Session: 169 - Using Data to Inform Public Policy
Reducing Childhood Agricultural Injuries in the United States: Policy Analysis

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Appendix A

Additional Results

Figure 1

Flow Diagram of Inclusion and Exclusion of Cases (Unweighted Dataset)

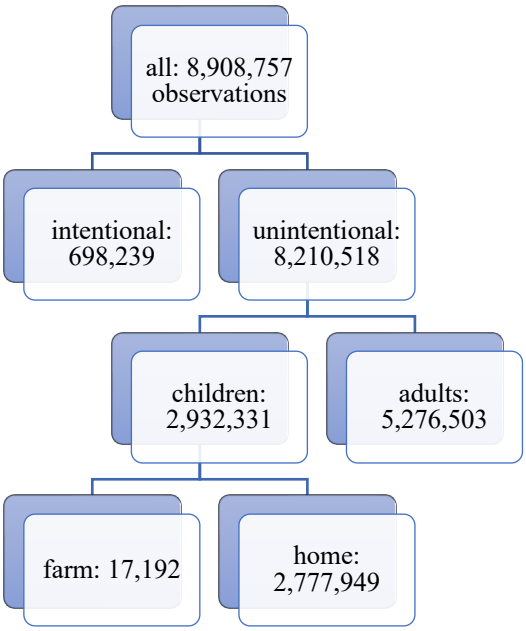


Table 3

Risk Factors for Unintentional Injuries Presenting to Emergency Departments That Occurred on Farms as Compared to at Homes in Children 0 to 18 Years Old, NEISS-AIP, 2000-2017

		OR[1] (95% CI)	aOR[2] (95% CI)
Body part[3]			
	Upper Trunk	3.25 (2.66 – 3.97) *	1.99 (1.56 – 2.54) *
	Lower Trunk	3.03 (2.21 – 4.15) *	1.96 (1.41 – 2.74) *
	Arm/Hand	1.53 (1.27 – 1.86) *	1.02 (0.81 – 1.27)
	Leg/Foot	1.99 (1.59 – 2.49) *	1.35 (1.06 – 1.72) *

[1] OR = Odds Ratio, aOR = adjusted Odds Ratio, CI = Confidence Interval

[2] Adjusted for sex, race, ethnicity, seasonality, year, and age

[3] Reference group omitted.

	Other Body Parts	1.12 (0.75 – 1.67)	1.26 (0.83 – 1.90)
Diagnosis			
	Soft tissue	0.87 (0.73 – 1.04)	0.90 (0.74 – 1.08)
	Neurologic	3.08 (2.36 – 4.01) *	2.10 (1.55 – 2.86) *
	Foreign substance	0.45 (0.31 – 0.69) *	0.44 (0.27 – 0.74) *
	Skin/conjunctiva	0.48 (0.26 – 0.90) *	0.70 (0.34 – 1.43)
	Hemorrhage/internal injury	1.00 (0.70 – 1.44)	1.18 (0.79 – 1.77)
	Other	0.66 (0.48 – 0.90) *	0.79 (0.57 – 1.10)
Precipitating cause			
	Overexertion	0.48 (0.33 – 0.70) *	0.48 (0.32 – 0.72) *
	Poisoning	0.85 (0.45 – 1.57)	0.43 (0.20 – 0.92) *
	Bite/sting	0.86 (0.64 – 1.14)	0.93 (0.68 – 1.26)
	Environmental	0.80 (0.43 – 1.48)	1.06 (0.56 – 1.99)
	Blunt trauma	0.84 (0.68 – 1.03)	1.08 (0.89 – 1.30)
	Transportation	7.01 (5.08 – 9.670*	6.34 (4.66 – 8.61) *
	Machinery	102.08 (81.26 – 128.22) *	82.91 (64.21 – 107.08) *
	Other	0.95 (0.50 – 1.79)	0.50 (0.28 – 0.93) *

Table 4

Characteristics of Injured Children 0 to 18 Years Old Leaving Without Being Seen/Against Medical Advice for Unintentional Injuries Occurring in Farms and Homes, NEISS-AIP, 2000-2017

		Leaving AMA/WBS % [95%CI]	Treated, Hospitalized, Observed or Transferred %[95%CI]	p-value[4]
Demographic characteristics				
Sex	Male	56.08 [53.49 – 58.64]	56.28 [55.85 – 56.21]	0.88
	Female	43.91 [41.36 – 46.51]	43.72 [43.29 – 44.16]	

[4] Significant at an alpha value of <0.05

Age Group	<5 years	57.52 [53.09 – 61.82]	42.09 [39.29 – 44.94]	0.00*
	5 to 9 years	18.54 [16.92 – 20.28]	23.23 [22.64 – 23.83]	
	10-14 years	9.64 [7.71 – 11.99]	19.21 [17.83 – 20.67]	
	15-18 years	14.30 [11.31 -17.93]	15.47 [14.23 – 16.80]	
Race	White	57.31 [44.71 – 69.02]	67.40 [57.69 – 75.83]	0.00*
	Black	22.09 [14.05 – 32.95]	16.98 [12.05 – 23.38]	
	Asian[5]	2.04 [0.72 – 5.67]	1.71 [0.74 – 3.90]	
	American Indian[6]	1.87 [0.31 – 10.56]	1.91 [0.37 – 9.24]	
	Other	16.69 [10.01 – 26.54]	11.99 [7.54 – 18.57]	
Ethnicity	Hispanic	16.20 [9.50 – 26.25]	12.19 [7.23 – 19.81]	0.03*
	Non-Hispanic/Not Stated	83.79 [73.75]	87.81 [80.19 – 92.77]	
Season	Jan to Mar	23.77 [20.88 – 26.91]	20.16 [19.68 - 20.67]	0.02*
	Apr to June	25.64 [23.85 – 27.51]	25.72 [24.76 – 26.71]	
	Jul to Sep	27.27 [24.36 – 30.41]	29.50 [28.64 – 30.38]	
	Oct to Dec	23.31 [21.01 – 25.79]	24.61 [23.60 – 25.65]	
Injury Characteristics				
Body part	Head/Neck	52.14 [48.26 – 56.00]	41.49 [39.83 – 43.19]	0.00*
	Upper Trunk	2.13 [1.61 – 2.83]	3.46 [3.25 – 3.69]	
	Lower Trunk	3.26 [2.34 – 4.52]	3.17 [2.91 – 3.44]	

[5] Coefficient of variation >0.3

[6] Coefficient of variation >0.3

	Arm/Hand	18.84 [16.90 – 19.16]	26.32 [25.38 – 27.28]	
	Leg/Foot	9.53 [7.67 – 11.80]	17.97 [16.83 – 19.16]	
	Other Body Parts	14.09 [11.63 – 16.97]	7.59 [6.99 – 8.23]	
Diagnosis	Orthopedic	4.20 [2.59 – 6.76]	20.59 [19.09 – 22.18]	0.00*
	Soft tissue	45.87 [40.07 – 51.78]	51.16 [49,05 – 53.27]	
	Neurologic	0.10 [0.04 – 0.32]	1.10 [0.92 – 1.33]	
	Foreign substance	17.82 [14.83 – 21.26]	9.98 [9.23 – 10.35]	
	Skin/conjunctiva	3.06 [2.58 – 3.63]	3.31 [3.02 – 3.62]	
	Hemorrhage/internal injury	12.66 [8.50 – 18.45]	6.18 [4.92 – 7.75]	
	Other	16.27 [13.07 – 20.08]	7.89 [7.09 – 8.72]	
Precipitating Cause	Penetrating trauma	17.20 [14.11 – 20.83]	13.49 [13.05 – 13.95]	0.02*
	Overexertion	2.15 [1.33 – 3.45]	5.56 [4.96 – 6.24]	
	Poisoning	4.25 [3.27 – 5.50]	2.87 [2.57 – 3.19]	
	Bite/sting	8.55 [6.52 – 11.13]	7.68 [6.98 – 8.39]	
	Environmental	2.66 [2.28 – 3.08]	2.76 [2.55 – 2.97]	
	Blunt trauma	56.44 [51.02 – 61.69]	60.31 [59.04 – 61.57]	
	Transportation	2.21 [1.46 – 3.35]	4.08 [3.36 – 4.77]	
	Machinery	-	0.11 [0.07 – 0.14]	
	Other	6.53 [5.17 – 8.22]	3.22 [2.87 – 0.36]	

Table 5

Annual Unintentional Injuries Presenting to Emergency Departments That Occurred on Farms as Compared to at Homes in Children 0 to 18 Years Old, NEISS-AIP, 2000-2017

Year	Injuries on Farms N = 493, 675	Injuries in Homes N = 2,104,617
2000	32,385	130,486
2001	33,965	131,118
2002	30,545	130,698
2003	31,126	130,465
2004	35,954	141,262
2005	33,437	135,222
2006	27,374	138,089
2007	34,873	122,531
2008	29,781	119,458
2009	21,555	111,988
2010	23,516	115,670
2011	25,666	108,659
2012	27,043	107,913
2013	22,568	99,111
2014	19,454	97,886
2015	19,347	99,764
2016	23,582	94,834
2017	21,504	89,002

Figure 9

System Dynamics Model of the Childhood Agricultural Injury System

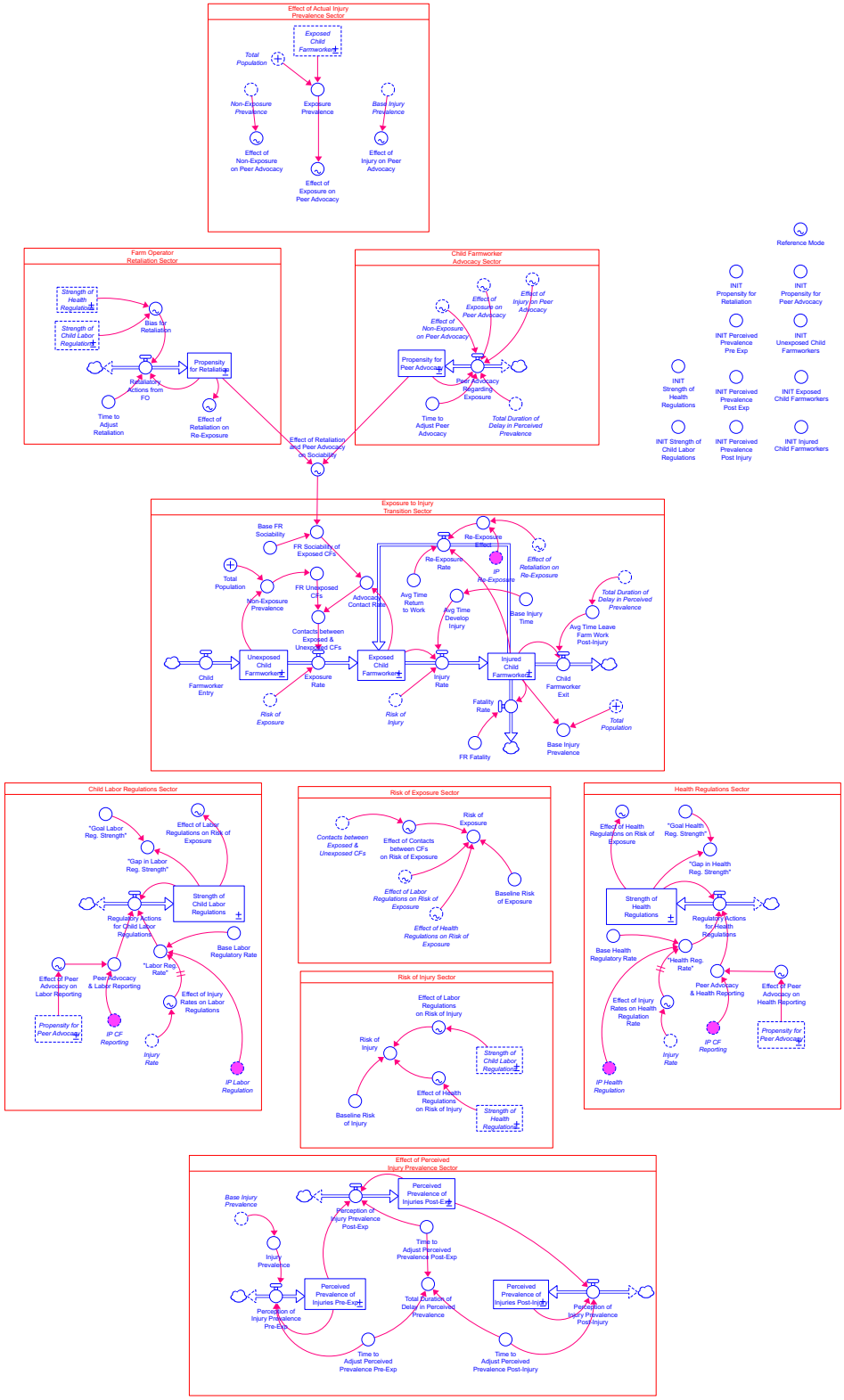


Figure 10

Injury Trends in Reference Mode vs Childhood Agricultural Injury Model (Model Base Run)

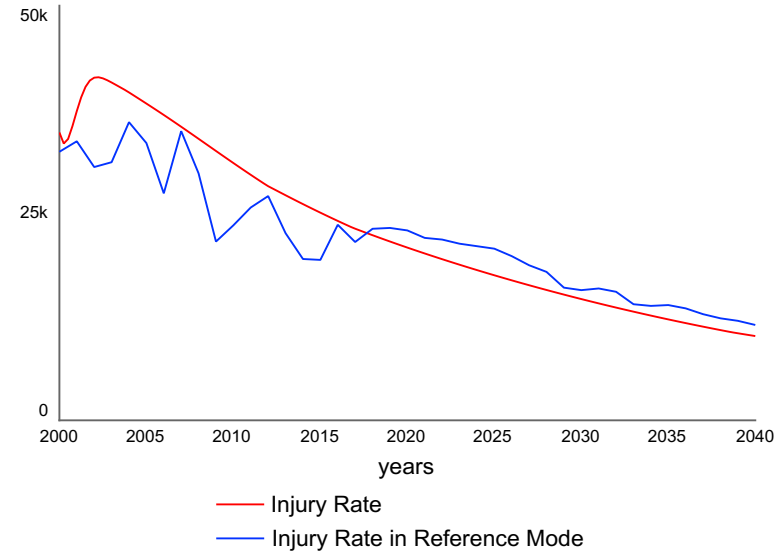


Figure 22

Extreme Conditions: Child Farmworker Entry & Fatality Rates

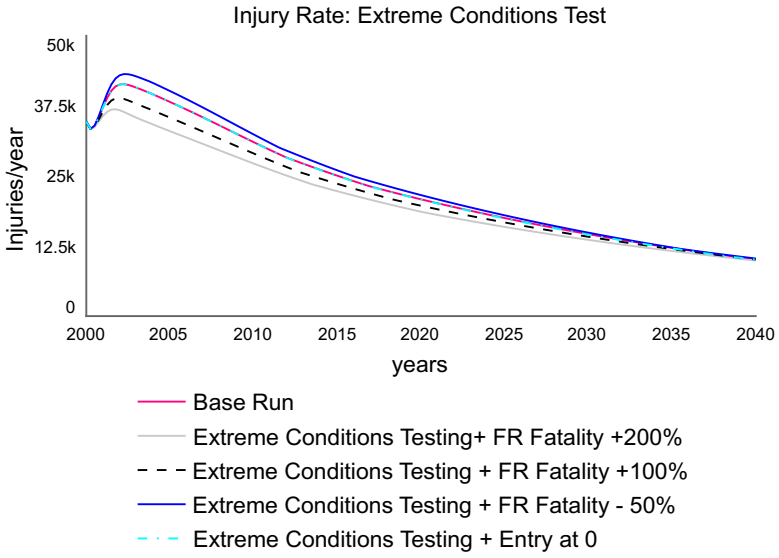


Figure 23

Extreme Conditions: Child Farmworker Propensity for Peer Advocacy

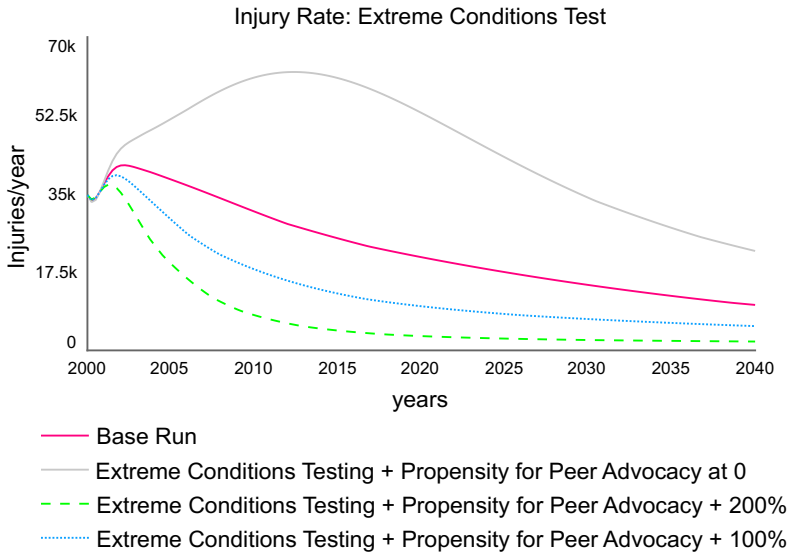


Figure 24

Sensitivity Analysis: Adjusting Average Time to Return to Work

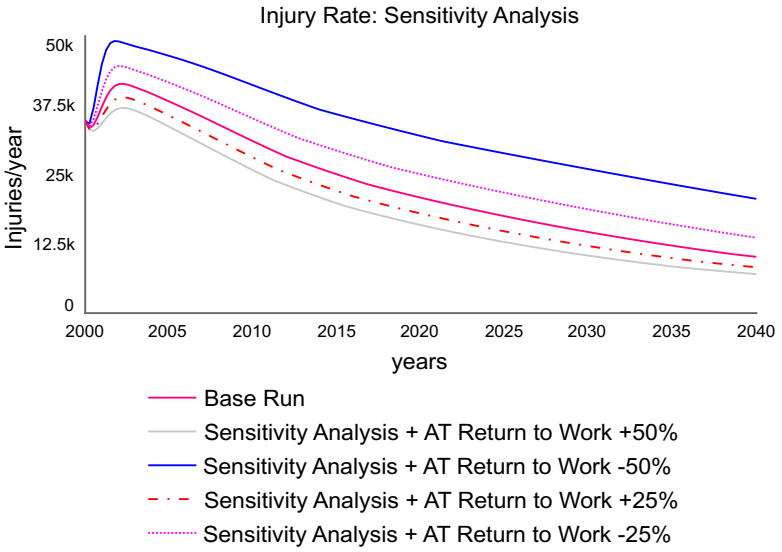


Figure 25

Sensitivity Analysis: Average Time to Develop Injury

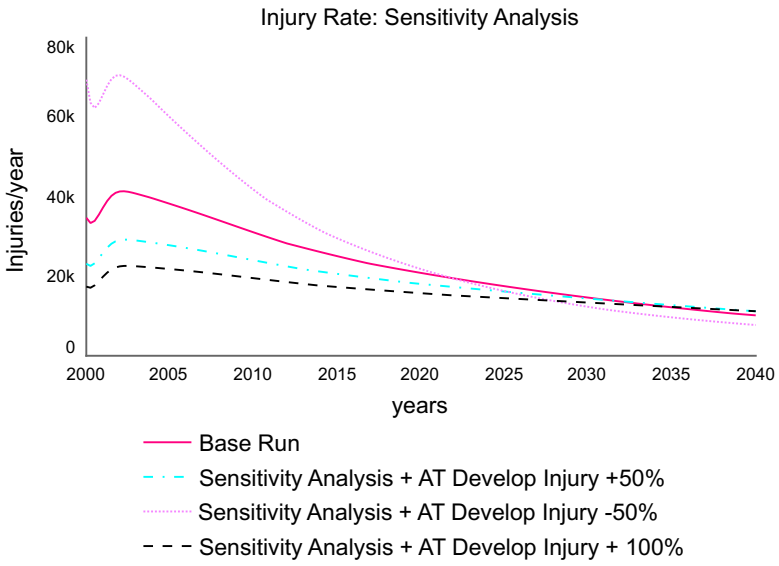
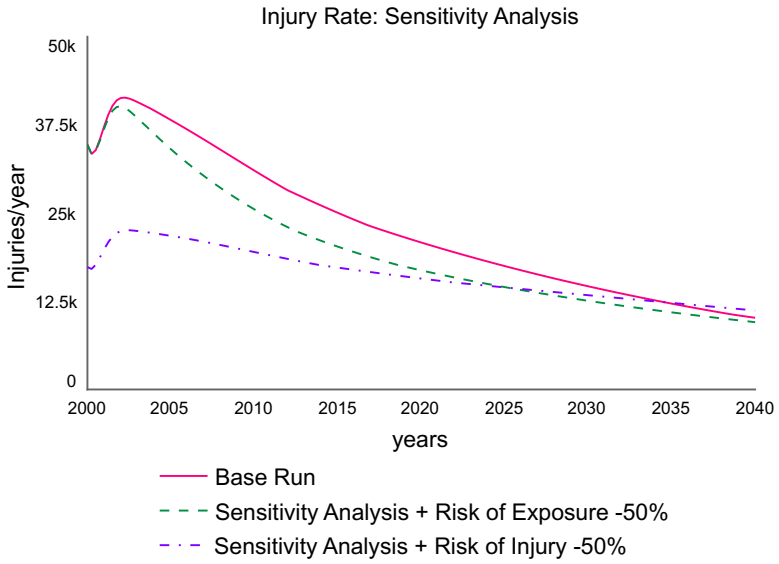


Figure 26
Sensitivity Analysis: Baseline Risks of Injury

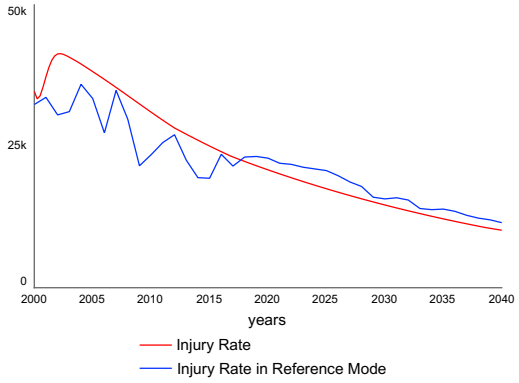


Appendix B

Model Documentation

Formulations and Comments	Units
Reference Mode	
Reference_Mode = GRAPH(TIME) Points: (2000.00, 32385), (2001.00, 33649), (2002.00, 30545), (2003.00, 31126), (2004.00, 35954), (2005.00, 33437), (2006.00, 27374), (2007.00,	people/year

34873), (2008.00, 29781), (2009.00, 21555), (2010.00, 23516), (2011.00, 25666), (2012.00, 27043), (2013.00, 22568), (2014.00, 19454), (2015.00, 19347), (2016.00, 23582), (2017.00, 21504), (2018.00, 26500), (2019.00, 27000), (2020.00, 28000), (2021.00, 28900), (2022.00, 29500), (2023.00, 30500), (2024.00, 32000), (2025.00, 33500), (2026.00, 35000), (2027.00, 35500), (2028.00, 37000), (2029.00, 39000), (2030.00, 40000), (2031.00, 40800), (2032.00, 41300), (2033.00, 42000), (2034.00, 42600), (2035.00, 43100), (2036.00, 44000), (2037.00, 44900), (2038.00, 45900), (2039.00, 46300), (2040.00, 47200)



Description
Graphical representation of childhood agricultural injuries over time.

Source
Author's analysis of 2000 to 2017 data from the NEISS-AIP dataset.
Note: Projections from 2017 to 2040 indicate imputed values for feared behavior. Reference Mode differs from Developing Severe Injury because the latter incorporates re-exposure and re-injury.

Child Farmworker Advocacy Sector

Peer_Advocacy_Regarding_Exposure = (("Effect_of_Non Exposure_on_Peer_Advocacy" *Effect_of_Exposure_on_Peer_Advocacy *Effect_of_Injury_on_Peer_Advocacy) - (Propensity_for_Peer_Advocacy))/(Time_to_Adjust_Peer_Advocacy+Total_Duration_of_Delay_in_Perceived_Prevalence) dmnl/years

Description
The rate of change in peer advocacy among child farmworkers.

Source
Model formulation

Propensity_for_Peer_Advocacy(t) = Propensity_for_Peer_Advocacy(t - dt) + (Peer_Advocacy_Regarding_Exposure) * dt
  INIT Propensity_for_Peer_Advocacy = INIT_Propensity_for_Peer_Advocacy

dmnl

Description
Likelihood of peer advocacy by child farmworkers.
Source
Author's hypotheses based on literature which suggests that children in later transition states are more familiar with navigating the power dynamics between child farmworkers and farm operators.

See Quandt, S. A., Arnold, T. J., Mora, D. C., Sandberg, J. C., Daniel, S. S., & Arcury, T. A. (2019). Hired Latinx child farm labor in North Carolina: The demand-support-control model applied to a vulnerable worker population. American Journal of Industrial Medicine, 62(12), 1079–1090. https://doi.org/10.1002/ajim.23039

Time_to_Adjust_Peer_Advocacy = 5

years

Description
The length of time it takes to for child farmworkers to increase self-advocacy. Value= 5 years to represent the interval of aging between ages 10 and 15 years, the most frequently injured age group for children on farms.

Source
Authors hypotheses

Child Labor Regulations Sector

"Goal_Labor_Reg._Strength" = MAX(0.40 , 0)

dmnl

Description
This is the goal strength of labor regulatory enforcement by DOL

Source
Author's hypotheses, adapted from Marlenga et al paper estimating that enforcing child labor regulations could reduce up to 34% of childhood agricultural injuries. Labor and health regulations are used as analogues for one another in this adaptation.

"Gap_in_Labor_Reg._Strength" = "Goal_Labor_Reg._Strength"-Strength_of_Child_Labor_Regulations — dmnl

Description
Represents the difference between goal strength of health regulations (this is labeled “Goal Labor Reg Strength”) and the strength of health regulations as perceived by child farmworkers (this is labeled " Strength of Health Regulations')

Source
Model formulation

"Labor_Reg._Rate" = IP_Labor_Regulation * (Base_Labor_Regulatory_Rate + DELAY1(Effect_of_Injury_Rates_on_Labor_Regulations, 2017)) — dmnl/dmnl/year

Description
This represents the rate of labor regulatory enforcements for child farmworkers, which factor in rising injury rates. When the delay gap is narrowed, injury rates affect regulatory enforcement activities. The model is not sensitive to the duration of the time constant in the delay formulation.

Source
See Base Labor Regulatory Rate

Base_Labor_Regulatory_Rate = 0.04 — dmnl/dmnl/year

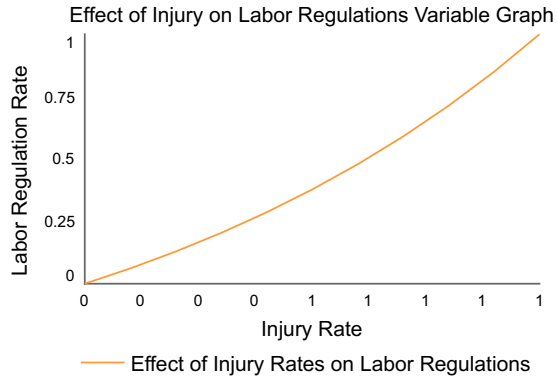
Description
Base Labor Regulatory Rate is the base rate at which labor regulations are enforced for child farmworkers, independent of injury rates e.g., violations discovered during routine DOL inspections which lead to civil penalties. This is a fractional rate that is estimated as 1/25.

Source
Author's hypotheses based on literature: injuries for adult farmworkers are underreported by 74%, this model assumes that the Base Labor Regulatory Rate for child farmworkers is a fifth of that size, due to power dynamics and coercion that child farmworkers experience.

See Quandt, S. A., Arnold, T. J., Mora, D. C., Sandberg, J. C., Daniel, S. S., & Arcury, T. A. (2019). Hired Latinx child farm labor in North Carolina: The demand-support-control model applied to a vulnerable worker population. American Journal of Industrial Medicine, 62(12), 1079–1090. https://doi.org/10.1002/ajim.23039

Leigh, J. P., Du, J., & McCurdy, S. A. (2014). An estimate of the U.S. government's undercount of nonfatal occupational injuries and illnesses in agriculture. Annals of Epidemiology, 24(4), 254–259. https://doi.org/10.1016/j.annepidem.2014.01.006

Effect_of_Injury_Rates_on_Labor_Regulations = GRAPH(Injury_Rate) dmnl/dmnl/year
Points: (0.000, 0.000), (0.100, 0.0612070245601), (0.200, 0.128851248086), (0.300, 0.203609676702), (0.400, 0.28623051789), (0.500, 0.377540668798), (0.600, 0.478453992107), (0.700, 0.589980462274), (0.800, 0.713236273698), (0.900, 0.849455011967), (1.000, 1.000)



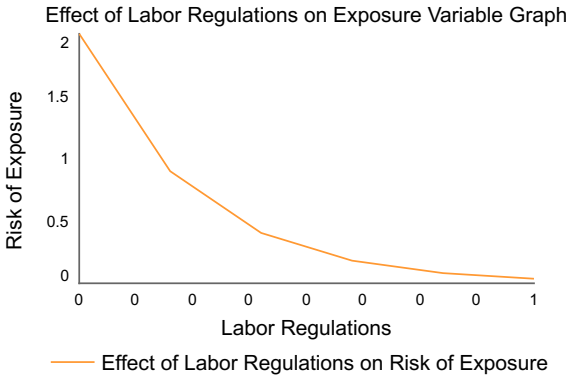
Description
Graphical depiction of the positive relationship between injury rates and the enforcement of child labor regulations.

Source
Author's hypotheses, informed by multiple peer-reviewed articles noting the disconnect between injury prevalence and enforcement of protective child labor regulations, including:

Miller, M. E. (2012). Historical Background of the Child Labor Regulations: Strengths and Limitations of the Agricultural Hazardous Occupations Orders. Journal of Agromedicine, 17(2), 163–185. https://doi.org/10.1080/1059924X.2012.660434

Marlenga, B., RL, B., JG, L., RJ, B., & Pickett, W. (2007). Changing the child labor laws for agriculture: impact on injury. American Journal of Public Health, 97(2), 276–282. https://doi.org/10.2105/AJPH.2005.078923

Effect_of_Labor_Regulations_on_Risk_of_Exposure = GRAPH(Strength_of_Child_Labor_Regulations) dmnl
Points: (0.0000, 2.000), (0.1000, 0.898657928234), (0.2000, 0.403793035989), (0.3000, 0.181435906579), (0.4000, 0.0815244079567), (0.5000, 0.0366312777775)

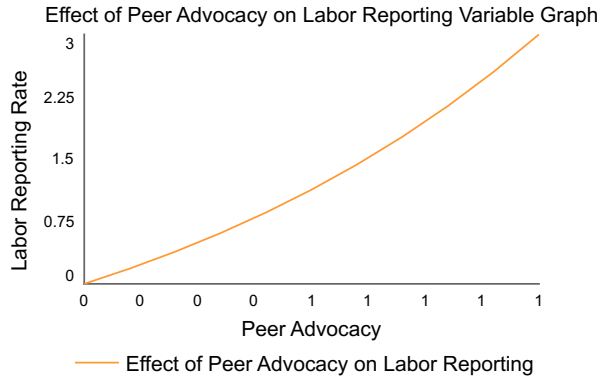


Description
Graphical representation of the negative relationship between labor regulations and the risk of occupational exposure. As child labor regulations are strengthened, the risk of exposure to occupational hazards decreases.

Source
Author's hypotheses, based on literature estimating a reduction in child farmworker injuries with increased enforcement of labor regulations such as Hazardous Occupation Orders.

See Marlenga, B., RL, B., JG, L., RJ, B., & Pickett, W. (2007). Changing the child labor laws for agriculture: impact on injury. American Journal of Public Health, 97(2), 276–282. https://doi.org/10.2105/AJPH.2005.078923

Effect_of_Peer_Advocacy_on_Labor_Reporting = GRAPH(Propensity_for_Peer_Advocacy) dmnl
Points: (0.000, 0.000), (0.100, 0.18362107368), (0.200, 0.386553744258), (0.300, 0.610829030107), (0.400, 0.858691553671), (0.500, 1.13262200639), (0.600, 1.43536197632), (0.700, 1.76994138682), (0.800, 2.13970882109), (0.900, 2.5483650359), (1.000, 3.000)



Description
Graphical representation of the strong positive relationship between peer advocacy and reporting to labor regulations.

Source
Author's hypotheses, based on OSHA reporting-to-investigation pathway.

Peer_Advocacy_&_Labor_Reporting = Effect_of_Peer_Advocacy_on_Labor_Reporting *IP_CF_Reporting — dmnl

Description
See Effect of Peer Advocacy on Labor Reporting

Regulatory_Actions_for_Child_Labor_Regulations = (Strength_of_Child_Labor_Regulations *"Labor_Reg._Rate") *Peer_Advocacy_&_Labor_Reporting — dmnl/dmnl/year

Description
Rate of change of labor regulatory actions for occupational exposure, which is taken as a delayed effect of recognizing rising injury rates on child labor regulation of approximately 25 years. This is a function of the Base Labor Regulatory Rate and the Effect of Injury Rates on Labor Regulation Rate. The equation assumes that the movement from recognizing injury rates to changing child labor regulations behaves like a first-order information delay, and the injury rates that increase regulations take time to develop.

Source
Based on the interval between 1949 Revisions to FLSA regarding child farm work during school and 1974 revisions regarding hazardous tasks for 14- and 15-year-olds.

See US Department of Labor (2011). The Fair Labor Standards Act Of 1938, As Amended. https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/FairLaborStandAct.pdf

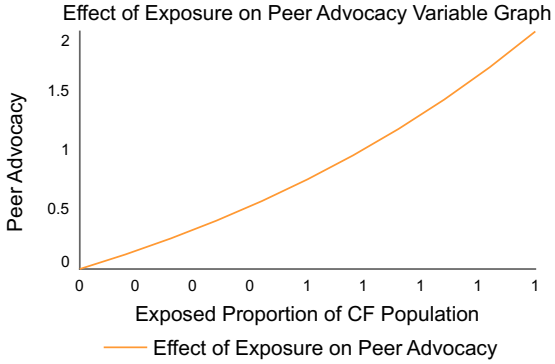
Strength_of_Child_Labor_Regulations(t) = Strength_of_Child_Labor_Regulations(t - dt) + (Regulatory_Actions_for_Child_Labor_Regulations) * dt dmnl
INIT Strength_of_Child_Labor_Regulations = MAX(INIT_Strength_of_Child_Labor_Regulations, 0)

Description
The strength of child labor regulations from DOL which act on childhood agricultural injuries. It has a minimum level of 0 (no enforcement), and a maximum value of 1.

Source
Author's hypotheses

Effect_of_Actual_Injury_Prevalence_Sector

Effect_of_Exposure_on_Peer_Advocacy = GRAPH(Exposure_Prevalence) dmnl
Points: (0.000, 0.000), (0.100, 0.12241404912), (0.200, 0.257702496172), (0.300, 0.407219353405), (0.400, 0.572461035781), (0.500, 0.755081337596), (0.600, 0.956907984213), (0.700, 1.17996092455), (0.800, 1.4264725474), (0.900, 1.69891002393), (1.000, 2.000)

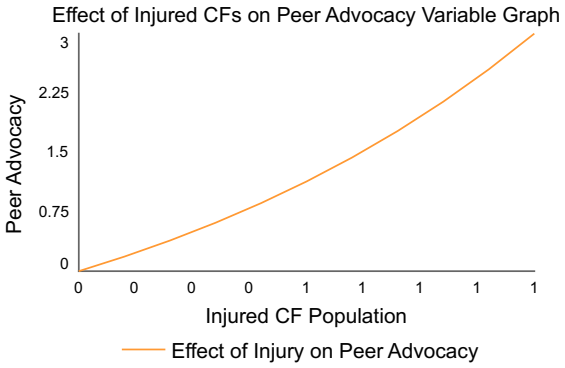


Description
Graphical representation of the moderate positive relationship between the size of the exposed child farmworker population and the likelihood of peer advocacy.

Source

Model formulation

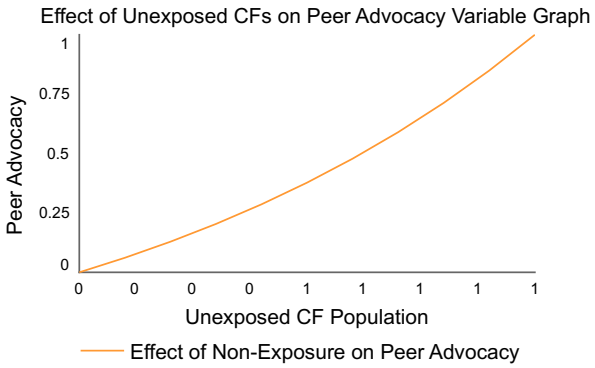
Effect_of_Injury_on_Peer_Advocacy = GRAPH(Base_Injury_Prevalence) dmnl
Points: (0.000, 0.000), (0.100, 0.18362107368), (0.200, 0.386553744258), (0.300, 0.610829030107), (0.400, 0.858691553671), (0.500, 1.13262200639), (0.600, 1.43536197632), (0.700, 1.76994138682), (0.800, 2.13970882109), (0.900, 2.5483650359), (1.000, 3.000)



Description
Graphical representation of the strong positive relationship between the size of the injured child farmworker population and the likelihood of peer advocacy.

Source
Model formulation

"Effect_of_Non-Exposure_on_Peer_Advocacy" = GRAPH("Non-Exposure_Prevalence") dmnl
Points: (0.000, 0.000), (0.100, 0.0612070245601), (0.200, 0.128851248086), (0.300, 0.203609676702), (0.400, 0.28623051789), (0.500, 0.377540668798), (0.600, 0.478453992107), (0.700, 0.589980462274), (0.800, 0.713236273698), (0.900, 0.849455011967), (1.000, 1.000)



Description
Graphical representation of the weak positive relationship between the size of the unexposed child farmworker population and the likelihood of peer advocacy.

Source
Model formulation

Exposure_Prevalence = Exposed_Child_Farmworkers/Total_Population	people/people

Description
Proportion of total child farmworker population with occupational exposures.

Source
Model formulation

Effect of Perceived Injury Prevalence Sector

Injury_Prevalence = Base_Injury_Prevalence	dmnl

Description
See Base Injury Prevalence

"Perceived_Prevalence_of_Injuries_Post-Exp"(t) = "Perceived_Prevalence_of_Injuries_Post-Exp"(t - dt) + ("Perception_of_Injury_Prevalence_Post-Exp") * dt INIT "Perceived_Prevalence_of_Injuries_Post-Exp" = INIT_Perceived_Prevalence_Post_Exp	dmnl

Description
The perceived prevalence of injuries among child farmworkers, post-exposure. Initial Value = 3.06.

Source
Author's hypotheses, computed as two-thirds the Base Injury Prevalence.

"Perceived_Prevalence_of_Injuries_Post-Injury"(t) = "Perceived_Prevalence_of_Injuries_Post-Injury"(t - dt) + ("Perception_of_Injury_Prevalence_Post-Injury") * dt INIT "Perceived_Prevalence_of_Injuries_Post-Injury" = INIT_Perceived_Prevalence_Post_Injury	dmnl

Description

The perceived prevalence of injuries among child farmworkers, post-injury. Initial Value = 6.12.

Source
Author's hypotheses, computed as one and a third the Base Injury Prevalence.

"Perceived_Prevalence_of_Injuries_Pre-Exp"(t) = "Perceived_Prevalence_of_Injuries_Pre-Exp"(t - dt) + ("Perception_of_Injury_Prevalence_Pre-Exp") * dt
INIT "Perceived_Prevalence_of_Injuries_Pre-Exp" = INIT_Perceived_Prevalence_Pre_Exp

dmnl

Description
The perceived prevalence of injuries among child farmworkers, pre-exposure. Initial Value = 1.53.

Source
Author's hypotheses, computed as a third of Base Injury Prevalence.

"Perception_of_Injury_Prevalence_Post-Exp" = ("Perceived_Prevalence_of_Injuries_Pre-Exp"-"Perceived_Prevalence_of_Injuries_Post-Exp")/"Time_to_Adjust_Perceived_Prevalence_Post-Exp"

people/year

Description
The rate at which perceived prevalence of injuries updates among child farmworkers who have been exposed.

Source
Model formulation

"Perception_of_Injury_Prevalence_Post-Injury" = ("Perceived_Prevalence_of_Injuries_Post-Exp"-"Perceived_Prevalence_of_Injuries_Post-Injury")/"Time_to_Adjust_Perceived_Prevalence_Post-Injury"

people/year

Description
The rate at which perceived prevalence of injuries updates among child farmworkers who have been injured.

Source
Model formulation

"Perception_of_Injury_Prevalence_Pre-Exp" = (Injury_Prevalence-("Perceived_Prevalence_of_Injuries_Pre-Exp"))/"Time_to_Adjust_Perceived_Prevalence_Pre-Exp" — people/year

Description
The rate at which perceived prevalence of injuries updates among child farmworkers who have not been exposed.

Source
Model formulation

"Time_to_Adjust_Perceived_Prevalence_Post-Exp" = 0.25 — years

Description
The length of time it takes to adjust perception of injury prevalence after experiences of occupational exposure. Value = 0.25 years.

Source
Authors hypotheses, model not sensitive to this parameter.

"Time_to_Adjust_Perceived_Prevalence_Post-Injury" = 0.16 — years

Description
The length of time it takes for injured child farmworkers to adjust perception of injury prevalence following injury. Value = 0.16 years.

Source
Authors hypotheses, model not sensitive to this parameter.

"Time_to_Adjust_Perceived_Prevalence_Pre-Exp" = 0.5 — years

Description
The length of time it takes to adjust perception of injury prevalence pre-exposure. Value = 0.5 years

Source

Authors hypotheses, model not sensitive to this parameter.

Total_Duration_of_Delay_in_Perceived_Prevalence = "Time_to_Adjust_Perceived_Prevalence_Pre-Exp"+"Time_to_Adjust_Perceived_Prevalence_Post-Exp"+"Time_to_Adjust_Perceived_Prevalence_Post-Injury" | years

Description
The total duration of the information delay in perceived prevalence of injuries. It influences regulatory actions for occupational exposures, self-advocacy regarding exposure and leaving farm work following injury.

Source
Model formulation, based on perceived injury prevalence pre-exposure, post-exposure and post-injury.

Exposure to Injury Transition Sector

Effect_of_Retaliation_and_Peer_Advocacy_on_Sociability = GRAPH(Propensity_for_Peer_Advocacy + Propensity_for_Retaliation) Points: (0.000, 0.000), (0.200, 0.12241404912), (0.400, 0.257702496172), (0.600, 0.407219353405), (0.800, 0.572461035781), (1.000, 0.755081337596), (1.200, 0.956907984213), (1.400, 1.17996092455), (1.600, 1.4264725474), (1.800, 1.69891002393), (2.000, 2.000) | dmnl

Description
Graphical representation of the additive effects of retaliation and peer advocacy on the sociability of exposed child farmworkers regarding exposure.

Source
Author's hypotheses based on the literature.
See Quandt, S. A., Arnold, T. J., Mora, D. C., Sandberg, J. C., Daniel, S. S., & Arcury, T. A. (2019). Hired Latinx child farm labor in North Carolina: The demand-support-control model applied to a vulnerable worker population. American Journal of Industrial Medicine, 62(12), 1079–1090. https://doi.org/10.1002/ajim.23039

Advocacy_Contact_Rate = FR_Sociability_of_Exposed_CFs*Exposed_Child_Farmworkers | people/year

Description

The rate at which child farmworkers who have encountered occupational exposures make advocacy encounters with unexposed peers.

Source
Model formulation

Avg_Time_Develop_Injury = Base_Injury_Time — years

Description
See Base Injury Time

"Avg_Time_Leave_Farm_Work_Post-Injury" = (Total_Duration_of_Delay_in_Perceived_Prevalence)+1 — years

Description
The average length of time it takes injured child farmworkers to exit farm work altogether.

Source
Author's hypotheses that a child farmworker's experience of exposure and injury could inform the decision to exit farm work. Draws on the NEISS-AIP analysis findings that 11% of children injured on farms are either transferred or hospitalized from emergency departments, suggestive of injury severity (it cannot be ascertained from the data if severely injured child farmworkers resume farm work).

Avg_Time_Return_to_Work = 1 — years

Description
The average length of time it takes for a previously injured child farmworker to become re-exposed by returning to work. Value = 1 year.

Source
Author's hypotheses, model is sensitive to this parameter

Base_FR_Sociability = 0.25 — dmnl/dmnl/year

Description
The base proportion of child farmworkers who are sociable (engaging in peer advocacy). Value = 1 of 4.

Source
Author's hypotheses, model not sensitive to this parameter

Base_Injury_Prevalence = Injured_Child_Farmworkers/Total_Population | people/people

Description
Proportion of total child farmworker population with injuries.

Source
Model formulation

Base_Injury_Time = 0.6 | years

Description
The average length of time it takes for an exposed child farmworker to develop severe injury. Value = 0.6 years.

Source
Author's hypotheses, model is sensitive to this parameter

Child_Farmworker_Entry = 300 {UNIFLOW} | people/year

Description
The number of child farmworkers who enter farm work each year.

Source
Author's hypotheses, model not sensitive to this parameter

Child_Farmworker_Exit = Injured_Child_Farmworkers/"Avg_Time_Leave_Farm_Work_Post-Injury" {UNIFLOW} | people/year

Description
The number of injured child farmworkers who exit farm work each year.

Source
Model formulation

Contacts_between_Exposed_&_Unexposed_CFs = FR_Unexposed_CFs*Advocacy_Contact_Rate — people/year

Description
The rate of peer advocacy ("diffusion") from exposed child farmworkers to unexposed child farmworkers.

Source
Model formulation

Exposed_Child_Farmworkers(t) = Exposed_Child_Farmworkers(t - dt) + (Exposure_Rate + "Re-Exposure_Rate" - Injury_Rate) * dt
INIT Exposed_Child_Farmworkers = INIT_Exposed_Child_Farmworkers — people

Description
Child farmworkers exposed to occupational hazards.

Source
See INIT Exposed Child Farmworkers

Exposure_Rate = Contacts_between_Exposed_&_Unexposed_CFs*Risk_of_Exposure {UNIFLOW} — people/year

Description
The number of child farmworkers who encounter occupational exposures each year.

Source
Model formulation

Fatality_Rate = Injured_Child_Farmworkers*FR_Fatality {UNIFLOW} — people/year

Description
Fatality rate among injured child farmworkers each year.

Source
Model formulation

FR_Fatality = 0.159 | people/people/year

Description

The proportion of child farmworkers among all child farmworkers who die due to occupational injuries each year. Value = 0.159.

Source

See National Children's Center for Rural and Agricultural Health and Safety (2020). Childhood Agricultural Injuries Fact Sheet. https://marshfieldresearch.org/Media/Default/NFMC/PDFs/ChildAgInjuryFactsheet2020.pdf

FR_Sociability_of_Exposed_CFs = Base_FR_Sociability*Effect_of_Retaliation_and_Peer_Advocacy_on_Sociability | dmnl/dmnl/year

Description

The proportion of exposed child farmworkers who are sociable i.e., engage with unexposed peers about occupational exposures.

Source

Model formulation, based on literature describing power dynamics between farm operators and child farmworkers, and the resulting culture of silence among child farmworkers.
See Quandt, S. A., Arnold, T. J., Mora, D. C., Sandberg, J. C., Daniel, S. S., & Arcury, T. A. (2019). Hired Latinx child farm labor in North Carolina: The demand-support-control model applied to a vulnerable worker population. American Journal of Industrial Medicine, 62(12), 1079–1090. https://doi.org/10.1002/ajim.23039

FR_Unexposed_CFs = "Non-Exposure_Prevalence" | people/people

Description

See Non-Exposure Prevalence

Injured_Child_Farmworkers(t) = Injured_Child_Farmworkers(t - dt) + (Injury_Rate - Child_Farmworker_Exit - "Re-Exposure_Rate" - Fatality_Rate) * dt
  INIT Injured_Child_Farmworkers = INIT_Injured_Child_Farmworkers | peopl

Description

The number of exposed child farmworkers who develop injuries.

Source
See INIT Injured Child Farmworkers

Injury_Rate = (Exposed_Child_Farmworkers*Risk_of_Injury)/Avg_Time_Develop_Injury {UNIFLOW} — people/year

Description
The number of exposed child farmworkers who develop injuries each year.

Source
Model formulation

"Non-Exposure_Prevalence" = Unexposed_Child_Farmworkers/Total_Population — people/people

Description
Proportion of total child farmworker population without any occupational exposures.

Source
Model formulation

"Re-Exposure_Effect" = "Effect_of_Retaliation_on_Re-Exposure" *"IP_Re-Exposure" — dmnl

Description
See Effect of Retaliation on Re-Exposure

"Re-Exposure_Rate" = Injured_Child_Farmworkers*("Re-Exposure_Effect")/Avg_Time_Return_to_Work {UNIFLOW} — people/year

Description
The rate at which injured child farmworkers re-encounter occupational exposures.

Source
Author's hypotheses that regulations can limit re-exposure and re-injury.

Total_Population = Exposed_Child_Farmworkers + Injured_Child_Farmworkers + Unexposed_Child_Farmworkers {SUMMING CONVERTER} | people

Description
Total population of child farmworkers in all transition states, unexposed, exposed, and injured.

Source
Model formulation

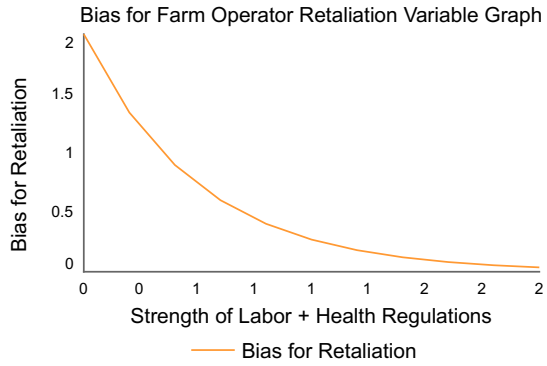
Unexposed_Child_Farmworkers(t) = Unexposed_Child_Farmworkers(t - dt) + (Child_Farmworker_Entry - Exposure_Rate) * dt
INIT Unexposed_Child_Farmworkers = INIT_Unexposed_Child_Farmworkers | people

Description
Child farmworkers unexposed to occupational hazards.

Source
See INIT Unexposed Child Farmworkers

Farm Operator Retaliation Sector

Bias_for_Retaliation = GRAPH(Strength_of_Health_Regulations + Strength_of_Child_Labor_Regulations) | dmnl
Points: (0.000, 2.000), (0.200, 1.34064009207), (0.400, 0.898657928234), (0.600, 0.602388423824), (0.800, 0.403793035989), (1.000, 0.270670566473), (1.200, 0.181435906579), (1.400, 0.12162012525), (1.600, 0.0815244079567), (1.800, 0.0546474448946), (2.000, 0.0366312777775)

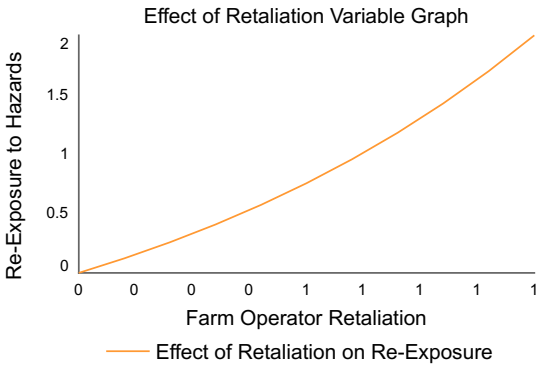


Description

Graphical representation of the changing negative relationship between strength of regulation enforcement and bias for retaliation(maltreatment) over time (policy resistance from farm operators to avoid additional sanctions).

Source
Author's hypotheses[7]

"Effect_of_Retaliation_on_Re-Exposure" = GRAPH(Propensity_for_Retaliation) dmnl
Points: (0.000, 0.000), (0.100, 0.12241404912), (0.200, 0.257702496172), (0.300, 0.407219353405), (0.400, 0.572461035781), (0.500, 0.755081337596), (0.600, 0.956907984213), (0.700, 1.17996092455), (0.800, 1.4264725474), (0.900, 1.69891002393), (1.000, 2.000)



Description
Graphical representation of the strong positive relationship between retaliation and re-exposure. As retaliation from farm operators increase, the likelihood of re-encountering exposure increases.

Source
Author's hypotheses, based on literature describing retaliation.
See Quandt, S. A., Arnold, T. J., Mora, D. C., Sandberg, J. C., Daniel, S. S., & Arcury, T. A. (2019). Hired Latinx child farm labor in North Carolina: The demand-support-control model applied to a vulnerable worker population. American Journal of Industrial Medicine, 62(12), 1079–1090. https://doi.org/10.1002/ajim.23039

[7] Health and labor regulations additive here because they are only two of many possible pathways through which a bias for retaliation arises.

Sexsmith, K. (2017). ‘But we can’t call 911’: undocumented immigrant farmworkers and access to social protection in New York. Oxford Development Studies, 45(1), 96–111. https://doi.org/10.1080/13600818.2016.1193130

Snipes, S. A., Cooper, S. P., & Shipp, E. M. (2017). “The Only Thing I Wish I Could Change Is That They Treat Us Like People and Not Like Animals”: Injury and Discrimination Among Latino Farmworkers. Journal of Agromedicine, 22(1), 36–46. https://doi.org/10.1080/1059924X.2016.1248307

Propensity_for_Retaliation(t) = Propensity_for_Retaliation(t - dt) + (Retaliatory_Actions_from_FO) * dt — dmnl

INIT Propensity_for_Retaliation = INIT_Propensity_for_Peer_Advocacy

Description
Likelihood of retaliation from farm operators who have experienced regulatory actions.

Source
Author's hypotheses based on farm operator retaliation as described in the literature.

See Quandt, S. A., Arnold, T. J., Mora, D. C., Sandberg, J. C., Daniel, S. S., & Arcury, T. A. (2019). Hired Latinx child farm labor in North Carolina: The demand-support-control model applied to a vulnerable worker population. American Journal of Industrial Medicine, 62(12), 1079–1090. https://doi.org/10.1002/ajim.23039

Retaliatory_Actions_from_FO = (Bias_for_Retaliation-Propensity_for_Retaliation)/Time_to_Adjust_Retaliation — dmnl/year

Description
The rate of change in retaliatory actions by farm operators who have experienced regulatory sanctions.

Source
Model formulation

Time_to_Adjust_Retaliation = 2.5 — years

Description
The time it takes for a farm operator to retaliate against child farmworkers following sanctions (e.g., backpay civil or criminal penalties) levied by OSHA, DOL WHD or the US EPA for labor and health violations.

Source
Author's hypotheses based on:
OSHA requirement to issue citations for any violations (in this case, reported injuries or illnesses) within 6 months, and fix a reasonable time for the abatement of the violation.
OSHA Act of 1970: SEC. 9. Citations, (1970). https://www.osha.gov/laws-regs/oshact/section_9

The duration of compliance investigations with DOL WHD varies depending on whether a full or limited investigation, conciliation, office audit or self-audit for violations was conducted. However, 80% of cases are resolved within the same fiscal year of reporting.
See Government Accountability Office. (2020). FLSA: Tracking Additional Complaint Data Could Improve DOL's Enforcement.

Health Regulations Sector

"Goal_Health_Reg._Strength" = MAX(0.40 , 0) dmnl

Description
This is the goal strength of health regulatory enforcement by OSHA and EPA. Unit: dmnl

Source
Author's hypotheses, adapted from Marlenga et al paper estimating that enforcing child labor regulations could reduce up to 34% of childhood agricultural injuries. Labor and health regulations are used as analogues for one another in this adaptation.

"Gap_in_Health_Reg._Strength" = "Goal_Health_Reg._Strength" - Strength_of_Health_Regulations dmnl

Description

Represents the difference between goal strength of health regulations and the strength of health regulations as perceived by child farmworkers (this is labeled " Strength of Health Regulations')

"Health_Reg._Rate" = IP_Health_Regulation * (Base_Health_Regulatory_Rate + DELAY1(Effect_of_Injury_Rates_on_Health_Regulation_Rate, 2017)) — dmnl/year

Description
This represents the rate of health regulatory enforcements for child farmworkers, which factor in rising injury rates. When the delay gap is narrowed, injury rates affect regulatory enforcement activities.

The model is not sensitive to the duration of the time constant in the delay formulation.

Source
See Base Health Regulatory Rate

Base_Health_Regulatory_Rate = 0.05 — dmnl/dmnl/year

Description
Base Health Regulatory Rate is the base rate at which health regulations are enforced for child farmworkers, independent of injury rates e.g., violations discovered during routine OSHA inspections which lead to civil penalties. This is a fractional rate that is estimated as 1/20.

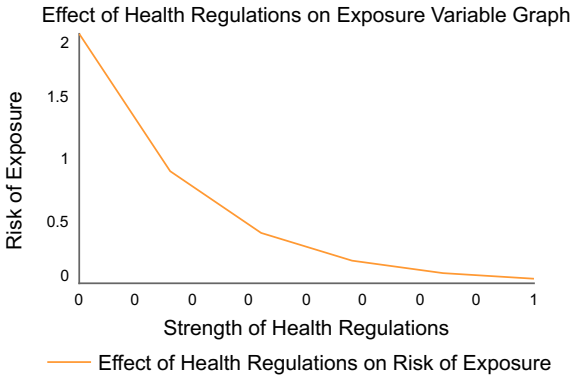
Source
Author's hypotheses based on literature: injuries for adult farmworkers are underreported by 74%, this model assumes that the Base Regulatory Rate for child farmworkers is a fifth of that size, due to power dynamics and coercion that child farmworkers experience.

See Quandt, S. A., Arnold, T. J., Mora, D. C., Sandberg, J. C., Daniel, S. S., & Arcury, T. A. (2019). Hired Latinx child farm labor in North Carolina: The demand-support-control model applied to a vulnerable worker population. American Journal of Industrial Medicine, 62(12), 1079–1090. https://doi.org/10.1002/ajim.23039

Leigh, J. P., Du, J., & McCurdy, S. A. (2014). An estimate of the U.S. government's undercount of nonfatal occupational injuries and illnesses in agriculture. Annals of Epidemiology, 24(4), 254–259. https://doi.org/10.1016/j.annepidem.2014.01.006

Effect_of_Health_Regulations_on_Risk_of_Exposure = GRAPH(Strength_of_Health_Regulations) dmnl

Points: (0.0000, 2.000), (0.1000, 0.898657928234), (0.2000, 0.403793035989), (0.3000, 0.181435906579), (0.4000, 0.0815244079567), (0.5000, 0.0366312777775)



Description

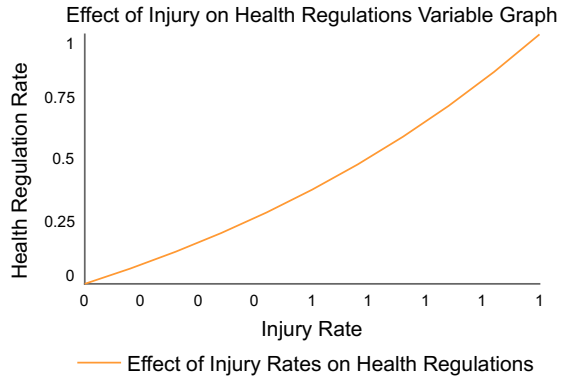
Graphical representation of the negative relationship between health regulations and the risk of occupational exposures. As regulations are strengthened, the risk of exposure to occupational hazards decreases.

Source

Author's hypotheses

Effect_of_Injury_Rates_on_Health_Regulation_Rate = GRAPH(Injury_Rate) dmnl/dmnl/year

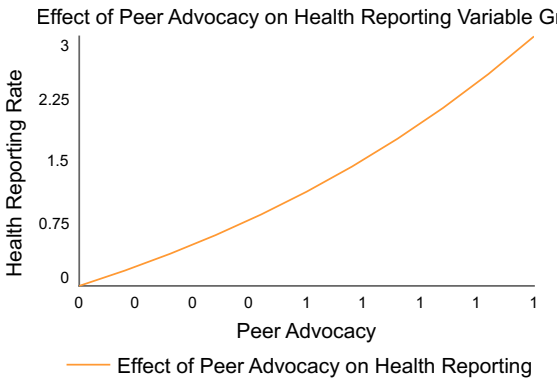
Points: (0.000, 0.000), (0.100, 0.0612070245601), (0.200, 0.128851248086), (0.300, 0.203609676702), (0.400, 0.28623051789), (0.500, 0.377540668798), (0.600, 0.478453992107), (0.700, 0.589980462274), (0.800, 0.713236273698), (0.900, 0.849455011967), (1.000, 1.000)



Description
Graphical representation of the positive relationship between injury rates and the enforcement of health regulations.

Source
Author's hypotheses, based on the influence of NIOSH SENSOR surveillance data on updates to the US EPA Worker Protection Standard. See NIOSH (n.d.) SENSOR. https://www.cdc.gov/niosh/topics/pesticides/overview.html

Effect_of_Peer_Advocacy_on_Health_Reporting = GRAPH(Propensity_for_Peer_Advocacy) dmnl
Points: (0.000, 0.000), (0.100, 0.18362107368), (0.200, 0.386553744258), (0.300, 0.610829030107), (0.400, 0.858691553671), (0.500, 1.13262200639), (0.600, 1.43536197632), (0.700, 1.76994138682), (0.800, 2.13970882109), (0.900, 2.5483650359), (1.000, 3.000)



Description
Graphical representation of the strong positive relationship between peer advocacy and reporting to health regulations.

Source

Author's hypotheses, based on the influence of NIOSH SENSOR surveillance data on updates to the EPA Worker Protection Standard.
See NIOSH (n.d.) SENSOR.
https://www.cdc.gov/niosh/topics/pesticides/overview.html

Peer_Advocacy_&_Health_Reporting = Effect_of_Peer_Advocacy_on_Health_Reporting *IP_CF_Reporting — dmnl

Description
See Effect of Peer Advocacy on Health Reporting

Regulatory_Actions_for_Health_Regulations = (Strength_of_Health_Regulations * "Health_Reg._Rate") *Peer_Advocacy_&_Health_Reporting — dmnl/year

Description
Rate of regulatory actions for occupational exposure, which is taken as a delayed effect on regulations from recognizing change in injury rates of approximately 20 years. This is a function of the Base Health Regulatory Rate and the Effect of Injury Rates on Health Regulation Rate. The equation assumes that health regulation rate behaves like a first-order information delay, and the injury rate that increases regulatory enforcement takes time to develop.

If the perceived strength of regulations is higher than the goal strength of regulations, the rate of regulatory actions will take some time to update. Regulatory actions can strengthen or weaken health regulations.

Source
Author's hypotheses, as it took ~20 years to change US EPA Worker Protection Standards. These changes were credited to the NIOSH pesticide injury surveillance data.
See NIOSH (n.d.) About the NIOSH Pesticide Surveillance Program.
https://www.cdc.gov/niosh/topics/pesticides/overview.html

Strength_of_Health_Regulations(t) = Strength_of_Health_Regulations(t - dt) + (Regulatory_Actions_for_Health_Regulations) * dt — dmnl
INIT Strength_of_Health_Regulations = MAX(INIT_Strength_of_Health_Regulations, 0)

Description
The strength of occupational health regulations from OSHA and EPA which act on childhood agricultural injuries. It has a minimum level of 0 (no enforcement, and a maximum value of 1).

Source
Author's hypotheses

Interventions Sector

ES_CF_Reporting = +0.90 dmnl

Description
Effect Size of Child Farmworker Reporting Intervention.

IP_CF_Reporting = 1 + STEP(ES_CF_Reporting, Time_CF_Reporting) *Switch_IP_CF_Reporting

Description
Intervention to increase child farmworker reporting. Formulated as a step function.

Switch_IP_CF_Reporting = 0

Description
Switch to turn "on" Child Farmworker Reporting Intervention.

Time_CF_Reporting = 2020

Description
Time of intervention: year 2020

ES_Health_Regulations = +1 dmnl

Description
Effect Size of Health Regulatory Enforcement Intervention.

IP_Health_Regulation = 1 + STEP(ES_Health_Regulations, Time_Health_Regulations) *Switch_Health_Regulation_Rate

Description

Intervention to scale up health regulatory enforcements. Formulated as a step function.

Switch_Health_Regulation_Rate = 0

Description: Switch to turn "on" Health Regulatory Enforcement Intervention.

Time_Health_Regulations = 2020

Description
Time of intervention: year 2020

"ES_IP_Re-Exposure" = -0.60 dmnl

Description
Effect Size of Re-Exposure Reduction Intervention.

"IP_Re-Exposure" = 1 + STEP("ES_IP_Re-Exposure", "Time_IP_Re-Exposure") *"Switch_IP_Re-Exposure"

Description
Intervention to limit re-exposure of injured child farmworkers. Formulated as a step function.

"Switch_IP_Re-Exposure" = 0

Description
Switch to turn "on" Re-Exposure Reduction Intervention.

"Time_IP_Re-Exposure" = 2020

Description
Time of intervention: year 2020

ES_Labor_Regulations = +1 dmnl

Description
Effect Size of Labor Regulatory Enforcement Intervention.

IP_Labor_Regulation = 1 + STEP(ES_Labor_Regulations, Time_Labor_Regulations) *Switch_Labor_Regulation_Rate

Description
Intervention to scale up labor regulatory enforcements. Formulated as a step function.

Switch_Labor_Regulation_Rate = 0

Description
Switch to turn "on" Labor Regulatory Enforcement Intervention.

Time_Labor_Regulations = 2020

Description
Time of intervention: year 2020

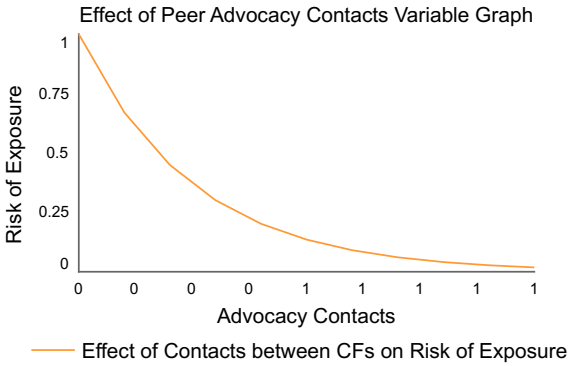
Risk of Exposure Sector

Baseline_Risk_of_Exposure = MAX (0.90, 0) dmnl

Description
The minimum risk of occupational exposures child farmworkers encounter following entry into the system. This parameter aggregates all forms of occupational hazards: biological, physical, chemical. Although there is no "safe" level of exposure, the initial value of this parameter is 0.9.

Source
Author's hypotheses, model not sensitive to this parameter.

Effect_of_Contacts_between_CFs_on_Risk_of_Exposure = GRAPH(Contacts_between_Exposed_&_Unexposed_CFs) dmnl
Points: (0.000, 1.000), (0.100, 0.670320046036), (0.200, 0.449328964117), (0.300, 0.301194211912), (0.400, 0.201896517995), (0.500, 0.135335283237), (0.600, 0.0907179532894), (0.700, 0.0608100626252), (0.800, 0.0407622039784), (0.900, 0.0273237224473), (1.000, 0.0183156388887)



Description
Graphical representation of the negative relationship between advocacy contacts between exposed and unexposed child farmworkers and risk of exposure to occupational hazards among unexposed child farmworkers.

Source
Author's hypotheses of the relationship between peer advocacy and exposure.

Risk_of_Exposure = MAX (((Baseline_Risk_of_Exposure * Effect_of_Health_Regulations_on_Risk_of_Exposure *Effect_of_Labor_Regulations_on_Risk_of_Exposure)+Effect_of_Contacts_between_CFs_on_Risk_of_Exposure), 0) dmnl

Description
This represents the risk of occupational exposures, driven by the effect of advocacy contacts between exposed and unexposed child farmworkers, effect of regulation enforcement on risk of exposure, effect of injury prevalence on risk of exposure, and initial susceptibility to exposure (baseline risk faced by any child working on a farm). Value ranges between 0 and 1.

Source
Model formulation, with parameter weighting. See Risk of Injury

Risk of Injury Sector

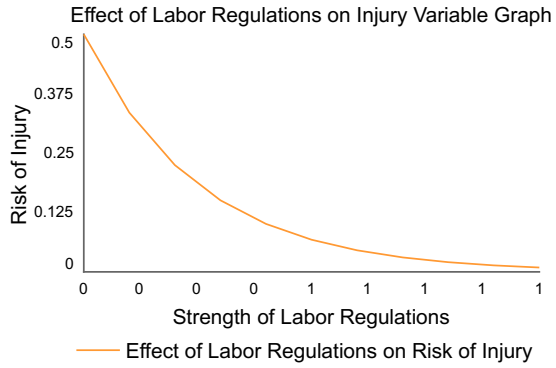
Baseline_Risk_of_Injury = MAX (0.93, 0) dmnl

Description
This represents the minimum risk of injury following occupational exposures. There is no "safe" level of risk, the initial value = 0.93.

Source
Author's hypotheses, model not sensitive to this parameter

Effect_of_Labor_Regulations_on_Risk_of_Injury = GRAPH(Strength_of_Child_Labor_Regulations)
Points: (0.000, 0.5000), (0.100, 0.335160023018), (0.200, 0.224664482059), (0.300, 0.150597105956), (0.400, 0.100948258997), (0.500, 0.0676676416183), (0.600, 0.0453589766447), (0.700, 0.0304050313126), (0.800, 0.0203811019892), (0.900, 0.0136618612236), (1.000, 0.00915781944437)

dmnl



Description
Graphical representation of the negative relationship between strength of child labor regulation and risk of injury. As regulations become stronger, the risk of injury falls, however, not as strongly as the risk of exposure.

Source
Author' s hypotheses, because the goal of regulations is to limit exposure as a primary approach to limiting injury.

See Alli, B. O. (2008). Fundamental principles of occupational health and safety (International Labor Office (ed.); 1st ed.). International Labor Office. https://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/@publ/Descriptions/publication/wcms_093550.pdf

Risk_of_Injury = MAX((Baseline_Risk_of_Injury *Effect_of_Health_Regulations_on_Risk_of_Injury *Effect_of_Labor_Regulations_on_Risk_of_Injury), 0)

dmnl

Description

This represents the risk of injury following occupational exposures, driven by the baseline risk of injury of every exposed child farmworker, and the effect of regulations on mitigating the risk of injury.
This parameter aggregates the risk of all causes of injury identified in the NEISS-AIP dataset, with an initial value of 0.93. Value ranges between 0 and 1.

Source
Model formulation, the graphical parameters are weighted: Health and labor regulations and age are multiplicative because they are central to the existence of injury risk (heavier weight).

Constants

INIT_Exposed_Child_Farmworkers = 190000 people

Description
The number of children actively engaged in the farm labor workforce and exposed to occupational hazards. Initial value = 190,000.

Source
Author's hypotheses informed by ratio relationships between Exposed Child Farmworkers and Injured Farmworkers, using average annual injuries sustained by children on farms between 2000 and 2017
Based on author's retrospective analysis of weighted 2000 to 2017 data from the National Electronic Injury Surveillance System-All Injury Program data (not published).

INIT_Injured_Child_Farmworkers = 288000

Description
The number of injured child farmworkers. Initial value = 288,000.

Source
Author's hypotheses informed by ratio relationships between Exposed Child Farmworkers and Injured Farmworkers, using average annual injuries sustained by children on farms between 2000 and 2017
Based on author's retrospective analysis of weighted 2000 to 2017 data from the National Electronic Injury Surveillance System-All Injury Program data (not published).

INIT_Unexposed_Child_Farmworkers = 600000

Description
The number of unexposed children in the farm labor workforce in the US. Initial value = 600,000.

Source
Author's hypotheses informed by ratio relationships between Unexposed and Exposed Child Farmworkers, using average annual injuries sustained by children on farms between 2000 and 2017.
Based on author's retrospective analysis of weighted 2000 to 2017 data from the National Electronic Injury Surveillance System-All Injury Program data (not published).

INIT_Perceived_Prevalence_Post_Exp = 0.0993 dmnl

Description
Initial perceived prevalence (proportion of injured child farmworkers among all child farmworkers) post-exposure. Value = 0.0993.

Source
Author's hypotheses, computed as two-thirds the injury prevalence (proportion with injuries)

INIT_Perceived_Prevalence_Post_Injury = 0.1987

Description
Initial perceived prevalence (proportion of injured child farmworkers among all child farmworkers) among injured child farmworkers. Value = 0.1987.

Source
Author's hypotheses, computed as one and a third the injury prevalence (proportion with injuries)

INIT_Perceived_Prevalence_Pre_Exp = 0.0497

Description
Initial perceived prevalence (proportion of injured child farmworkers among all child farmworkers) Value = 0.0497.

Source

Author's hypotheses, computed as a third of injury prevalence (proportion with injuries)	
INIT_Propensity_for_Peer_Advocacy = 0.0492	dmnl
Description Initial likelihood of exposed and/or injured child farmworkers to engage in peer advocacy. Source Author's hypotheses, model is sensitive to this parameter	
INIT_Propensity_for_Retaliation = 0.60	
Description Initial likelihood of farm operators to retaliate against child farmworkers due to prior OSHA or EPA or DOL sanctions. Source Author's hypotheses, model is sensitive to this parameter.	
INIT_Strength_of_Child_Labor_Regulations = 0.09	dmnl
Description Initial strength of child labor regulations enforced by the DOL. Initial value is 0.10 Source Author's hypotheses, model not sensitive to this parameter	
INIT_Strength_of_Health_Regulations = 0.10	
Description Initial strength of occupational health regulations (including EPA Worker Protection Standard). Initial value is 0.12. Source Author's hypotheses, model not sensitive to this parameter. The health regulations are assigned a slightly higher initial value than labor regulations because there are two institutions at play here, EPA and OSHA, as compared to labor policy which is primarily enforced by the DOL.	

A stated goal of the 2015 Worker Protection Standard revision was to, "... prevent unreasonable adverse effects from exposure to pesticides among agricultural workers and pesticide handlers, vulnerable groups (such as minority and low-income populations, child farmworkers, and farmworker families) and other persons who may be on or near agricultural establishments, and to mitigate exposures that do occur."

See US EPA (2015) Pesticides; Agricultural Worker Protection Standard Revisions https://www.federalregister.gov/Descriptions/2015/11/02/2015-25970/pesticides-agricultural-worker-protection-standard-revisions

{The model has 101 (101) variables (array expansion in parens).
In root model and 0 additional modules with 10 sectors.
Stocks: 10 (10) Flows: 13 (13) Converters: 78 (78)
Constants: 34 (34) Equations: 57 (57) Graphicals: 16 (16)
There are also 12 expanded macro variables.}