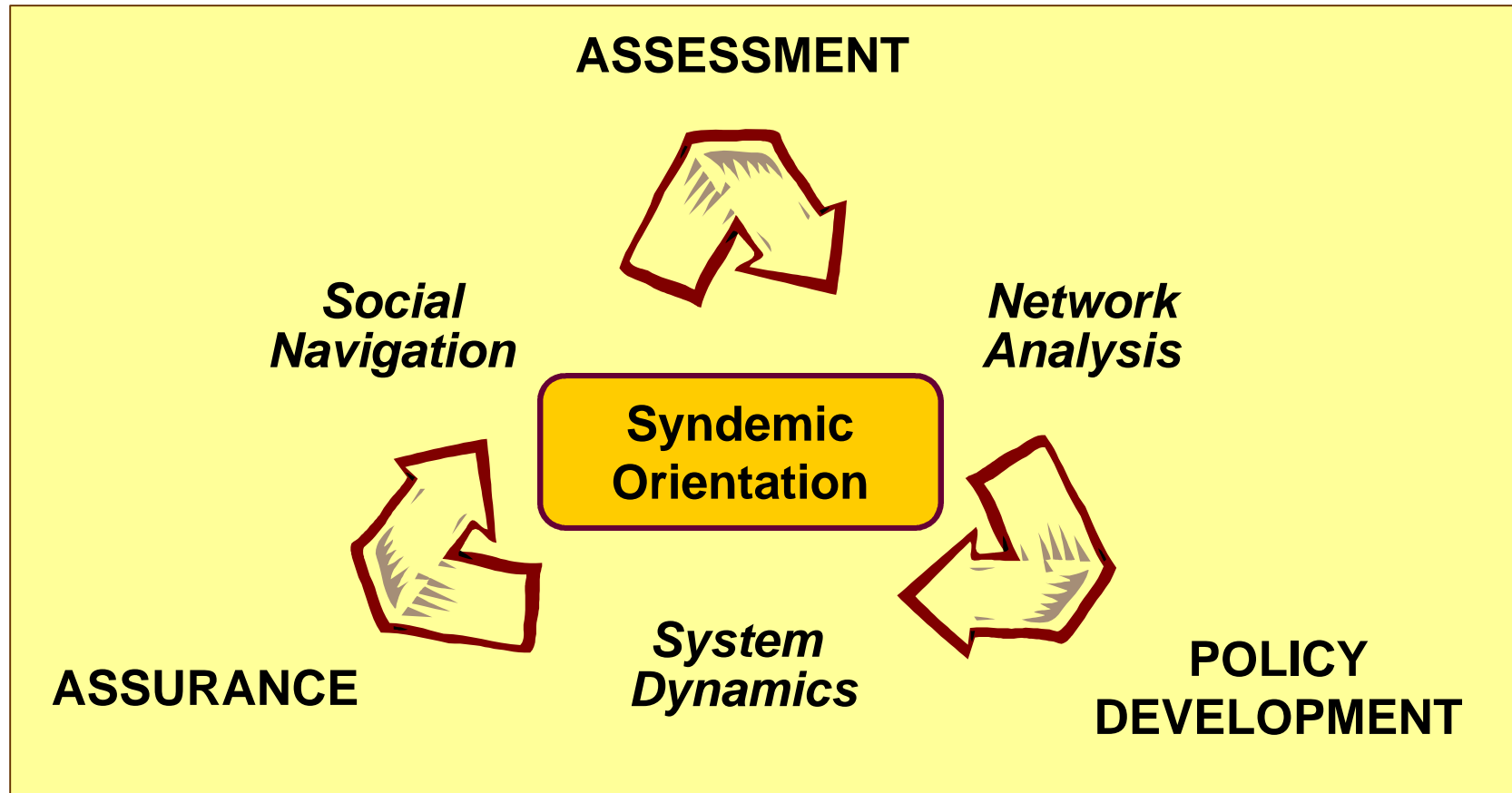
- Public health scholars agree: Effective responses to the health problems of the urban poor and other communities require system-wide interventions.
- However, most public health agencies continue to act as if each affliction can be prevented individually by understanding its unique causes and developing narrowly targeted interventions.
- This compartmentalized approach is engrained in the agencies' financial structures, scientific frameworks, and statistical models.

A Change in Perspective

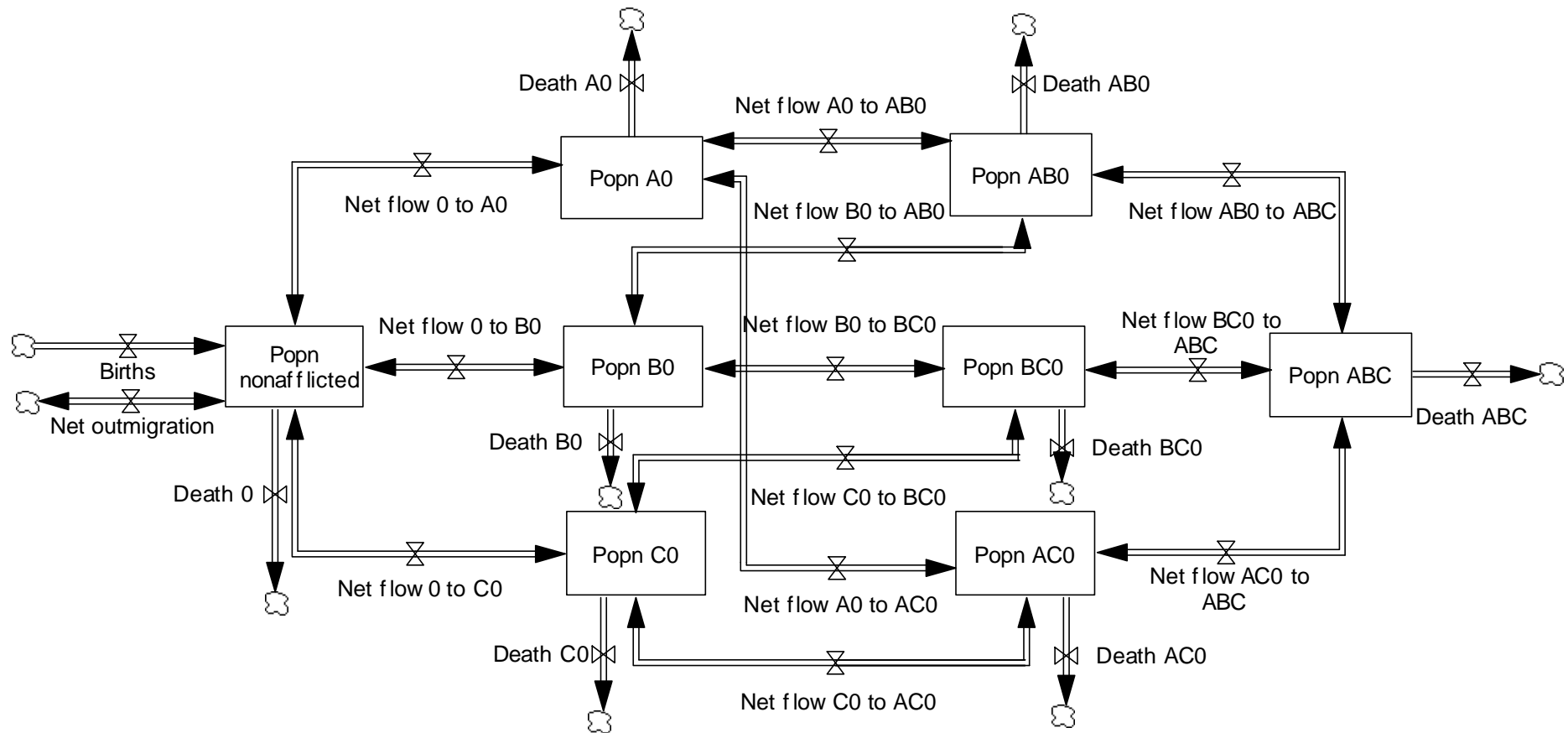
A syndemic public health orientation:

- Places multiple afflictions in context, and identifies systematic links among them
- Assesses the influence of community conditions
- Assesses the capacity of community organizations to direct health and social policy change
- Brings together the sciences of epidemiology and system dynamics with the action agenda of community leaders

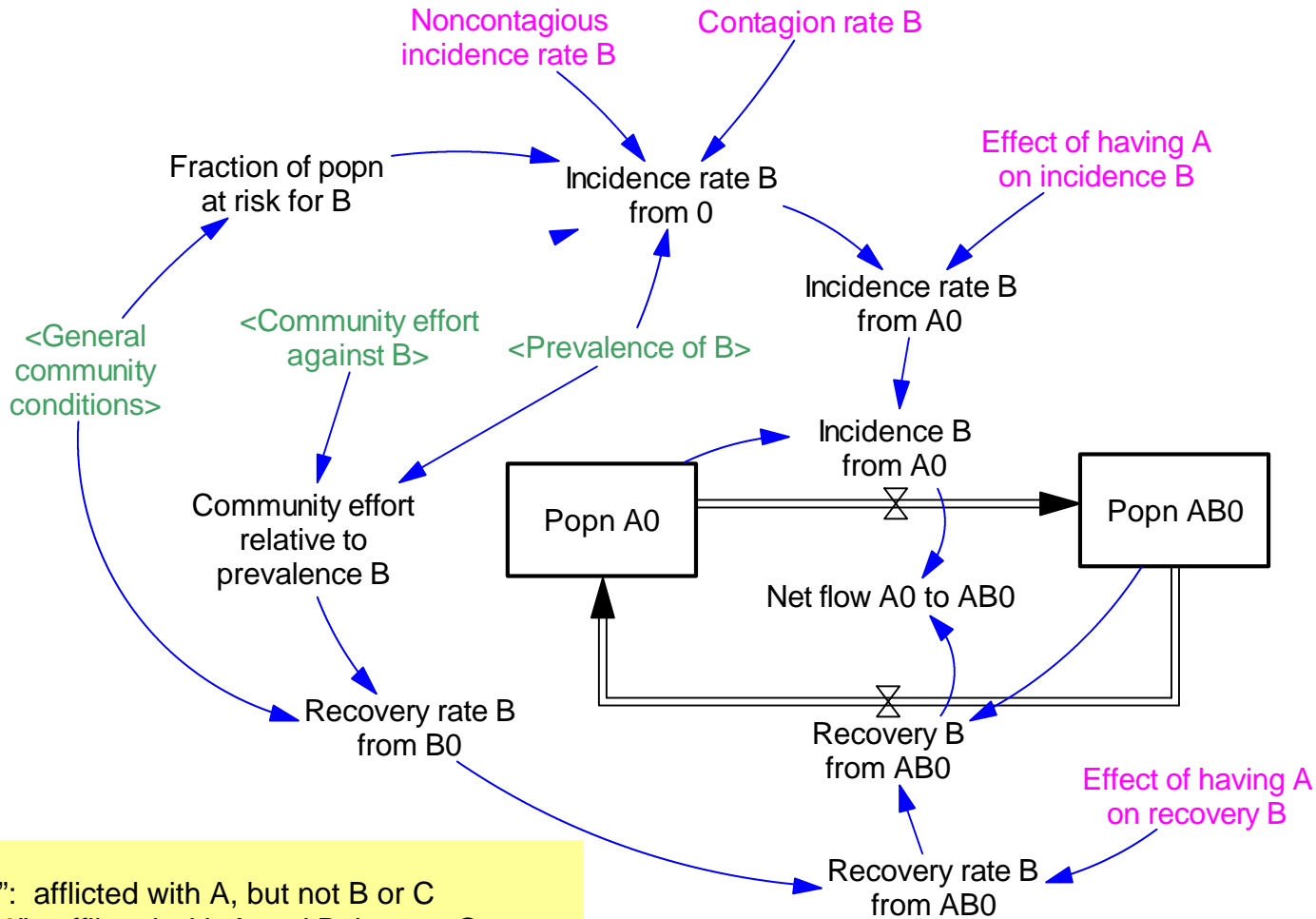
Core Public Health Functions Under a Syndemic Orientation



Population Stocks & Flows: 3 Affliction Types (A, B, C)



Incidence & Recovery Logic



"Popn A0": afflicted with A, but not B or C
 "Popn AB0": afflicted with A and B, but not C
 Magenta text: constant
 <Green text>: variable defined elsewhere in model

Websim Introductory Screen

<http://broadcast.forio.com/sims/syndemic/>

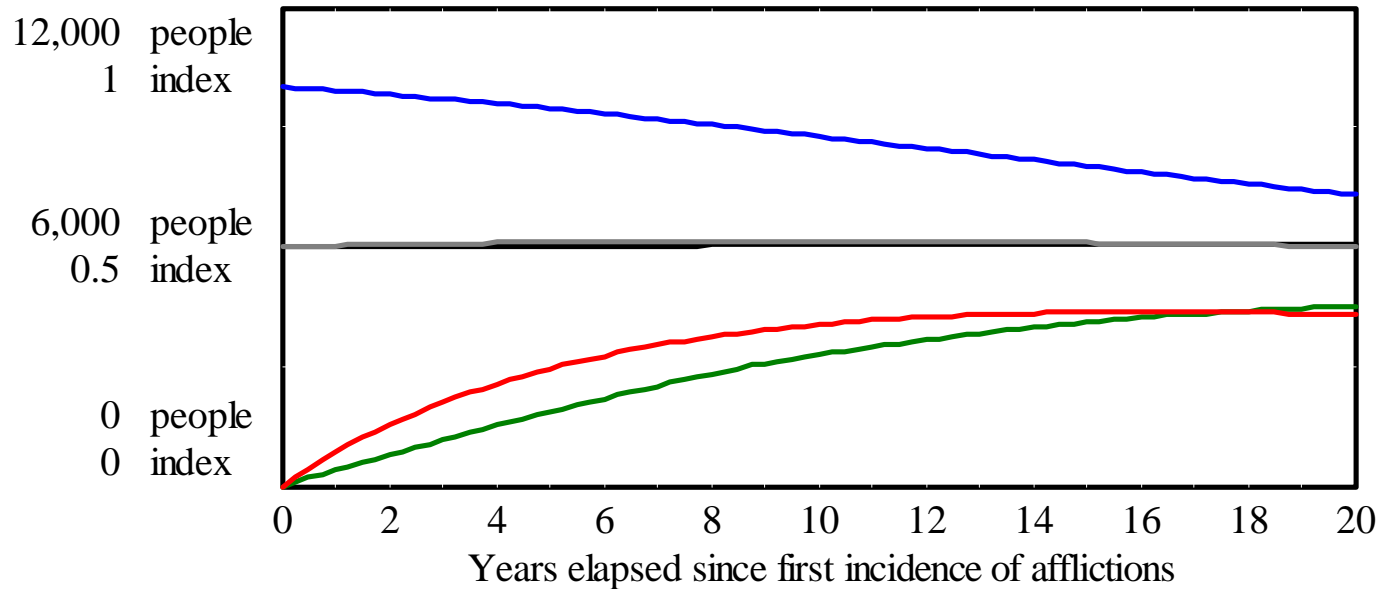
Three mutually compounding afflictions—let's call them A, B, and C—have just been introduced to a community. The general community conditions are only mediocre and not supportive of healthy living, so the threat of a growing "syndemic" is quite real. Your goal is to minimize the community's burden of affliction over a twenty year period.

The community is already making an effort to improve general conditions, but its internal capacity to do so is limited, and more could be done with backing from government and philanthropies. Government agencies and foundations could also step in with programs to help fight the afflictions directly by developing policies and services that reduce rates of incidence and boost rates of recovery. A third type of assistance would be leadership training and organizational development to build up the community's internal capacity for action of all sorts.

The government and philanthropic organizations have sufficient resources to fund all three types of assistance, but only for a limited number of years. You must decide (1) when to initiate each type of assistance, (2) how widely the community will be involved in externally-funded programs, and (3) how heavily each of the affliction types will be weighted in the community's allocation of effort.

A Severe Syndemic

Base conditions=.50, No outside assistance



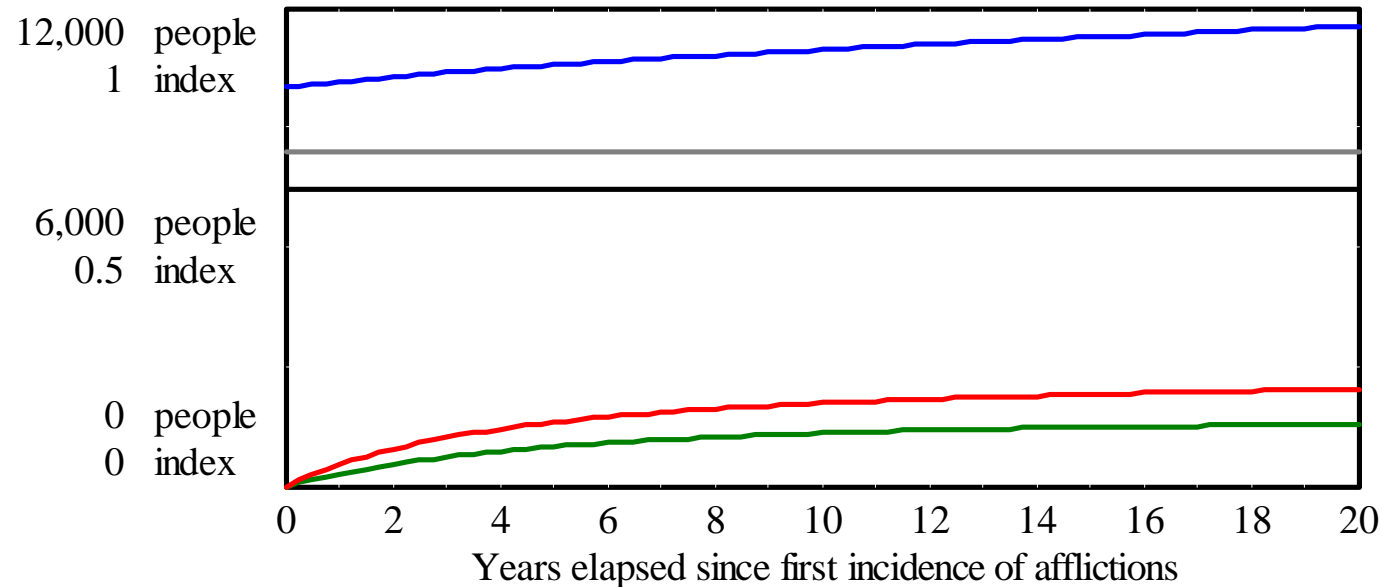
Popn total : Base50 — people
Popn afflicted : Base50 — people
Community effort against affliction : Base50 — index
General community conditions : Base50 — index
Community capacity : Base50 — index

For ease of presentation, in all simulation runs, the three afflictions are assigned identical parameter values for incidence and recovery, incl. both self-contagion and cross-impact.

In this run, after 20 years, 59% of the population have at least one of the three afflictions: 24% with one of them, 18% with two, and 17% with all three.

A Milder Syndemic

Base conditions=.70, No outside assistance



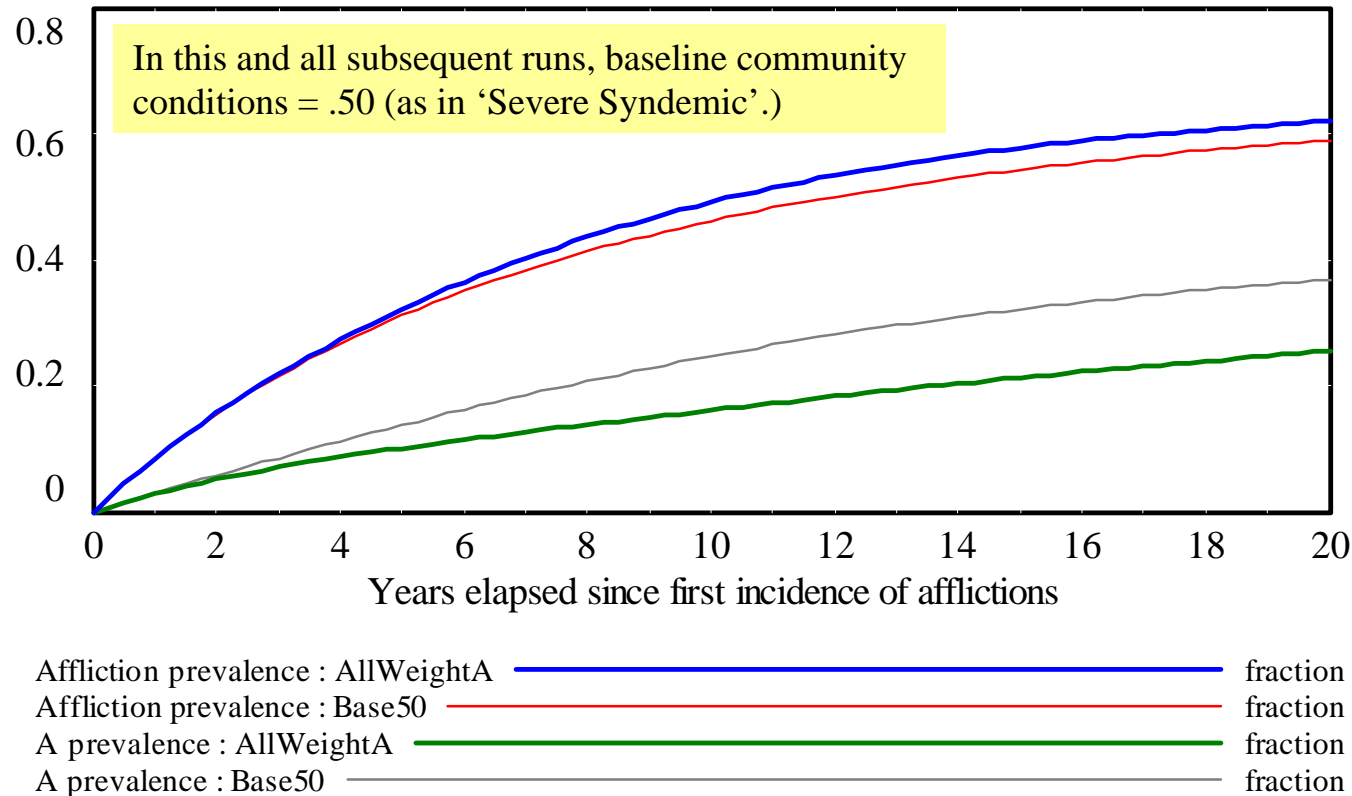
Popn total : Base70 ————— people
 Popn afflicted : Base70 ————— people
 Community effort against affliction : Base70 ————— index
 General community conditions : Base70 ————— index
 Community capacity : Base70 ————— index

In this run, improved general conditions of .70 are sustained by a higher assumed natural rate of community investment.

After 20 years, 21% of the population have at least one of the three afflictions: 16% with one of them, 4% with two, and only 1% with all three.

Focusing on a Single Affliction

All weight on fighting A, No outside assistance

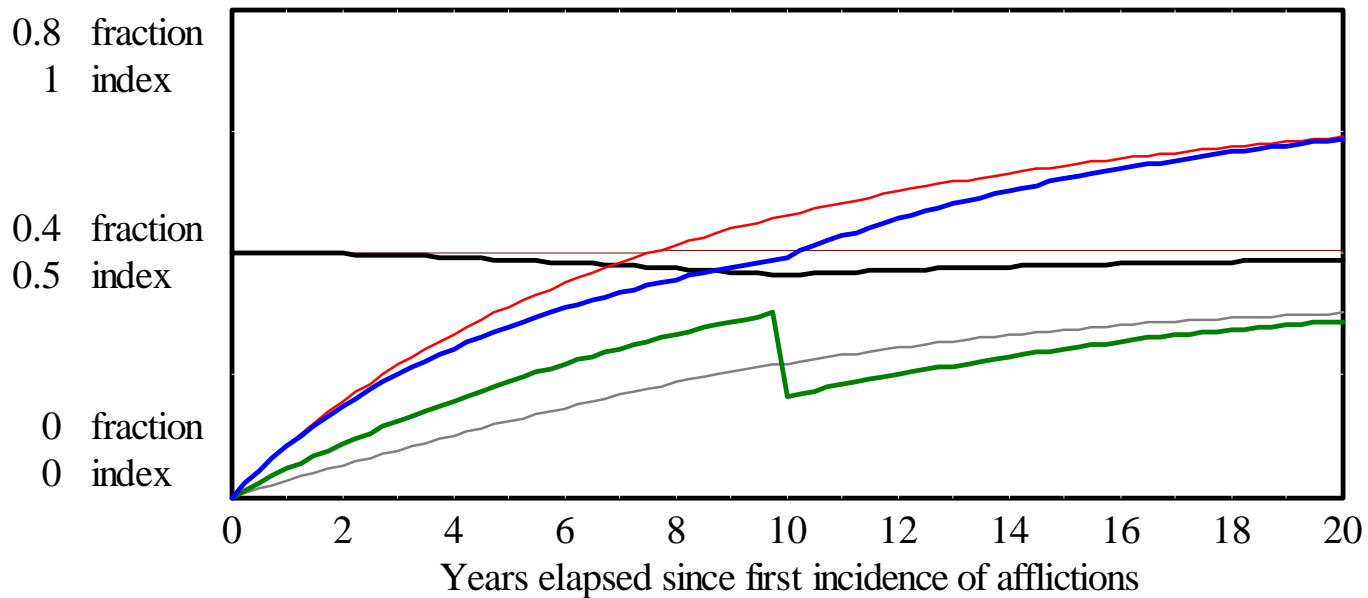


In this run, all community effort (still without any outside assistance) goes to fighting affliction A, in the hope that such focus may prevent the spread of all three mutually reinforcing afflictions. (In the base run, all three afflictions were given equal weight.)

The strategy does not work. It does reduce the prevalence of A, but allows B and C to grow further, resulting in an even greater fraction of people with at least one affliction.

Outside Assistance - Affliction

Assistance to fight affliction for 10 years



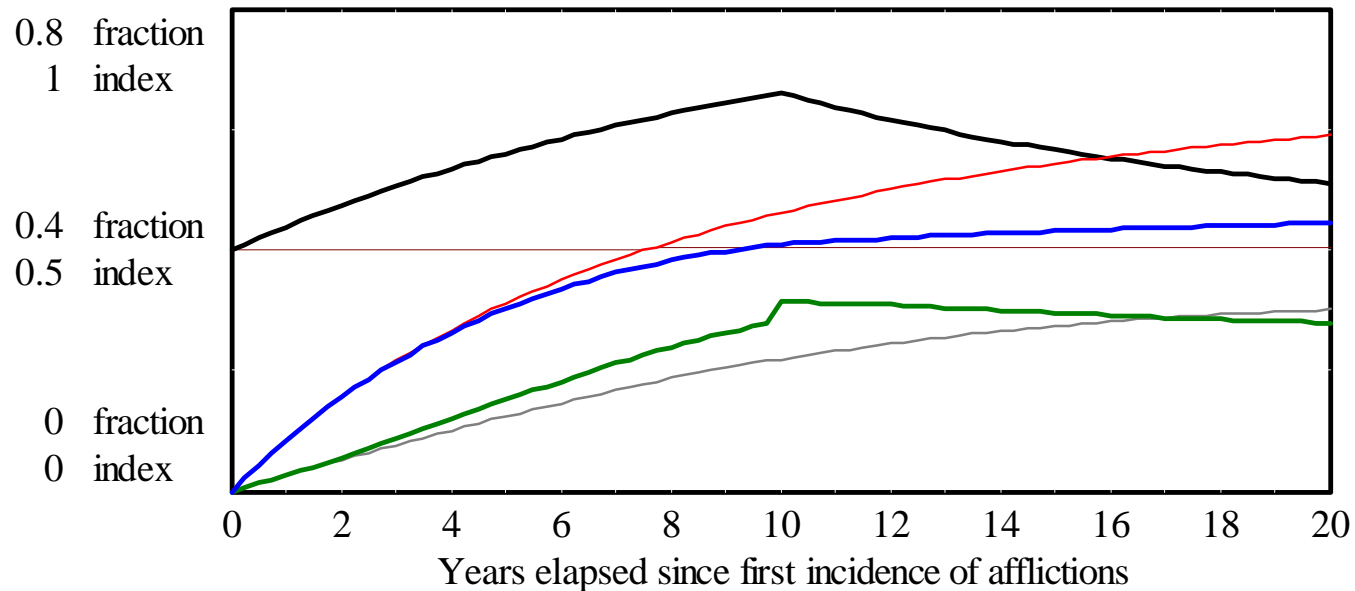
Affliction prevalence : AssistF10 ————— fraction
Affliction prevalence : Base50 ————— fraction
Community effort against affliction : AssistF10 ————— index
Community effort against affliction : Base50 ————— index
Community capacity : AssistF10 ————— index
Community capacity : Base50 ————— index

In this run, outside assistance to fight the afflictions is provided for the first 10 years.

The strategy works to slow the spread of affliction, but only for as long as the assistance is provided. The assistance disrupts the community's normal political balance, thereby hurting its capacity to act unassisted. Ten years after the end of assistance, affliction prevalence is back to where it was in the base run.

Outside Assistance - Capacity

Assistance to build capacity for 10 years



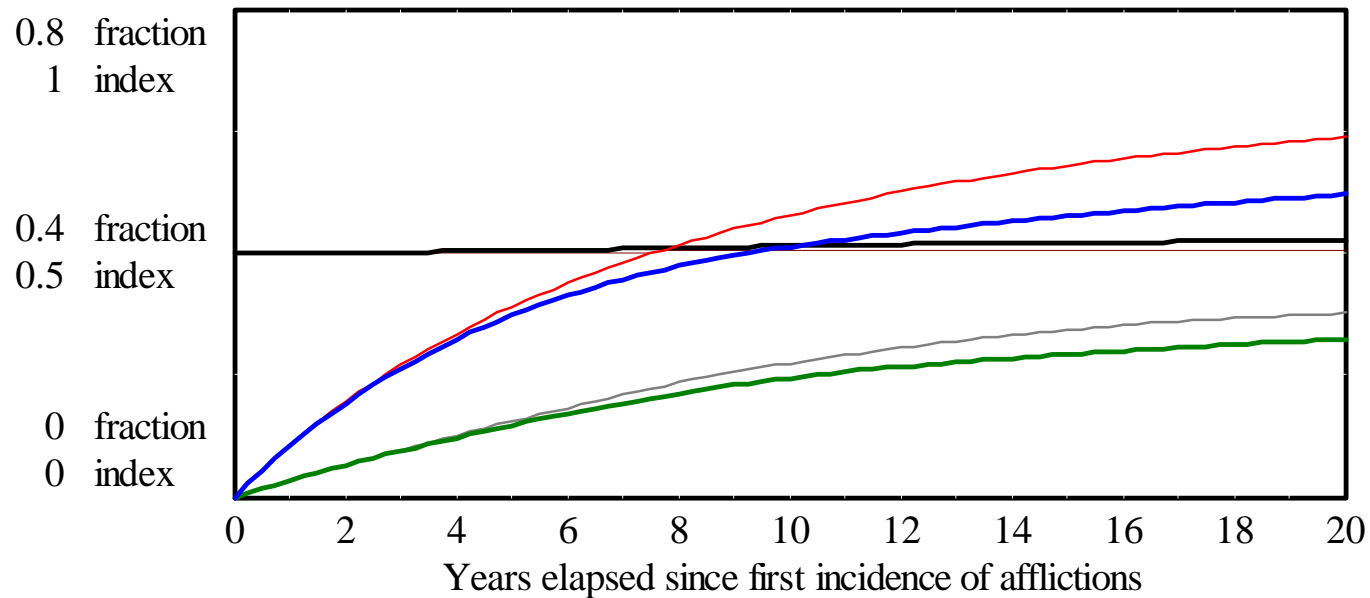
Affliction prevalence : AssistC10 — fraction
 Affliction prevalence : Base50 — fraction
 Community effort against affliction : AssistC10 — index
 Community effort against affliction : Base50 — index
 Community capacity : AssistC10 — index
 Community capacity : Base50 — index

In this run, outside assistance to build community capacity is provided for the first 10 years.

The strategy gradually helps the community to fight affliction more effectively, even after the assistance comes to an end. Greater capacity also leads to better general community conditions, which improve from .50 to .56 by the end of the run.(not shown).

Outside Assistance - Conditions

Assistance to improve general conditions for 10 years



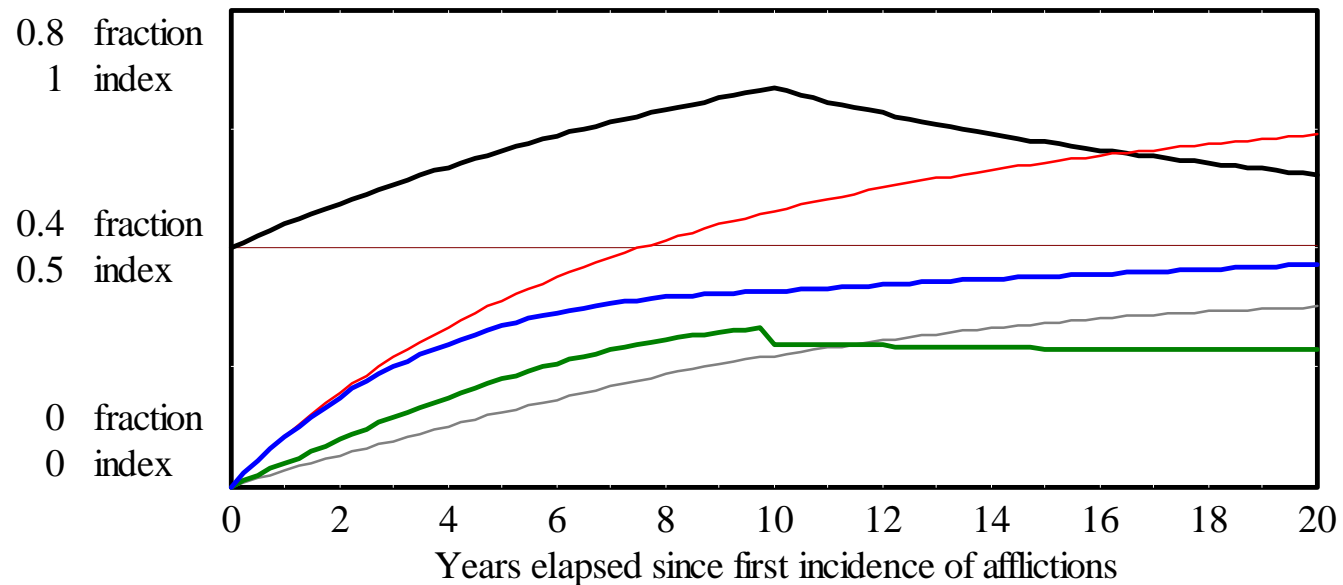
Affliction prevalence : AssistGI1 ————— fraction
Affliction prevalence : Base50 ————— fraction
Community effort against affliction : AssistGI1 ————— index
Community effort against affliction : Base50 ————— index
Community capacity : AssistGI1 ————— index
Community capacity : Base50 ————— index

In this run, outside assistance to improve community conditions is provided for the first 10 years. It is implemented in a way that is inclusive and does not disrupt the community's political balance. This avoids undermining capacity, but somewhat diminishes the direct effectiveness of the assistance.

The strategy gradually helps the community to fight affliction somewhat more effectively, even after the assistance comes to an end. General conditions improve from .50 to .54 by the end of the run (not shown).

Outside Assistance - Combined

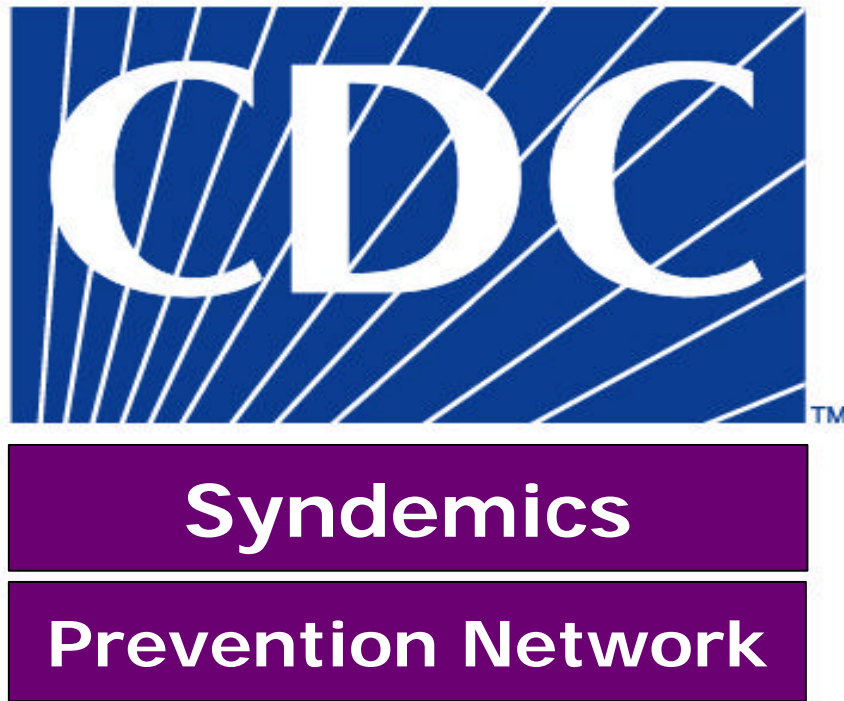
Combined (non-disruptive) assistance for 10 years



Affliction prevalence : AssistCGFI1 — fraction
Affliction prevalence : Base50 — fraction
Community effort against affliction : AssistCGFI1 — index
Community effort against affliction : Base50 — index
Community capacity : AssistCGFI1 — index
Community capacity : Base50 — index

In this run, assistance is provided for the first 10 years to (1) build capacity, (2) fight affliction, and (3) improve general conditions. #2 and #3 are implemented in a way that does not disrupt the community's political balance. This avoids undermining #1, but somewhat diminishes the direct effectiveness of #2 and #3.

This strategy is the best available, given the community's poor initial conditions and the temporary nature of the assistance. General community conditions improve from .50 to .59 by the end of the run (not shown).



<http://www.cdc.gov/syndemics>

[Web-based simulator & model background:](http://broadcast.forio.com/sims/syndemic/)

<http://broadcast.forio.com/sims/syndemic/>

Syndemics Prevention Network: U.S. Members 2001-2

