HIV Care Continuum System Dynamics Model: Variables, Definitions and Calibrations

TABLE 7: PEER ADVOCACY TO SUPPORT PLWH

(green: parameters that can be modified by users) (blue: dynamic formula) (purple: dynamic effect exported to other module[s])				
Variable Name	**Variable Type**	**Unit**	**Initial Parameter Values and Formulas**	**Variable Definition/Specification and Sources of Initial Parameters and Stock Values**
Initiation of the Peer Advocacy to Support PLWH Community Action Strategy				
Peer Advocacy OFF ON	auxiliary	dmnl	0	This is a mechanism used in the model to turn "On" (1) and "Off" (0) each of the community Action Strategies independently. Because community level programs like this one are not available or in place in all communities, this switch allows model users to select whether or not to engage this Action Strategy during model simulations.
Peer Advocacy Program 6 month kickoff	auxiliary	dmnl	IF (TIME > 6) THEN Peer Advocacy ON OFF ELSE 0	This is a mechanism to initiate the "On" condition (variable set to 1) at Month 6 of simulation runs, to allow a period of base case simulation prior to initiating the Action Strategy. The default of the Action Strategy is "Off" (set to 0).
Peer Advocacy Program Resources				
Annual peer advocate program budget	auxiliary	Dollars	50000	Stakeholder-proposed[a] budget allocated to training peer advocates.
Annual cost per peer advocate for training and support	auxiliary	Dollars	250	Stakeholder-estimated[a] per peer advocate cost of training and certification.
MAX number of active peer advocates	auxiliary	Persons	Annual peer advocate program budget / Annual cost per peer advocate for training and support	Community capacity to generate peer advocates based on available funding (total and per advocate costs).
Active peer advocate gap	auxiliary	Persons	MAX number of active peer advocates - Potential peer advocates	Gap between potentially available peer advocates (maximum possible, based on funding, who are in training, trained, or activated) and peer advocates actually activated.
Programming for Peer Advocacy Engagement				
Prop Engaged PLWH willing to do peer advocacy	auxiliary	dmnl	.2	Stakeholder-estimated[a] proportion of PLWH who are engaged in HIV medical care (defined as having seen a medical provider and reported a CD4 and VL count to the Dept. of Public Health within the prior 12 month reporting period) who are willing to provide peer advocacy (a.k.a., peer navigation, peer support) to other PLWH.
Time to recruit peer advocates	auxiliary	Month	6	Stakeholder-estimated[a] time needed to recruit peer advocate candidates.
Peer advocate recruitment rate	flow	Persons/ Month	Peer Advocacy Program 6 month kickoff * MIN(HIV INFECTION AND TREATMENT AS PREVENTION.PLWH ENGAGED in HIV MEDICAL CARE * Prop Engaged PLWH willing to do peer advocacy - Potential peer advocates, Active peer advocate gap) / Time to recruit peer advocates {UNIFLOW}	Monthly rate at which PLWH who are engaged in HIV medical care are recruited into training programs to become peer advocates. The number of PLWH who are engaged in care is being imported from the "HIV Infection and Treatment as Prevention" module.

Variable Name	Variable Type	Unit	Initial Parameter Values and Formulas	Variable Definition/Specification and Sources of Initial Parameters and Stock Values
Peer Advocates in Training	stock	Persons	Peer Advocates in Training(t - dt) + (Peer advocate recruitment rate - Peer advocate training rate - Trainee drop out rate) * dt {NON-NEGATIVE} **Initial value** = 0	Number of PLWH over time who are in training to become peer advocates.
Prop of recruits who drop out	auxiliary	dmnl	.25	Stakeholder-estimated[a] proportion of PLWH in training to become peer advocates who drop out of training before completing the program and being certified.
Trainee drop out rate	flow	Persons/ Month	(Peer Advocates in Training * Prop of recruits who drop out) / Time to train new peer advocates {UNIFLOW}	Monthly rate at which PLWH drop out of training programs to become certified as peer advocates/navigators.
Time to train new peer advocates	auxiliary	Month	6	Stakeholder-estimated[a] time needed to train and certify new PLWH as peer advocates/navigators.
Peer advocate training rate	flow	Persons/ Month	(Peer Advocates in Training * (1 - Prop of recruits who drop out)) / Time to train new peer advocates {UNIFLOW}	Monthly rate at which PLWH complete their training and certification program to become peer advocates.
Peer Advocates Trained and Waiting to be Activated	stock	Persons	Peer Advocates Trained and Waiting to be Activated(t - dt) + (Peer advocate training rate - Peer advocate activation rate - Trained Peer Advocates dropping out of Advocacy) * dt {NON-NEGATIVE} **Initial value** = 0	Number of PLWH over time who are trained and certified as peer advocates who are waiting to be called up to assist other PLWH. This calling up of trained peer advocates is referred to as "activation" of the peer advocate. Activation requires a mechanism to link trained peer advocates to other PLWH who need their support and assistance.
Trained Peer Advocates dropping out of Advocacy	flow	Persons/ Month	(Peer Advocates Trained and Waiting to be Activated * (1 - Prop of peer advocates activated)) / Time to activate peer advocates {UNIFLOW}	Monthly rate at which trained and certified peer advocates drop out of waiting to be called up to do peer advocacy.
Time to activate peer advocates	auxiliary	Month	6	Stakeholder-estimated[a] time needed to activate, or call up, trained and certified peer advocates after certification.
Prop of peer advocates activated	auxiliary	dmnl	Effect of Peer Advocate Call Up Programming on prop of peer advocates activated	This proportion is being generated by the "Effect of call up programming" variable on the proportion of trained peer advocates that get called up. (See Effect variables below.)
Peer advocate activation rate	flow	Persons/ Month	(Peer Advocates Trained and Waiting to be Activated * Prop of peer advocates activated) / Time to activate peer advocates {UNIFLOW}	Monthly rate at which trained, certified and waiting peer advocates get called up to provide peer advocacy (a.k.a. peer navigation, peer support) services to other PLWH.
Active Peer Advocates	stock	Persons	Active Peer Advocates(t - dt) + (Peer advocate activation rate - Peer advocates becoming inactive) * dt {NON-NEGATIVE} **Initial value** = 0	Number of PLWH over time who are providing peer advocacy (a.k.a. peer navigation, peer support, psychosocial supports) to other PLWH.
Length of time doing peer advocacy	auxiliary	Months	Effect of perceived value of peer advocacy on length of time doing peer advocacy	Simulated length of time trained peer advocates continue to provide peer support services, as affected by community perceived value of peer advocacy on HIV care outcomes. This is the same as the "Effect…" variable described below.
Potential peer advocates	auxiliary	Persons	Active Peer Advocates + (Peer Advocates in Training * (1 - Prop of recruits who drop out) + Peer Advocates Trained and Waiting to be Activated) * Prop of peer advocates activated	Sum of all PLWH who are potential peer advocates (including those in training, those trained and waiting to be activated, and those who are activated) multiplied by the proportion who are already activated. This variable is used to help generate the "Active peer advocate gap" defined above.
Peer advocates becoming inactive	flow	Persons/ Month	Active Peer Advocates / Length of time doing peer advocacy {UNIFLOW}	Monthly rate at which PLWH who are actively providing peer advocacy support stop doing so and become inactive.

Variable Name	Variable Type	Unit	Initial Parameter Values and Formulas	Variable Definition/Specification and Sources of Initial Parameters and Stock Values
Peer Advocacy Activation Programming				
Time to change peer advocate call up programming	Auxiliary	Months	12	Stakeholder-estimated[a] time needed for changes to programs designed to "call up" trained and certified peer advocates to occur. "Call up" programs are designed to link trained peer advocates to other PLWH who need support.
Level of peer advocate call up programming	Auxiliary	Peer advocate call up programming units	20	Scalable variable representing the quality of programming in the community designed to "call up" trained/certified peer advocates, that is, to link them to PLWH who need their support services. This scale is structured to range from 0 to 100.
Change in peer advocate call up programming	flow	Peer advocate call up programming units/ Month	(Effect of Perceived Value of Peer Advocacy on prop of peer leaders activated * (Level of peer advocate call up programming - Peer Advocate Call Up Programming)) / Time to change peer advocate call up programming	Monthly rate at which peer advocate call-up programming, which is designed to link trained/certified peer advocates to other PLWH who need their support, improves or degrades.
Peer Advocate Call Up Programming	stock	Peer advocate call up programming units	Peer Advocate Call Up Programming(t - dt) + (Change in peer advocate call up programming) * dt {NON-NEGATIVE} **Initial value**= 0	Quantity of programming over time that is available in the community designed to call up (link) trained peer advocates to PLWH who need their support. (Type of programming is not defined in this variable.)
Peer Advocacy Implementation and Impacts on PLWH				
Max PLWH per peer advocate	auxiliary	persons	4	Maximum number of PLWH a given peer advocate can retain and provide assistance to at any point in time.
Expected number of PLWH receiving peer advocacy	auxiliary	Persons	Active Peer Advocates * Max PLWH per peer advocate	Number of PLWH who are able to receive peer advocacy based on the available number of trained and active peer advocates in the community.
Prop of New PLWH and becoming lost to care who could benefit from peer advocacy	auxiliary	dmnl	.5	Stakeholder-estimated[a] proportion of newly diagnosed PLWH and those at risk of being lost to HIV medical care who could potentially benefit from the support of a trained peer advocate to enter or stay in medical care.
New PLWH Who could Benefit from Peer Advocacy	flow	Person/ Month	(HIV TESTING AND PREVENTION SERVICES.Total HIV positive tests per month + MEDICAL CARE SERVICES FOR PEOPLE LIVING WITH HIV.Lost to care rate) * Prop of New PLWH and becoming lost to care who could benefit from peer advocacy {UNIFLOW}	Monthly rate at which PLWH become in need of peer advocacy supports. Factors contributing to this variable are being imported from the "HIV Testing and Prevention Services" module (HIV positive tests/month) and the "Medical Care Services for PLWH" module (monthly lost to care rate).
PLWH Requiring Peer advocacy	stock	Persons	PLWH Requiring Peer advocacy(t - dt) + (New PLWH Who could Benefit from Peer Advocacy - Peer Outreach Rate) * dt **Initial value** = HIV INFECTION AND TREATMENT AS PREVENTION.Total DIAGNOSED PLWH * Prop of New PLWH and becoming lost to care who could benefit from peer advocacy	Number of PLWH over time who need peer support services in order to enter or stay in HIV medical care. Part of the formula producing the initial value for this stock (i.e., total number of PLWH) is imported from the "HIV Infection and Treatment as Prevention" module.

Variable Name	Variable Type	Unit	Initial Parameter Values and Formulas	Variable Definition/Specification and Sources of Initial Parameters and Stock Values
Time for peer advocates to reach PLWH	auxiliary	Month	3	Stakeholder-estimated[a] time needed for trained peer advocates to reach and engage PLWH who need support.
Peer Outreach Rate	flow	Person/ Month	Effect of perceived value of peer advocacy on peer outreach * MIN(PLWH Requiring Peer advocacy, Expected number of PLWH receiving peer advocacy - PLWH Receiving Peer Advocacy) / Time for peer advocates to reach PLWH {UNIFLOW}	Monthly rate at which peer advocates reach out to and provide support services to PLWH who need their assistance.
PLWH Receiving Peer Advocacy	stock	Persons	PLWH Receiving Peer Advocacy(t - dt) + (Peer Outreach Rate - Rate of Completing Peer advocacy) * dt {NON-NEGATIVE} __Initial value__ = 1	Number of PLWH over time who receive peer supports from trained peer navigators.
Time for PLWH to become empowered	auxiliary	Month	12	Stakeholder-estimated[a] time it takes for PLWH who are receiving peer supports from a trained peer advocate to become independently able to sustain their own HIV care maintenance.
Rate of Completing Peer advocacy	flow	Person/ Month	PLWH Receiving Peer Advocacy / Time for PLWH to become empowered {UNIFLOW}	Monthly rate at which PLWH who receive support from an active peer advocate stop receiving that support because they no longer need it.
Prop of PLWH who become empowered	auxiliary	dmnl	.5	Stakeholder-estimated[a] proportion of PLWH who, having receive peer advocacy, become empowered to sustain his/her/their own HIV care maintenance.
Empowerment rate	flow	Persons/ Month	(PLWH Receiving Peer Advocacy * Prop of PLWH who become empowered) / Time for PLWH to become empowered	Monthly rate at which PLWH who received peer support from a trained peer advocate become empowered to sustain his/her/their own HIV care maintenance.
PLWH Empowered with Capacity to Meet Personal Needs	stock	Persons	PLWH Empowered with Capacity to Meet Personal Needs(t - dt) + (Empowerment rate) * dt {NON-NEGATIVE} __Initial value__ = 1	Number of PLWH over time who have become empowered to sustain their own HIV care maintenance.
PLWH empowerment ratio	auxiliary	dmnl	PLWH Empowered with Capacity to Meet Personal Needs / PLWH Receiving Peer Advocacy	Ratio of PLWH empowered to sustain their own HIV care maintenance to all PLWH who are receiving peer advocate supports.
Prop of empowered PLWH of Total DIAGNOSED PLWH	auxiliary	dmnl	PLWH Empowered with Capacity to Meet Personal Needs / (HIV INFECTION AND TREATMENT AS PREVENTION.Total DIAGNOSED PLWH * Prop of New PLWH and becoming lost to care who could benefit from peer advocacy)	Model-generated proportion of PLWH empowered to sustain their own HIV care maintenance over PLWH who need peer support in order to get linked to care or prevent becoming lost to care. The total diagnosed PLWH is being imported from the "HIV Infection and Treatment as Prevention" module for this variable.

Variable Name	Variable Type	Unit	Initial Parameter Values and Formulas	Variable Definition/Specification and Sources of Initial Parameters and Stock Values
Peer Advocacy Effects and Community Level Outcomes				
Effect of HIV test and treat morbidity and mortality on perceived value of peer advocacy	auxiliary	Advocacy units	GRAPH(HIV INFECTION AND TREATMENT AS PREVENTION.Proportion of PLWH who are VS among all PLWH) (0.000, 50.0), (0.167, 83.3), (0.333, 92.3), (0.500, 96.6), (0.667, 97.4), (0.833, 99.1), (1.000, 100.0)	This is a graphic function of the effect of HIV viral suppression at the community level (HIV morbidity and mortality) on community perceived value of peer advocacy programs. This relationship follows a non-linear curve that advances quickly and then levels off, with lowest proportion who are virally suppressed (0.000) associated with a midpoint effect of perceived value of peer advocacy (50.0), and highest proportion who are virally suppressed (1.000) associated with the greatest effect of perceived value of peer advocacy (100.0). (Interim points on the curve graph are indicated in the formula and in **Fig. 7.1**.) To calibrate this variable, the proportion of PLWH who are virally suppressed is being imported from the "HIV Infection and Treatment as Prevention" module.
Time to change perceived value of peer advocacy	auxiliary	Month	12	Stakeholder-estimated[a] time it takes for community perception of the value of peer advocacy programs to change.
Effect of empowered PLWH on perceived value of peer advocacy	auxiliary	Advocacy units	GRAPH(Prop of empowered PLWH of Total DIAGNOSED PLWH) (0.000, 0.0), (0.111, 87.9), (0.222, 93.089), (0.333, 95.667), (0.444, 96.556), (0.556, 97.444), (0.667, 98.333), (0.778, 99.0), (0.889, 99.111), (1.000, 100.0)	This is a graphic function of the effect of PLWH becoming empowered to sustain their own health maintenance needs as a result of their participation in peer advocacy programs as this effect changes community level perceived value of peer advocacy programs. This relationship follows a non-linear curve that advances quickly and then levels off, with lowest proportion of empowered PLWH (0.000) associated with the lowest effect of perceived value of peer advocacy (0.0), and the highest proportion of empowered PLWH (1.000) associated with the greatest effect of perceived value of peer advocacy (100.0). (Interim points on the curve graph are indicated in the formula and in **Fig. 7.2**.)
Change in perceived value of peer advocacy	flow	Perceived value units/ Month	(((Effect of HIV test and treat morbidity and mortality on perceived value of peer advocacy + Effect of empowered PLWH on perceived value of peer advocacy) / 2) - Perceived Value of Peer Advocacy) / Time to change perceived value of peer advocacy	Monthly rate of change in community-level perceived value of peer advocacy programs to assist PLWH to enter and stay in care.
Perceived Value of Peer Advocacy	stock	Perceived value units	Perceived Value of Peer Advocacy(t - dt) + (Change in perceived value of peer advocacy) * dt {NON-NEGATIVE} **Initial value** = 0	Cumulative amount of community-level perceived valued of peer advocacy programs.
Effect of Peer Advocate Call Up Programming on prop of peer advocates activated	auxiliary	dmnl	GRAPH(Peer Advocate Call Up Programming) (0.0, 0.000), (100.0, 1.000)	This is a graphic function of the effect of peer advocacy call-up programs on the proportion peer advocates activated. This is a linear relationship, with lowest quality of peer advocacy call-up programming (0.0) associated with the lowest proportion of peer advocates activated (0.0), and highest quality of peer advocacy call-up programming (100.0) associated with the highest proportion of peer advocates activated (1.000). (See **Fig. 7.3**.)

Variable Name	Variable Type	Unit	Initial Parameter Values and Formulas	Variable Definition/Specification and Sources of Initial Parameters and Stock Values
Effect of Perceived Value of Peer Advocacy on prop of peer leaders activated	auxiliary	dmnl	Perceived Value of Peer Advocacy / 100	Used to determine a proportional effect of Value of Peer Advocacy on Level of Peer Call Up Programming.
Effect of perceived value of peer advocacy on length of time doing peer advocacy	auxiliary	Months	GRAPH(Perceived Value of Peer Advocacy) (0.0, 6.0), (100.0, 84.4)	This is a graphic function of the effect of perceived value of peer advocacy at the community level on the length of time peer advocates remain activated. This is a linear relationship, with lowest perceived value of peer advocacy (0.0) associated with a low effect on length of time peer advocates remain activated (0.0), and highest perceived value of peer advocacy (100.0) associated with a high effect on length of time peer advocates remain activated (84.4). (See **Fig. 7.4**.)
Effect of perceived value of peer advocacy on peer outreach	auxiliary	dmnl	GRAPH(Perceived Value of Peer Advocacy) (0.0, 0.000), (25.0, 2.000), (50.0, 4.000), (75.0, 8.000), (100.0, 10.000)	This is a graphic function of the relationship between the effect of perceived value of peer advocacy at the community level and the willingness of trained peer advocates to do peer advocacy. This relationship follows a non-linear S-curve, with lowest perceived value of peer advocacy (0.0) associated with the lowest effect on peer advocates doing advocacy work (0.000), and highest perceived value of peer advocacy (100.0) associated with highest effect on peer advocates being active (2.000). (Interim points on the S-curve graph are indicated in the formula and in **Fig. 7.5**.)
Effect of PLWH empowerment on lost to care rate	auxiliary	dmnl	GRAPH(Prop of empowered PLWH of Total DIAGNOSED PLWH) (0.000, 1.983), (0.0714, 0.958), (0.143, 0.500), (0.214, 0.308), (0.286, 0.233), (0.357, 0.225), (0.429, 0.192), (0.500, 0.150), (0.571, 0.133), (0.649, 0.125), (0.714, 0.117), (0.786, 0.117), (0.857, 0.092), (0.929, 0.050), (1.000, 0.000)	This is a graphic function of the relationship between the effect of PLWH becoming empowered to sustain their own health maintenance needs as a result of having received peer advocacy and the lost to care rate. This relationship follows a non-linear curve that drops quickly and then levels off, with the lowest proportion of empowered PLWH (0.000) associated with the highest effect on the lost to care rate (1.983), and the highest proportion of empowered PLWH (1.000) associated with lowest effect on the lost to care rate (1.000). (Interim points on the curve graph are indicated in the formula and in **Fig. 7.6**.) This variable is exported to the "Medical Care Services" module, "Effect of Action Strategies on Risk of being Lost to Care" variable.

a   Stakeholder-estimated and stakeholder-proposed parameters were set through a deliberative process with a broadly mixed stakeholder community modeling group that represented the spectrum of HIV medical and other care services and PLWH.

1.   CT Department of Public Health. Epidemiological Profile of HIV in Connecticut. 2018.

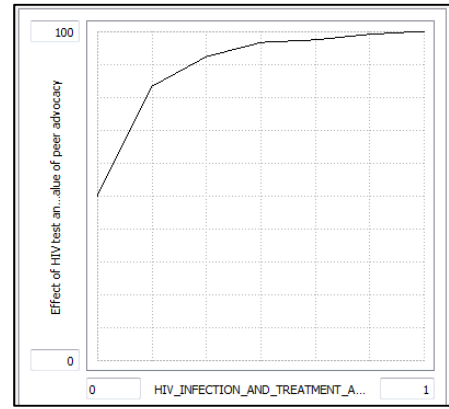Fig. 7.1 Effect of HIV test and treat morbidity and mortality on perceived value of peer advocacy

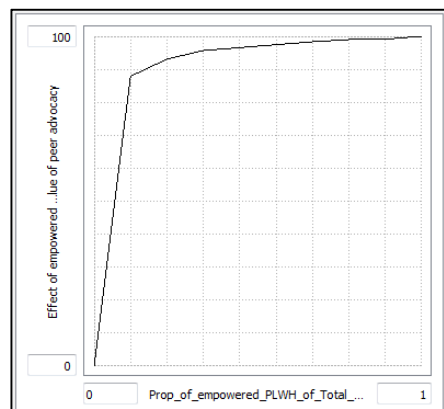Fig. 7.2 Effect of empowered PLWH on perceived value of peer advocacy

Fig 7.3 Effect of Peer Advocate Call Up Programming on prop of peer advocates activated
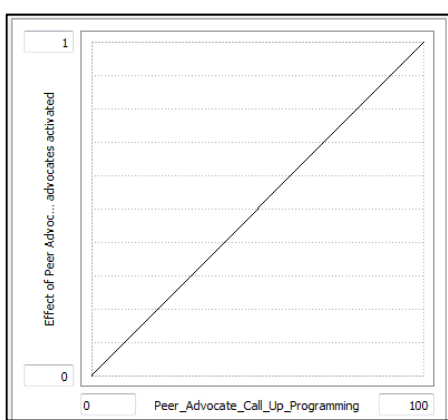

Fig. 7.4 Effect of perceived value of peer advocacy on length of time doing peer advocacy
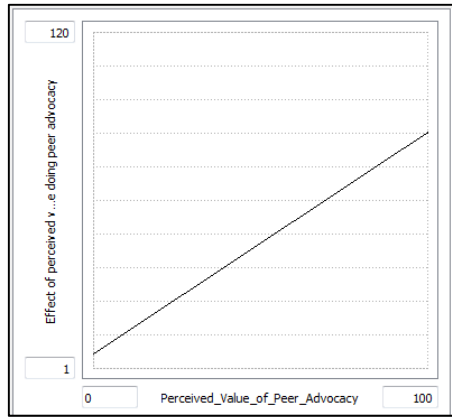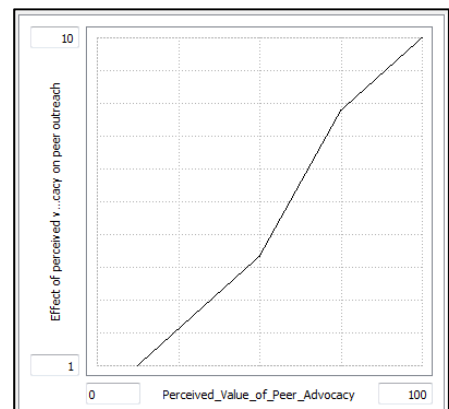

Fig. 7.5 Effect of perceived value of peer advocacy on peer outreach

Fig. 7.6 Effect of PLWH empowerment on lost to care rate