

System Dynamics Modeling of Medical Use, Nonmedical Use and Diversion of Prescription Opioid Analgesics

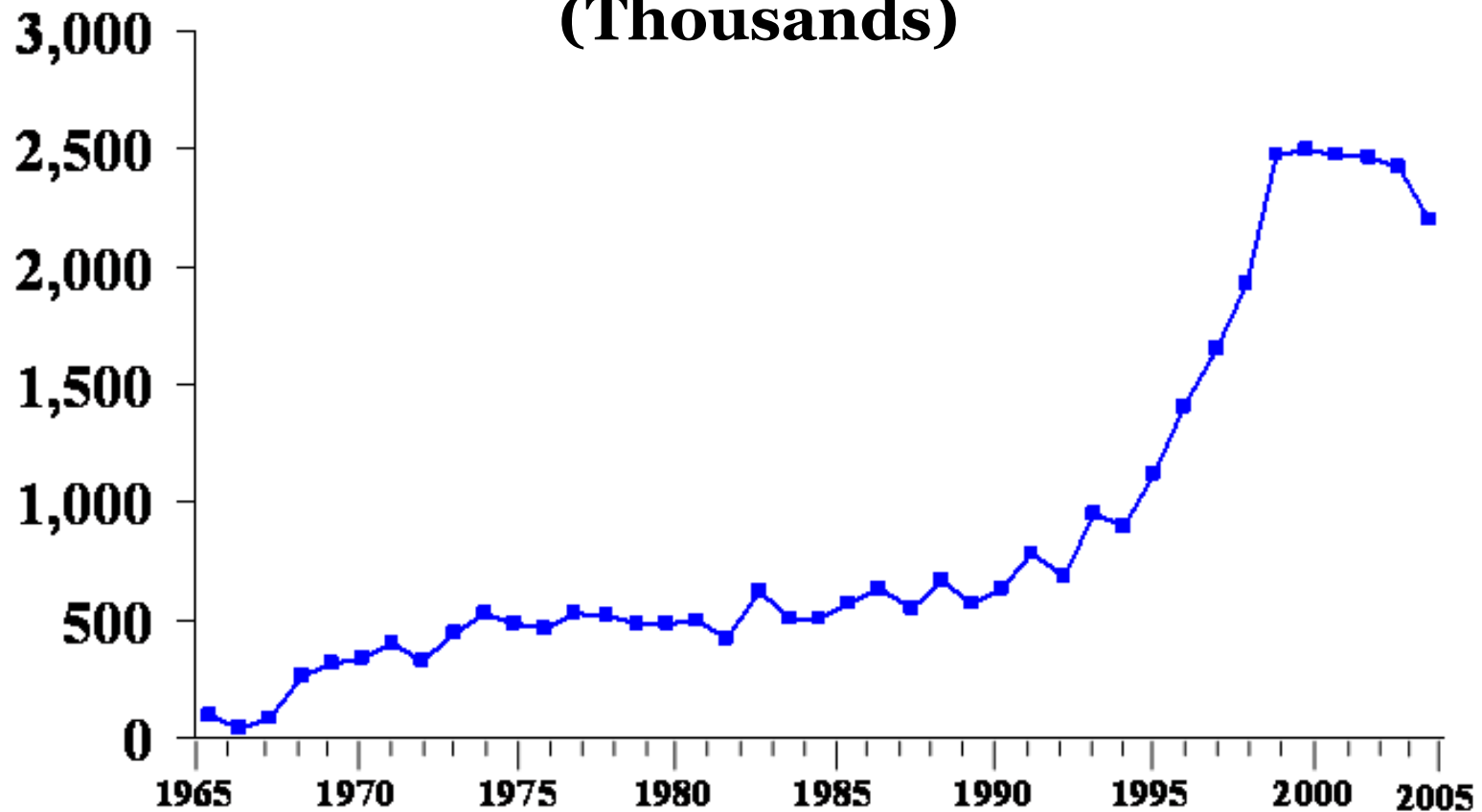
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Overview

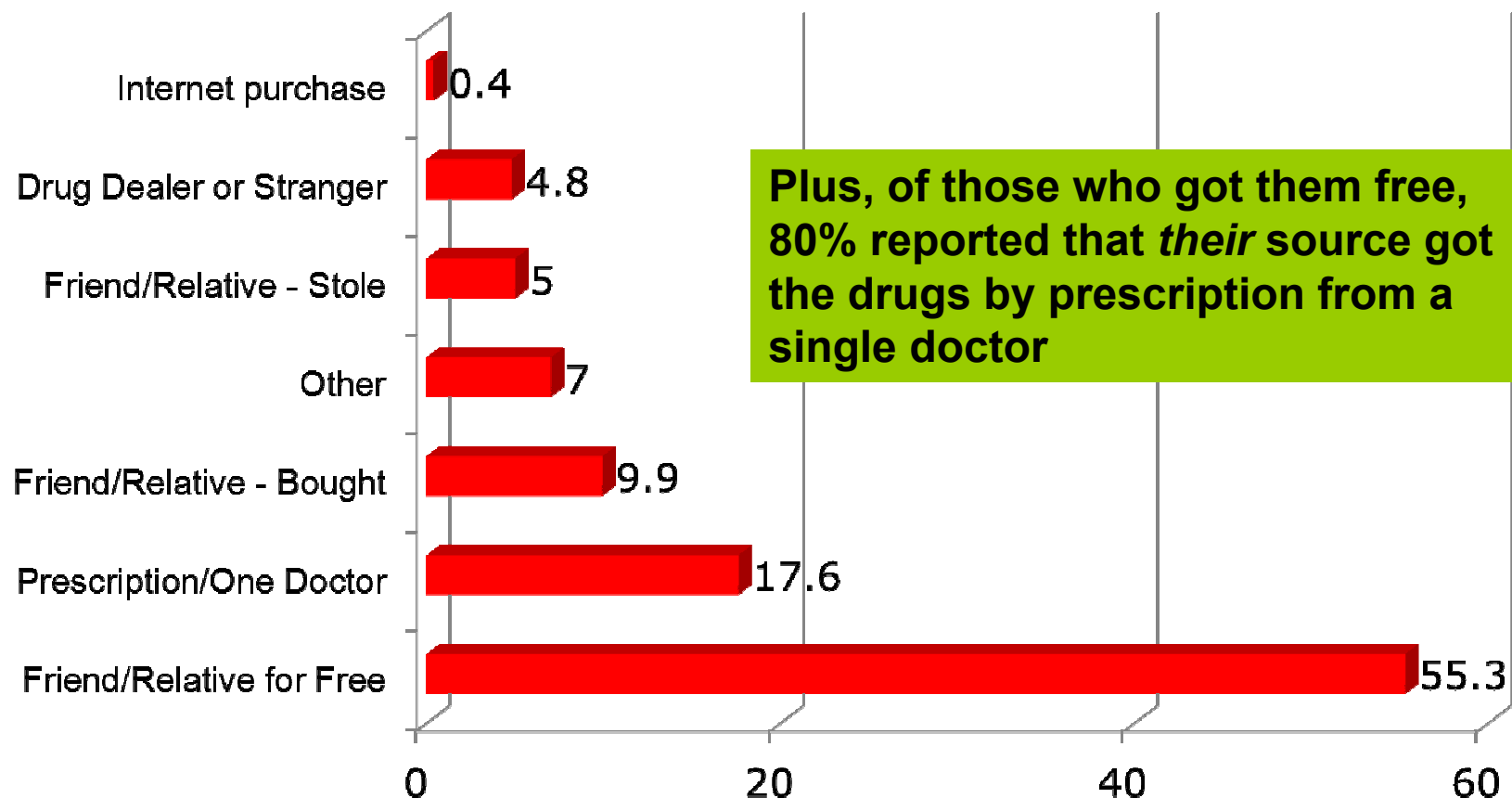
- Background
- Model Overview
- Model Testing
- Policy Analyses
- Limitations
- Future Research

Number of New Nonmedical Users of Opioid Analgesics (Thousands)



Source: SAMHSA (2006). Overview of findings from the 2005 National Survey on Drug Use and Health. (Office of Applied Studies, NSDUH Series H-30, DHSS Publication No. SMA 06-4194). Rockville, MD.

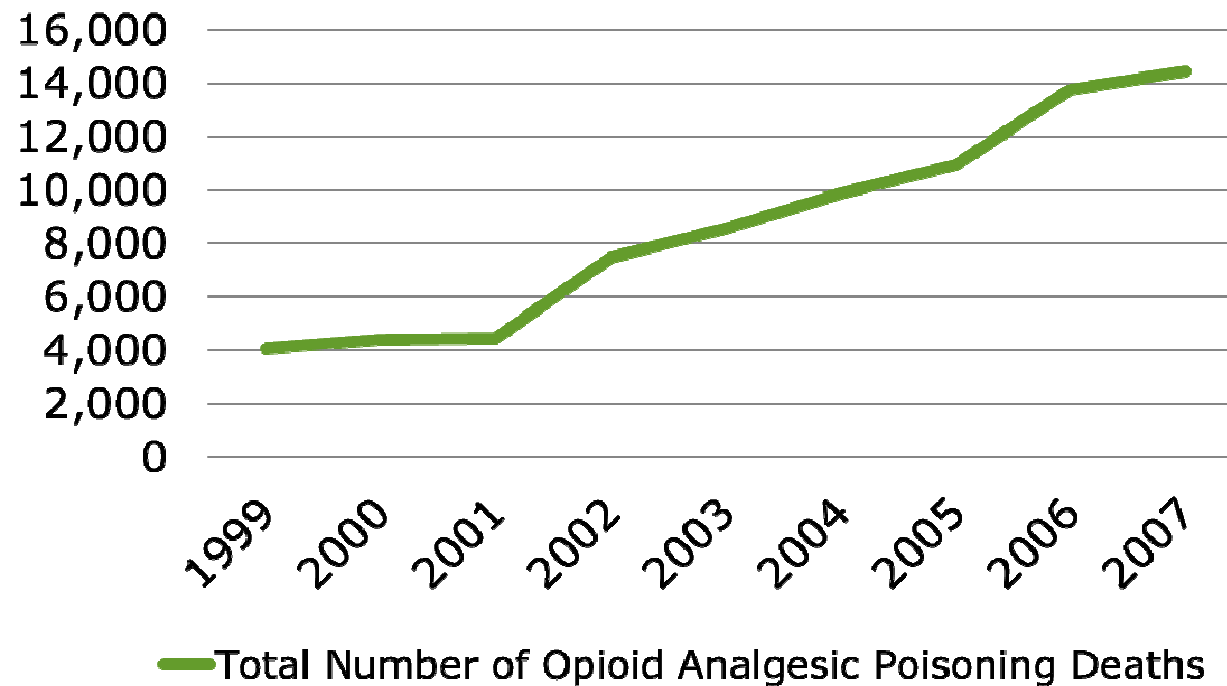
Sources of Opioids for Nonmedical Users (% of Respondents)



Internet = percent of people, not amount of drugs
Other = multiple doctors, forged prescription, pharmacy theft.

Source: Substance Abuse and Mental Health Services Administration. (2010). *Results from the 2009 National Survey on Drug Use and Health: Volume I. Summary of National Findings* (Office of Applied Studies, NSDUH Series H-38A, HHS Publication No. SMA 10-4586Findings). Rockville, MD.

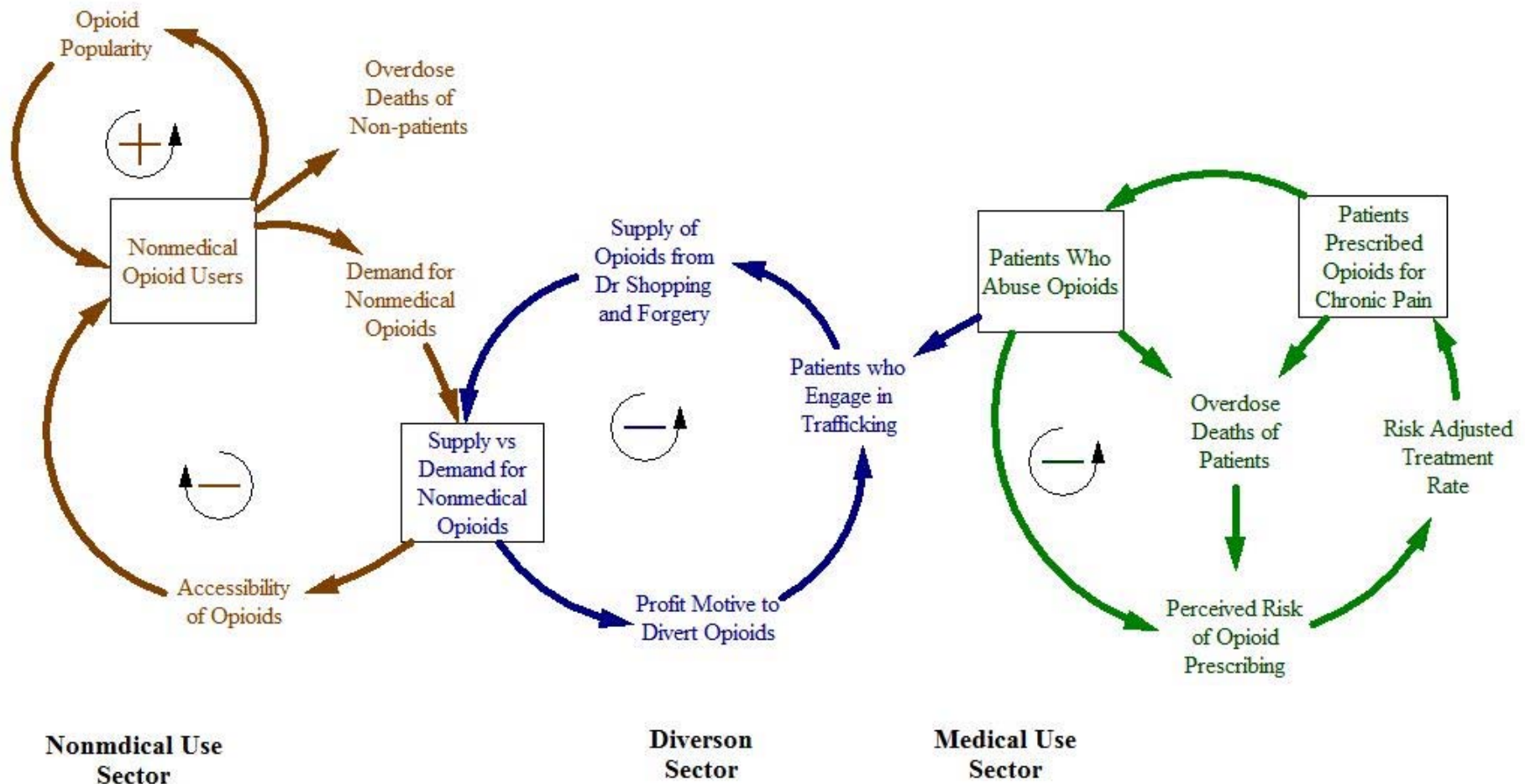
Total Number of Opioid Analgesic Poisoning Deaths in the United States



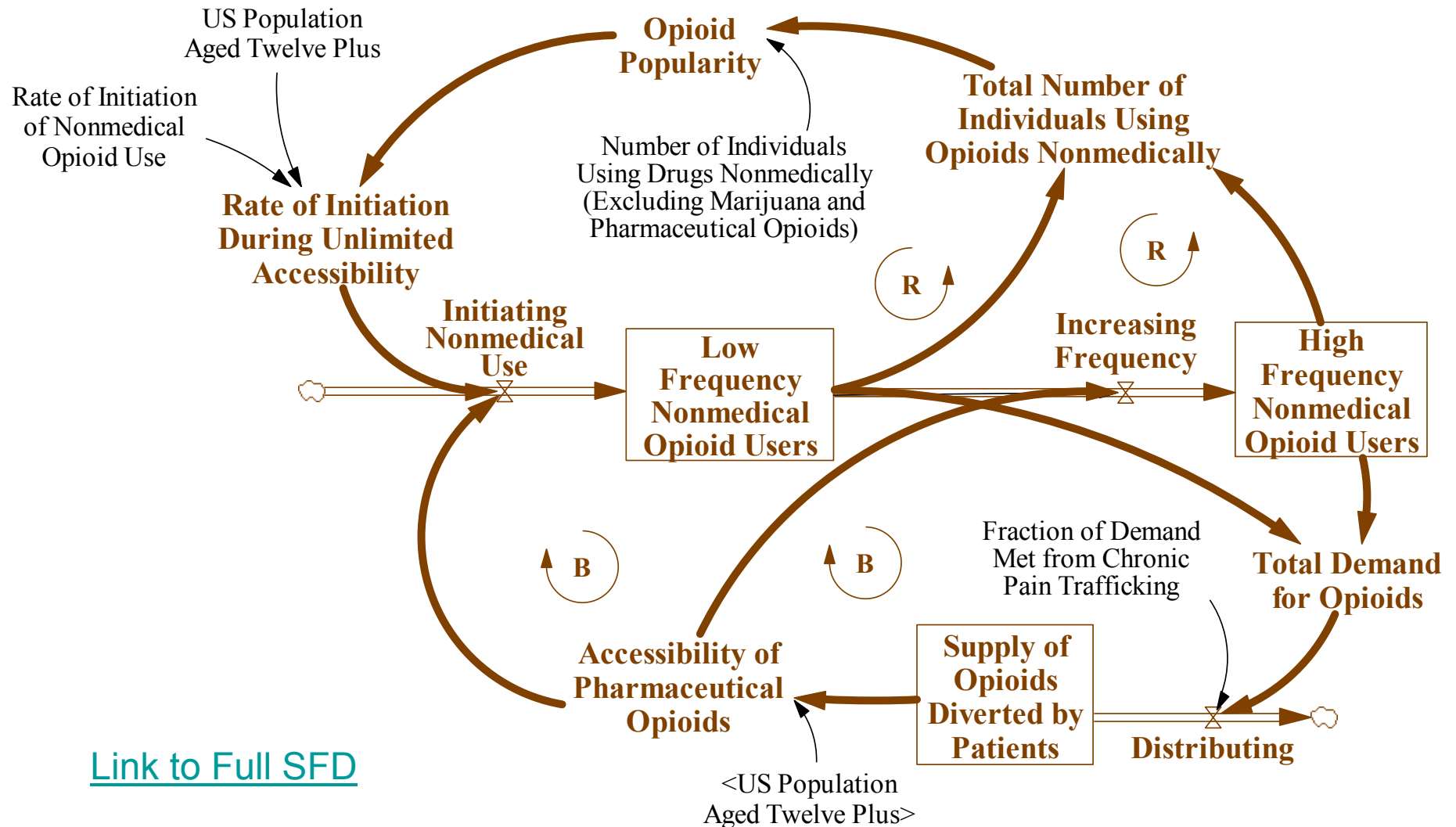
Are there feasible policy changes that could help to address this major health health concern?

Warner, M., Chen, L. H., & Makuc, D. M. (2009). Increase in fatal poisonings involving opioid analgesics in the United States, 1999–2006. NCHS Data Brief, 22.

Model Overview



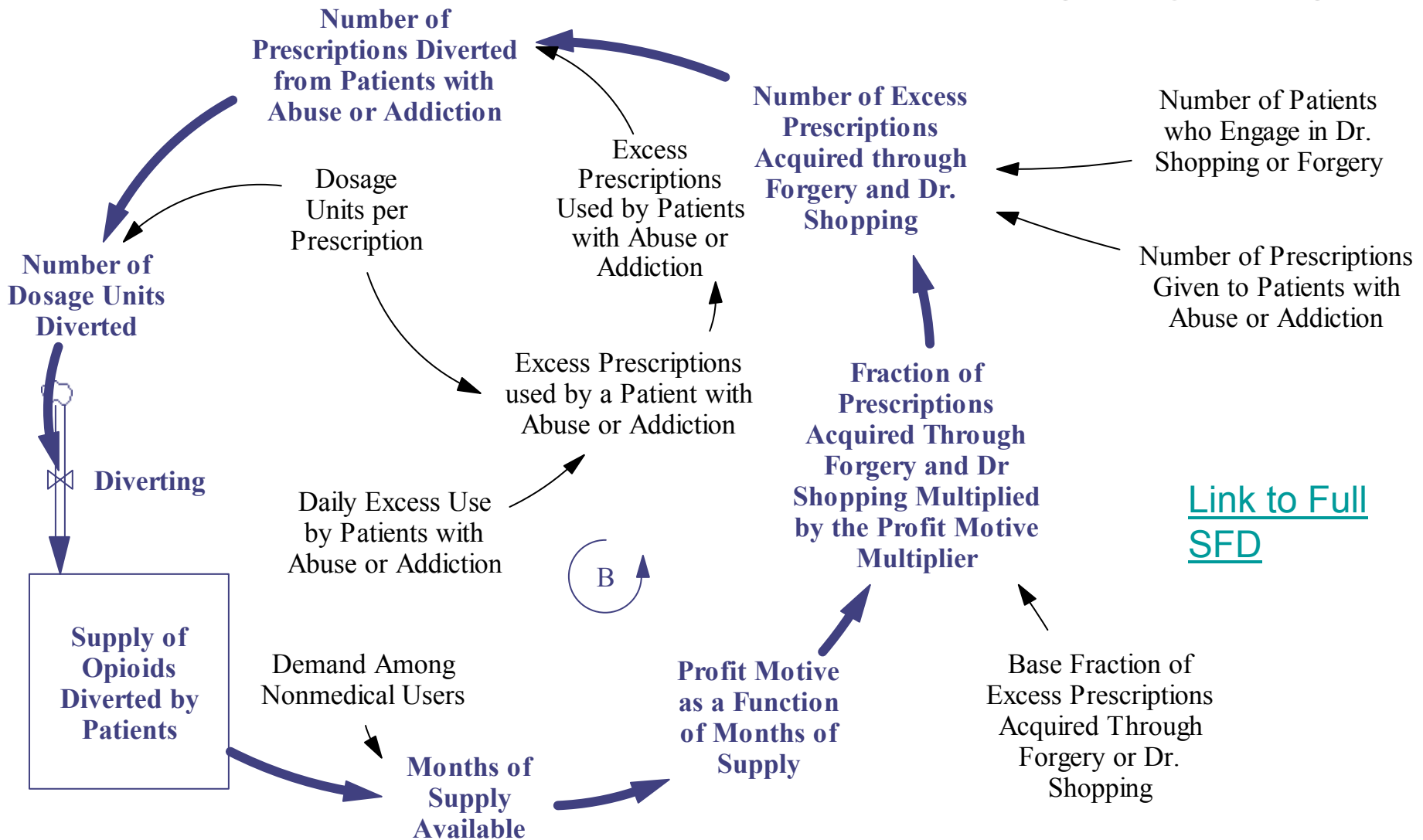
Nonmedical Use Sector










Data Support

Parameter			Support		
NONMEDICAL USE SECTOR			DIRECT	INDIRECT	PANEL
1	Base Level of Abuse Potential of Pharmaceutical Opioids	1.3			
2	Fraction of Demand Met from Chronic Pain Trafficking	.25			
3	Fraction of Low Freq Users who switch to High Freq	.06			
4	High Frequency User All-Cause Mortality Rate	.02			
5	High Frequency User Cessation Rate	.08			
6	Low Frequency User All-Cause Mortality Rate	.012			
7	Low Frequency User Cessation Rate	.15			
8	Number of Days of Nonmedical Use Among High Freq Users	220			
9	Number of Days of Nonmedical Use Among Low Freq Users	30			
10	Number of Dosage Units Taken per Day	2			
11	Overdose Mortality Rate for High Freq Nonmedical Users	.002			
12	Overdose Mortality Rate for Low Freq Nonmedical Users	.0002			
13	Rate of Initiation of Nonmedical Opioid Use	.006			
14	Table Function for the Impact of Limited Accessibility				
15	Table Function for the Number of Individuals Using Illicit Drugs Excluding Marijuana and Pharmaceutical Opioids				
16	US Population Ages 12 and Older				

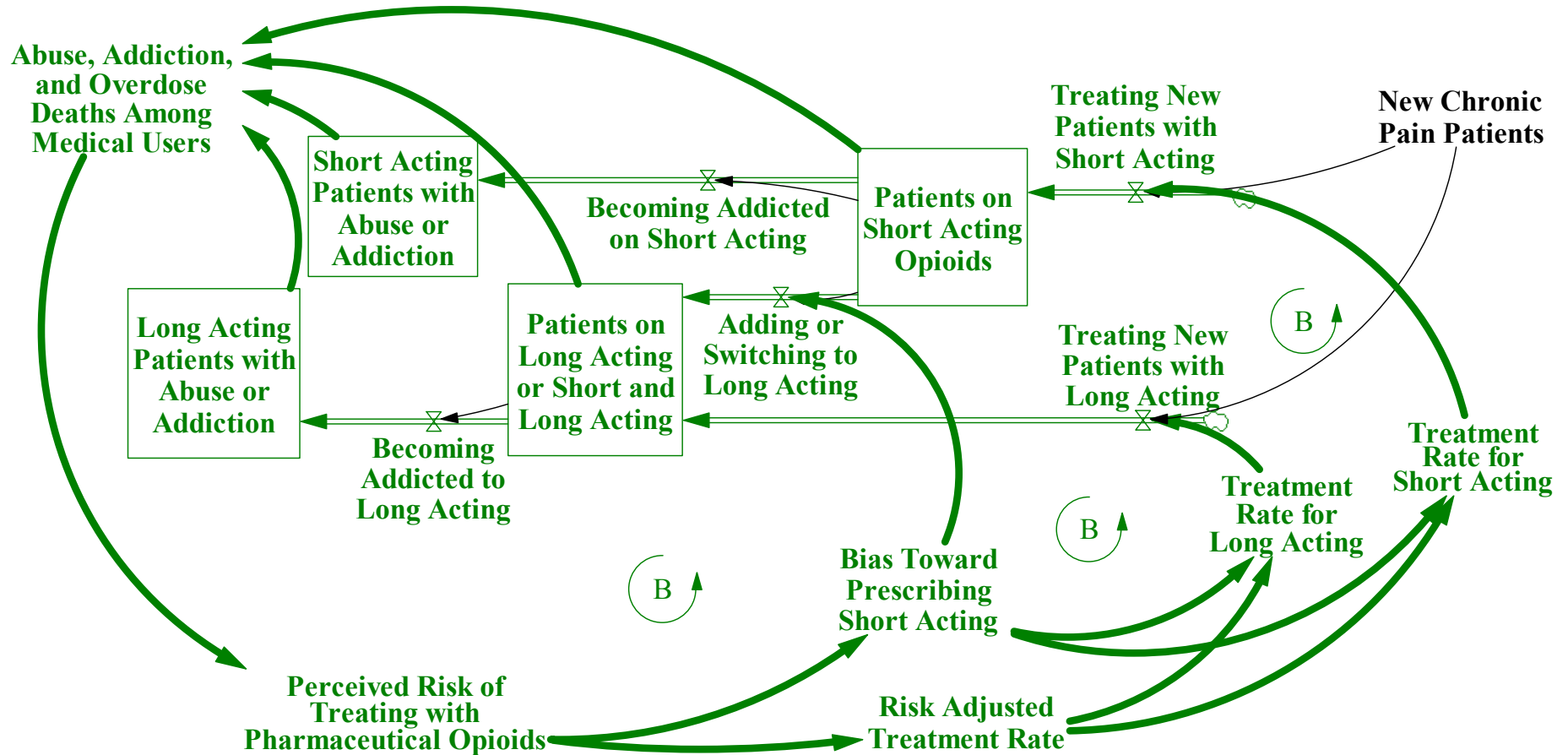
Diversion Sector



Data Support


















Parameter		Support		
DIVERSION SECTOR		DIRECT	INDIRECT	PANEL
1	Average Number of Dosage Units Per Opioid Prescription	86		
2	Average Number of Extra Dosage Units Taken/day Among Patients with Abuse or Addiction	1.5		
3	Fraction of those with Abuse/Addict who Engage in Dr. Shopping	.5		
4	Fraction of those with Abuse/Addict who Engage in Forgery	.4		
5	Number of Days of Extra Opioid Usage Among Patients with Abuse/Addiction	50		
6	Profit Multiplier	15		
7	Table Function for Effect of Perceived Risk on Extra Rx Obtained			

Medical Use Sector



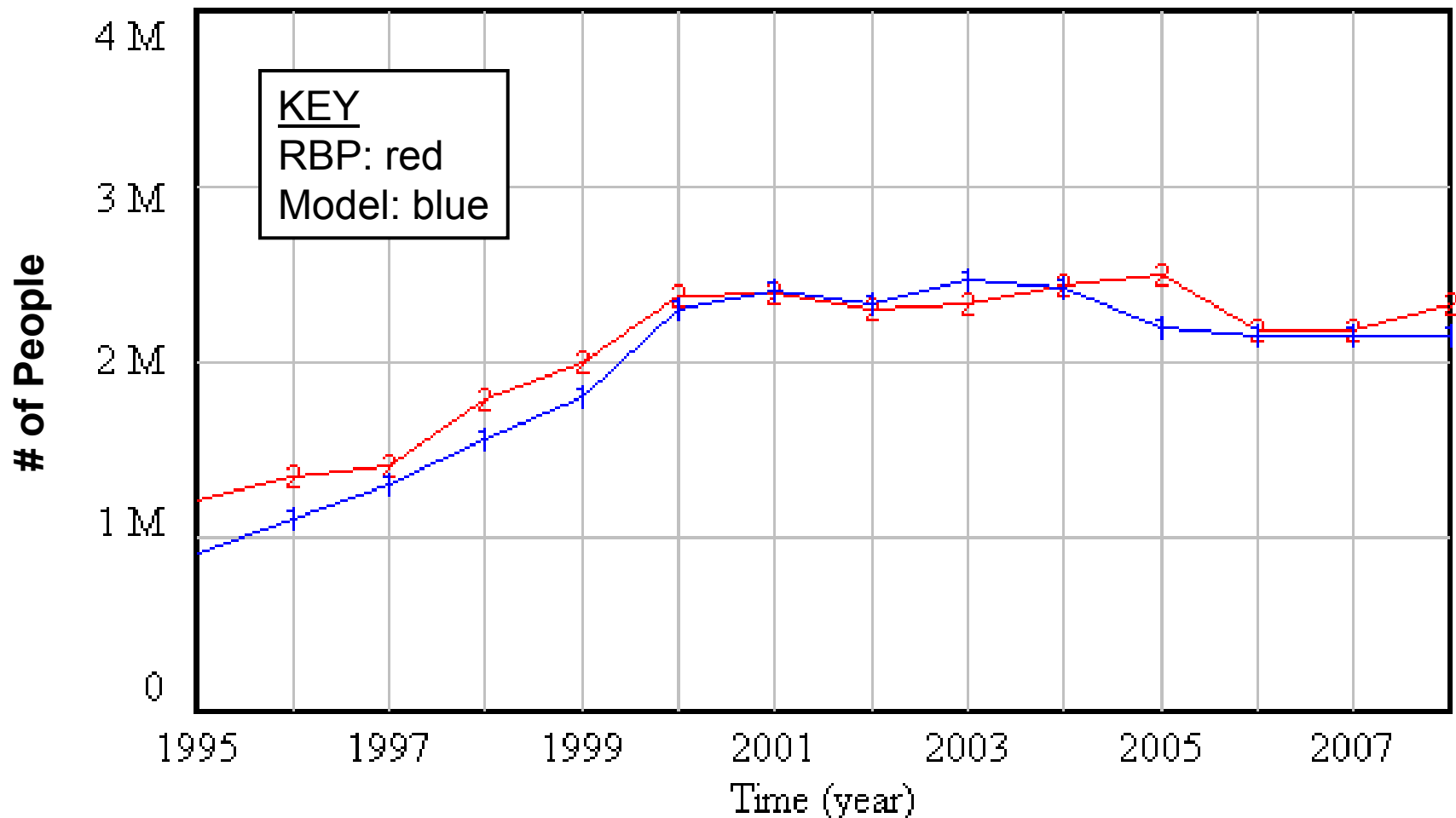
[Link to full SFD](#)

Data Support

Parameter		Support		
MEDICAL USE SECTOR		DIRECT	INDIRECT	PANEL
1	All Cause Mortality Rate for Patients on Long-acting Opioids .012			
2	All Cause Mortality Rate for Patients on Short-acting Opioids .01			
3	All Cause Mortality Rate for Patients with Abuse/Addiction .015			
4	Average Long-acting Treatment Duration (in years) 7			
5	Average Short-acting Treatment Duration (in years) 5			
6	Base Level of Abuse Potential for Pharmaceutical Opioids 1.3			
7	Base Rate for Adding or Switching (to Long-acting) .03			
8	Base Rate of Opioid Treatment for Pain .05-.23			
9	Base Risk Factor (degree Tx reduced in '95 due to risk) 1.3			
10	Diagnosis Rate for Chronic Pain .05-.15			
11	Overdose Mortality Rate for Patients Abusing Opioids .0015			
12	Overdose Mortality Rate for Patients on Long-acting .0025			
13	Overdose Mortality Rate for Patients on Short-acting .0005			
14	Rate of Addiction for Patients on Long-acting .05			
15	Rate of Addiction for Patients on Short-acting .02			
16	Table Function for Short-acting Bias (function of perceived risk)			
17	Tamper Resistance (baseline value) 1			

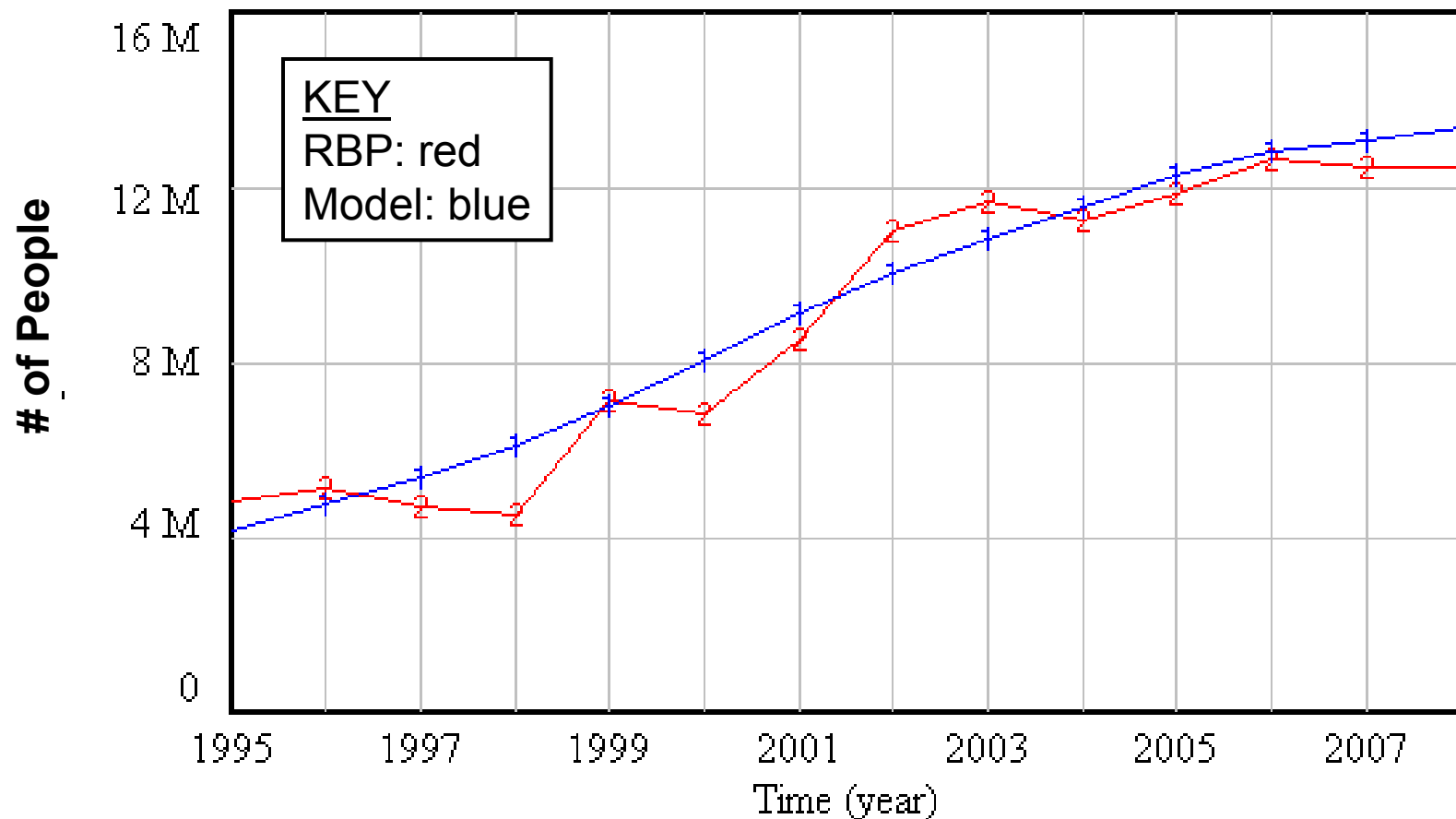
Model Testing: Model vs. Initiates RBP

Number of Initiates - RBP vs. Model Behavior



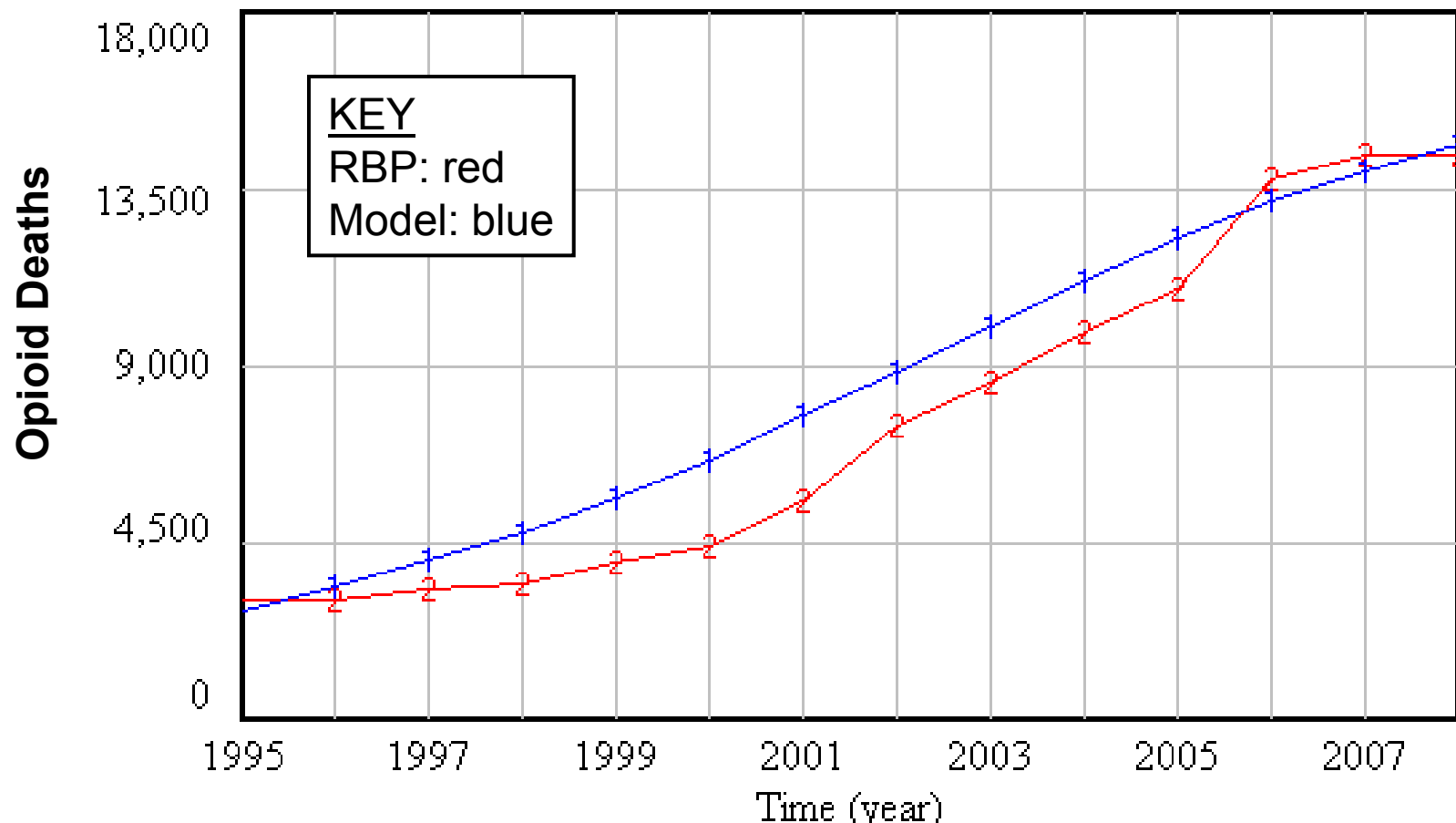
Model Testing: Model vs. Nonmedical Users RBP

Total Nbr of People Using Nonmedically vs. Reference Behavior



Model Testing: Model vs. Opioid Deaths RBP

Total Overdose Deaths vs. Reference Behavior

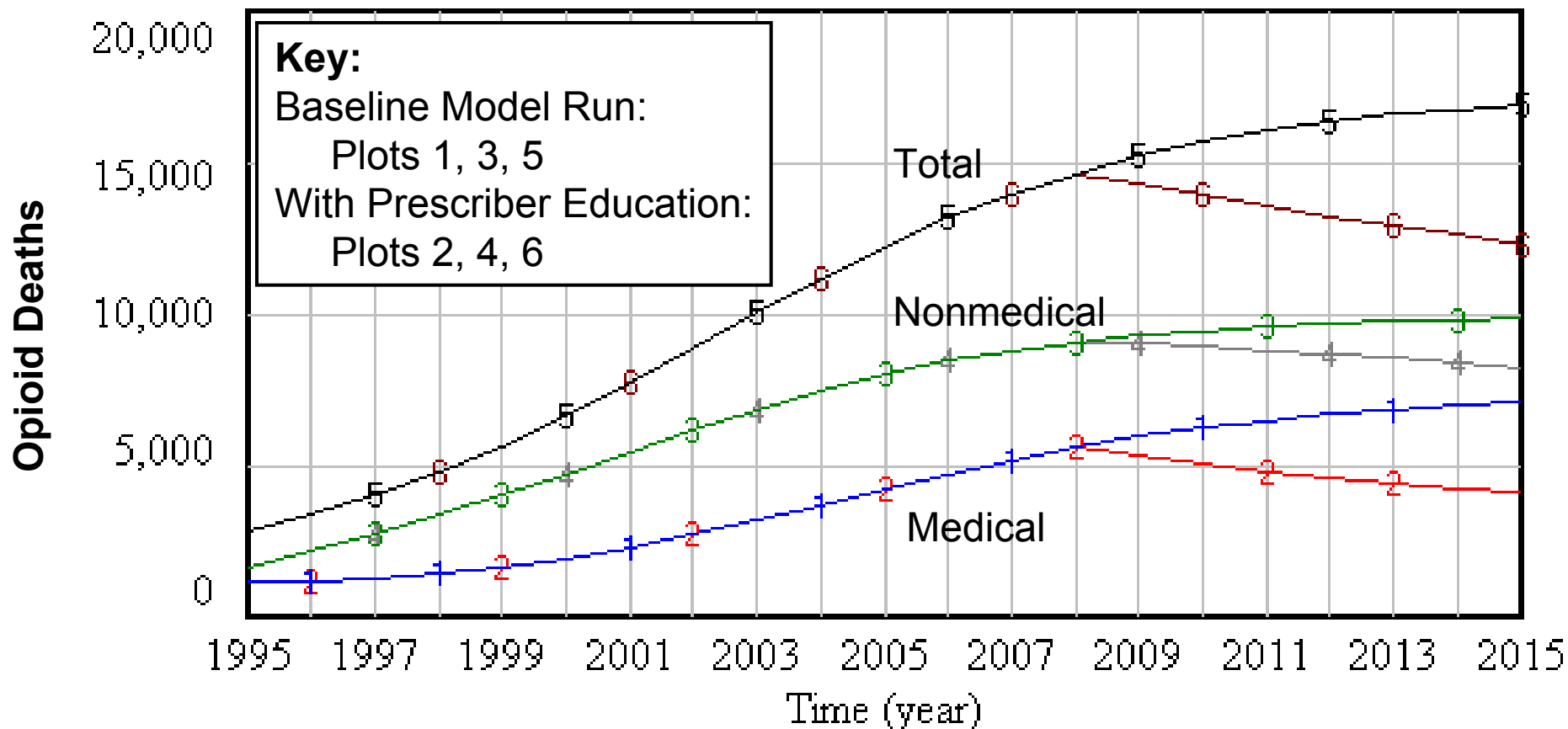


Interventions

- Prescriber Education
 - Simulated as halving the number of patients per year who become addicted to opioids
 - And doubling prescribers' perception of risk, which halved the fraction of pain patients prescribed opioids
- Popularity Suppression
 - Simulated as reducing the rate of initiation by half

Results: Prescriber Education

OD deaths per year

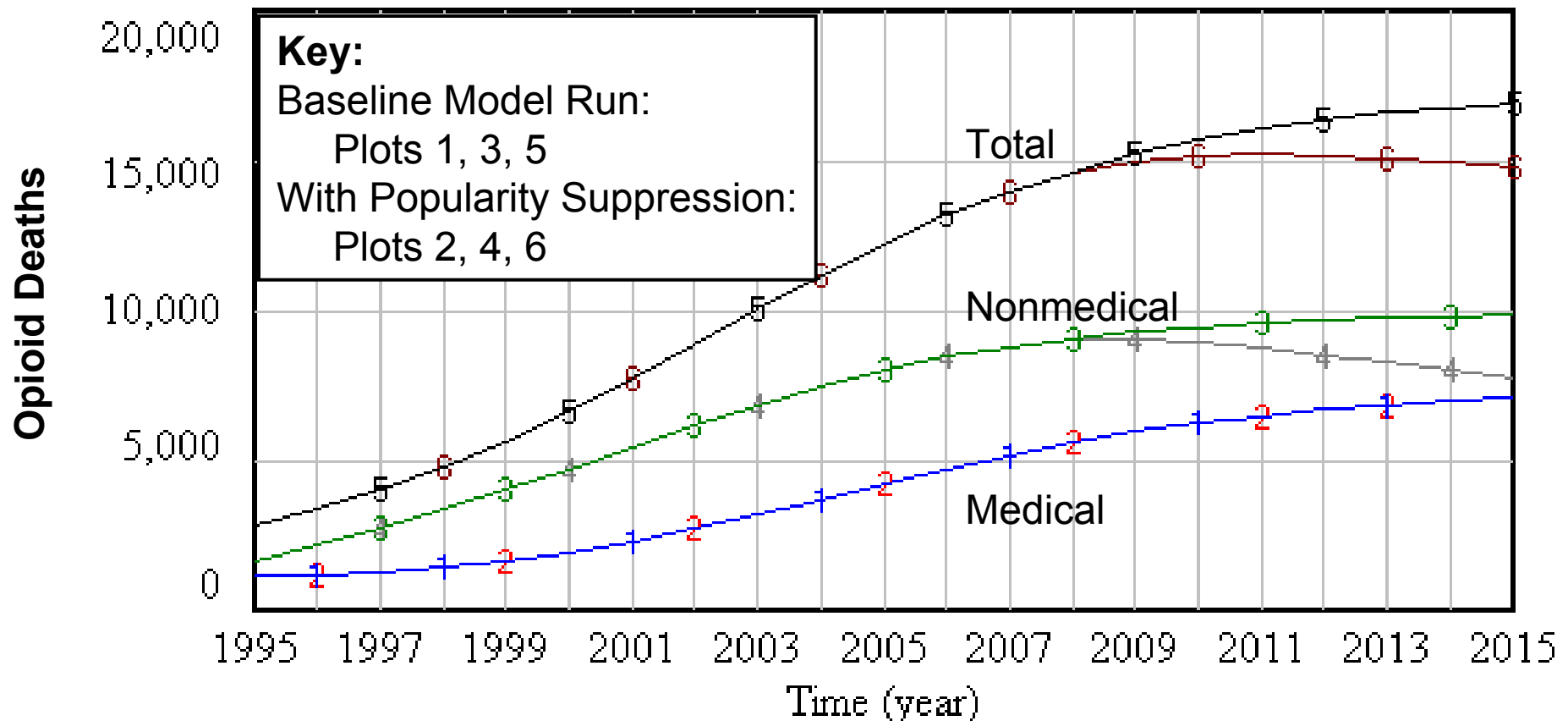


Implications of Prescriber Education Intervention

- Decreased overdose deaths among medical users because wary prescribers offer opioid therapy to far fewer individuals
 - But with possible denial of therapeutic treatment to some patients with legitimate chronic pain complaints
- Nonmedical overdose deaths also decrease
 - Due to fewer individuals with abuse or addiction who could engage in trafficking
 - And increased difficulty to obtain fraudulent prescriptions due to heightened prescriber risk perception

Results: Popularity Suppression

OD deaths per year



Implications of Popularity Suppression Intervention

- Sharply reduced nonmedical initiation and overall population of nonmedical users
- Substantially reduced nonmedical and total overdose deaths
- Once the nonmedical user population declines, positive feedback leads to virtuous cycle of decreased use and decreased popularity, which further reduces use and associated deaths
- Medical usage-related deaths not impacted
- Pain treatment not inhibited

Limitations

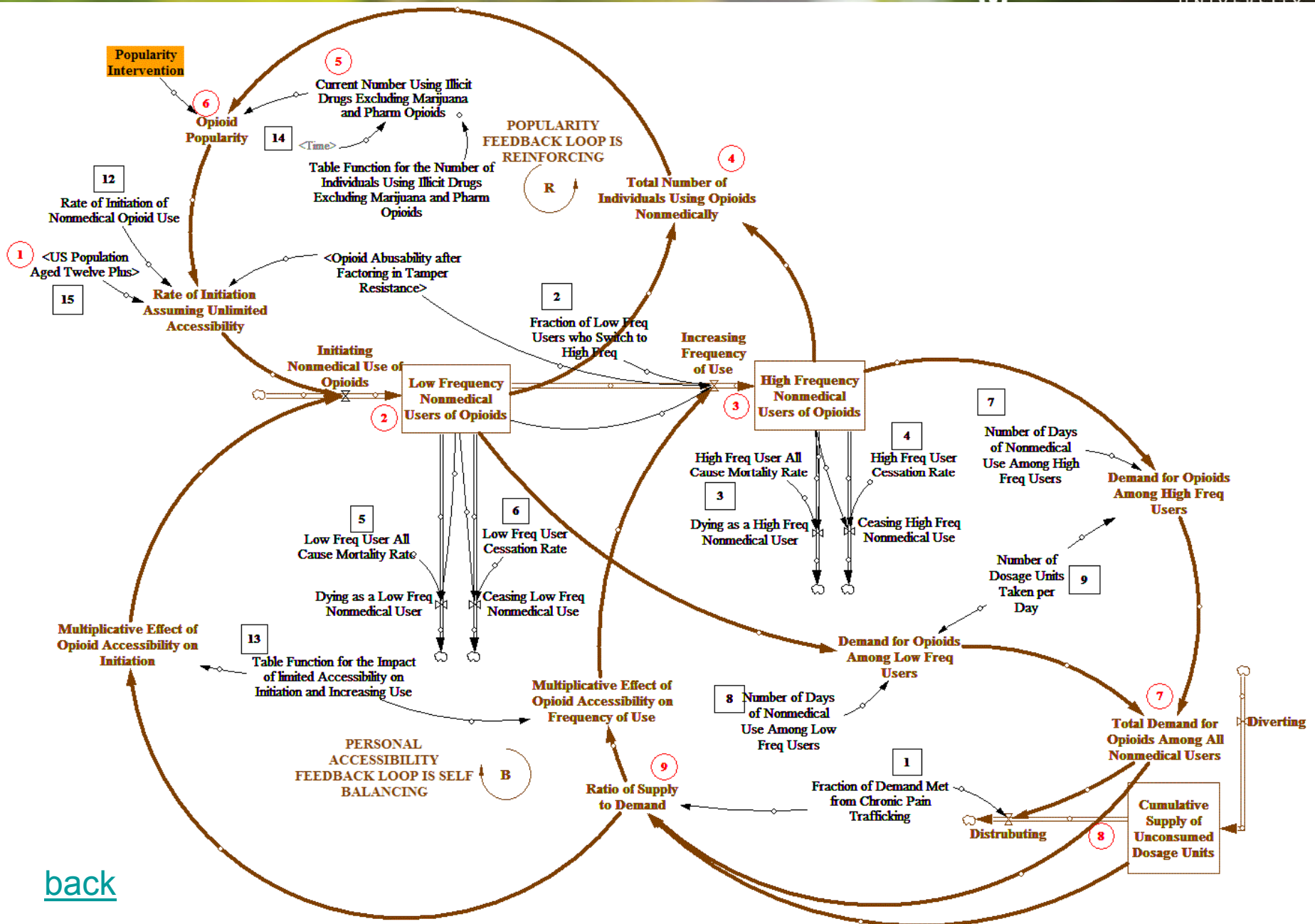
- Spotty empirical support
- Focused on trafficking versus interpersonal sharing
- Excluded consideration of key issues:
 - Effects of poly drug misuse
 - Treatment alternatives
 - Payor policies (formulary and co-pays)

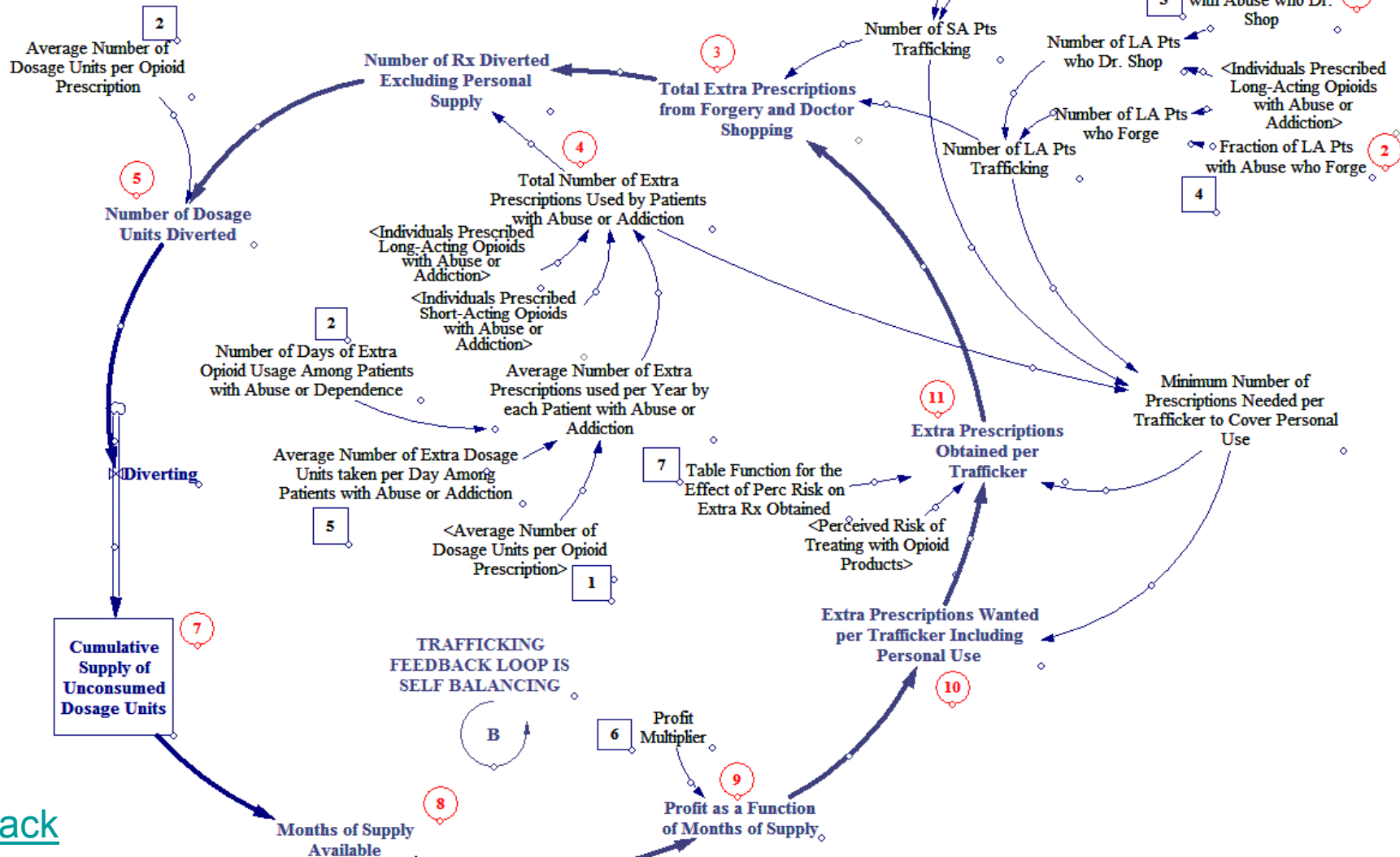
Future Research

- Use of Monte Carlo analyses to better gauge impacts of parameter uncertainty
- Improve model regarding interpersonal sharing
- Create models at the individual behavior level

Acknowledgments

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