

# OPIOID EPIDEMIC

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## THE OPIOID CRISIS

Systems Spring 2020

WICKED PROBLEMS



TAKE 10 TABLETS BY MOUTH UP TO 3 TIMES DAILY

**CARNEGIE MELLON UNIVERSITY HEALTH  
SERVICES**

**04935467 - 64430**



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# INTRODUCTION

Opioids are substances that act on opioid receptors to produce morphine-like effects. Some opioids are produced commercially and have gained popularity in medical contexts for their ability to manage pain, while others are illegal and sold on the street. Both are extremely addictive and physically damaging when abused.

Our team came into this project wanting to focus on the New England opioid epidemic because multiple members of our group are local to that area. As we researched, however, we found that our scope grew very fast, and soon we could not reconcile such a narrow focus. Our end product is a map that reflects not only the depth of our research but the also the range of our consideration.

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# OPIOID CRISIS

Joseph Kim • Maggie Ma • Teresa Lourie • Elysha Tsai • Zimmy Kang

## HISTORY

### Setting the Scene

#### Prevalence Context

In the 1980s, pain became increasingly recognized as a condition that required appropriate treatment. The US began to see remarkable pain-management success, which increased the demand for painkillers. In the 1990s, the pharmaceutical industry began to market painkillers with controlled substances. Before the opioid epidemic, controlled substances were prescribed mainly for chronic pain such as pain relief after surgery or to relieve advanced cancer or other terminal patients. Hypothesis: We also think opioids might be used for these indications more prevalently than they should be.

#### System Vulnerability

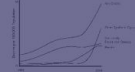
The structure of the healthcare system in the United States also contributed to the development of the epidemic. Because many doctors are on-site outside their job benefit, they are incentivized to prescribe controlled substances, which can increase the dependence of some individuals. Prescriptions are also cheap in the short term, and patients' health insurance often covers pain medications but not pain-management programs such as physical therapy.

#### Risk & Socio-Economic Affiliates

Public health has seen the wider marketing of pharmaceuticals, including the development of a drug pipeline or drug market that is increasingly dominated by pharmaceutical companies and medical societies. The industry's financial incentives are a major driver for the epidemic. Key factors include: an emphasis on the expansion of the US drug market, an emphasis on the expansion of the US drug market, and an emphasis on the expansion of the US drug market.

#### Characterize Opioid Epidemic

##### Opioids by Type



### Opioid Epidemic Occurred in Three Waves:

#### First Wave (1995)

**Prevalence Context**  
A sharp increase in the prescribing of rapid-acting opioids led to the realization of the epidemic. The medical market was dominated by pharmaceutical companies and medical societies. The industry's financial incentives are a major driver for the epidemic.

#### Second Wave (2010)

**Problem**  
Key factors in the second wave include: an emphasis on the expansion of the US drug market, an emphasis on the expansion of the US drug market, and an emphasis on the expansion of the US drug market.

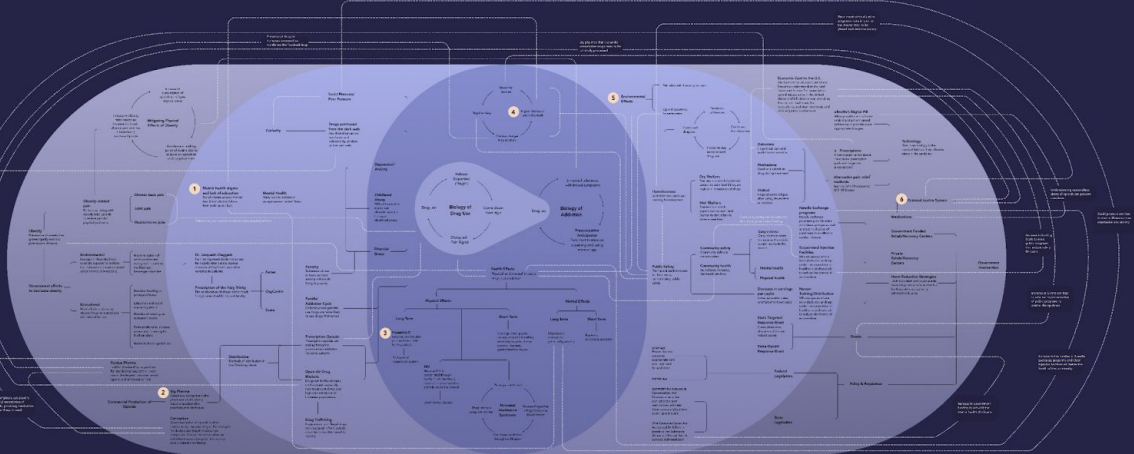
#### Third Wave (2015)

**Systemic Context**  
The epidemic has been characterized by an increase in the prescribing of rapid-acting opioids, which has led to the realization of the epidemic. The medical market was dominated by pharmaceutical companies and medical societies. The industry's financial incentives are a major driver for the epidemic.

Opioids are defined as drugs/heroin that are largely known for reducing severe pain but can become highly addictive. Some types are completely legal and are prescribed by a doctor in various amounts (codeine, fentanyl, morphine, etc.), while others, like heroin, are illegal. These types of drugs have gained popularity in medical contexts for their ability to manage pain caused by physical injury, trauma, and other illnesses, however, when self-administered over long periods of time, patients become at great risk for addiction. Over the course of the last few decades, the more addiction epidemics in United States history has emerged, demonstrating a sharp increase in the number of opioid-related deaths per year, especially in areas such as Massachusetts and West Pennsylvania. As governmental companies began to promote the use of opioids for non-emergency-related pain with little regard for research on the risks, more and more people became addicted after being legally prescribed opioids by their doctors.

The opioid-related mortality rate rose and became more commonly tied with heroin and synthetic drugs such as fentanyl in the recovery and fluctuations of the epidemic. Although efforts have been made by the U.S. government to prevent overprescription of opiates and teach hospitals regarding prevention, the opioid crisis is still considered a wicked problem. Due to the widespread nature of the issue and this way it branches into the different sectors of STEEP (social, technological, economic, environmental, political), there are no all-encompassing solutions that can completely solve the problem. Our group did not only aim to illustrate the interconnectedness between each of the sectors, effects, and feedback loops in our problem, but also suggests leverage points that could be introduced to help manage the crisis. These intervention methods introduce ideas our team has generated in efforts to address individual issues at different levels in the wicked problem.

## OPIOIDS BY NUMBERS



INPUT → OUTPUT

**1**

**PROBLEM**  
The epidemic is characterized by an increase in the prescribing of rapid-acting opioids, which has led to the realization of the epidemic. The medical market was dominated by pharmaceutical companies and medical societies. The industry's financial incentives are a major driver for the epidemic.

**PREFERRED FUTURE**  
The epidemic is characterized by an increase in the prescribing of rapid-acting opioids, which has led to the realization of the epidemic. The medical market was dominated by pharmaceutical companies and medical societies. The industry's financial incentives are a major driver for the epidemic.

**INTERVENTION METHODS**  
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**POTENTIAL NEGATIVE EXTERNALITIES**  
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**PREFERRED FUTURE**  
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**LEGAL PRESCRIPTIONS**  
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**PREFERRED FUTURE**  
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**NEEDLE EXCHANGE PROGRAMS**  
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**PREFERRED FUTURE**  
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**INCREASE IN JOB OPPORTUNITIES**  
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**WASTEWATER FILTERING**  
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**PREFERRED FUTURE**  
The epidemic is characterized by an increase in the prescribing of rapid-acting opioids, which has led to the realization of the epidemic. The medical market was dominated by pharmaceutical companies and medical societies. The industry's financial incentives are a major driver for the epidemic.

**DECOMMUNALIZATION**  
The epidemic is characterized by an increase in the prescribing of rapid-acting opioids, which has led to the realization of the epidemic. The medical market was dominated by pharmaceutical companies and medical societies. The industry's financial incentives are a major driver for the epidemic.

**POTENTIAL NEGATIVE EXTERNALITIES**  
The epidemic is characterized by an increase in the prescribing of rapid-acting opioids, which has led to the realization of the epidemic. The medical market was dominated by pharmaceutical companies and medical societies. The industry's financial incentives are a major driver for the epidemic.

### KEY

- PERSONAL
- COMMUNAL
- NATIONAL
- INTRACONNECTIONS
- INTERCONNECTIONS
- LEVERAGE POINTS

# INITIAL RESEARCH



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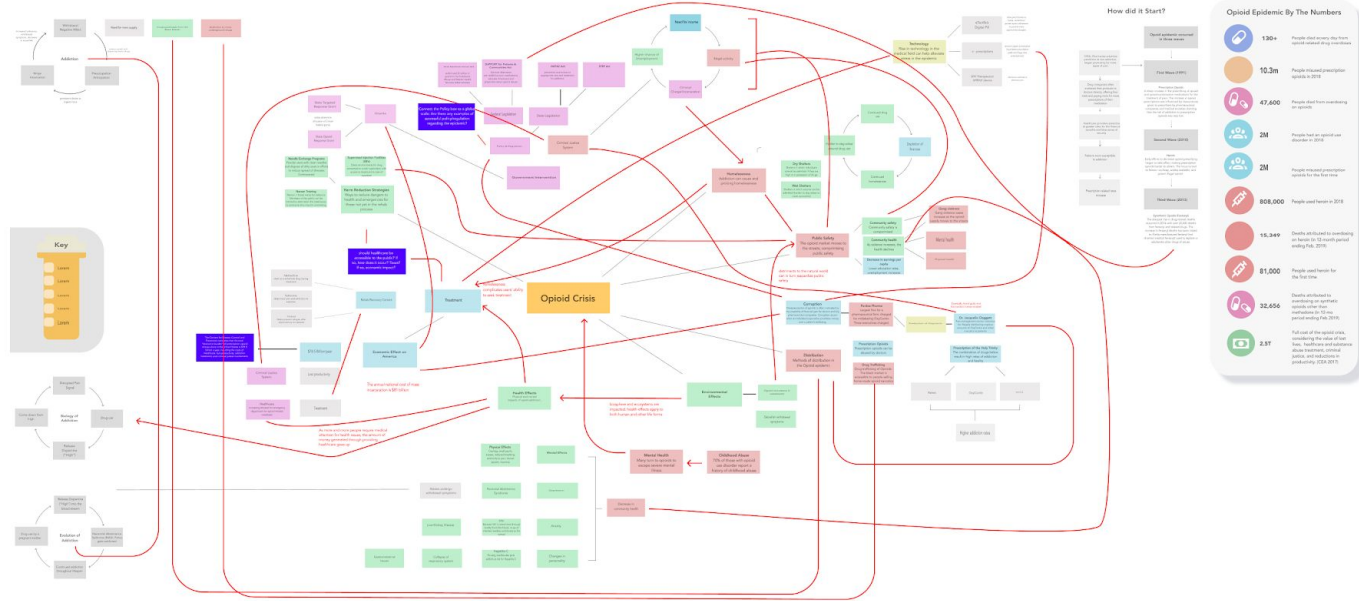
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# INITIAL RESEARCH



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# DESIGN

## Lenses of Analysis Considerations

While we were doing our research, we noticed different ways in which the research could be organized.

Past > Present > Future

Cause > Effect > Solution

Person > Community > State > Companies > Government

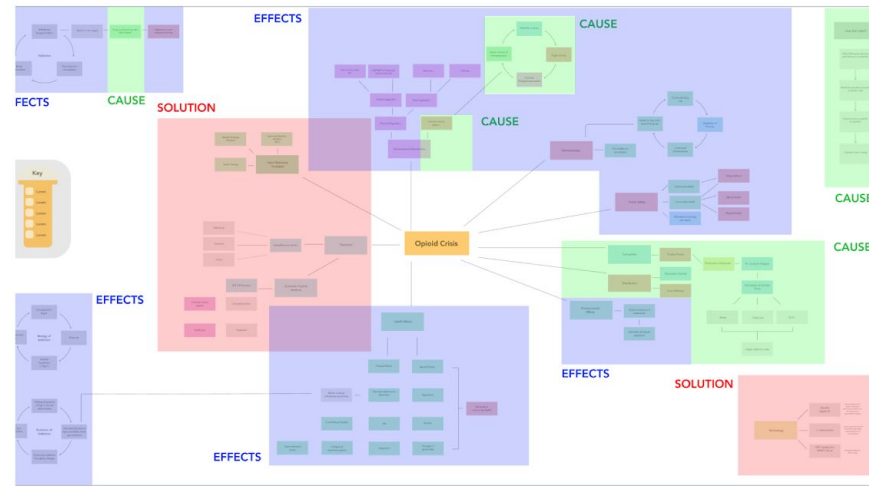
## Representation of Interconnections

We also started thinking about ways to demonstrate the complexity of the interconnections we made between subcategories.



# DESIGN

## Organizing Research into Categories



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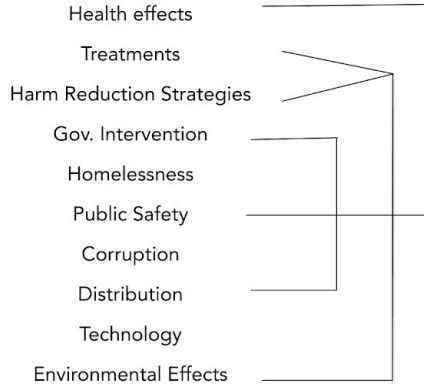
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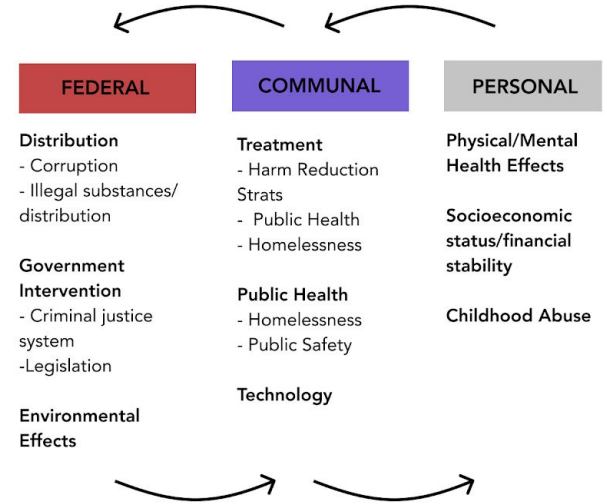
# DESIGN

## Refining Subcategories to Finalize Lens of Analysis



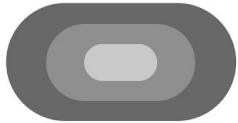
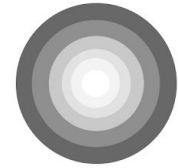
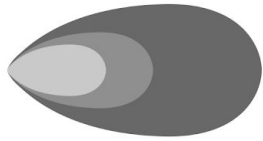
## Narrowed Down Subcategories

- Treatment**
  - Harm Reduction Strats
  - Public Health
  - Homelessness
- Public Health**
  - Homelessness
  - Public Safety
- Technology**
- Distribution**
  - Corruption
  - Illegal substances/distribution
- Government Intervention**
  - Criminal justice system
  - Legislation
- Environmental Effects**



# DESIGN

## Shape Considerations



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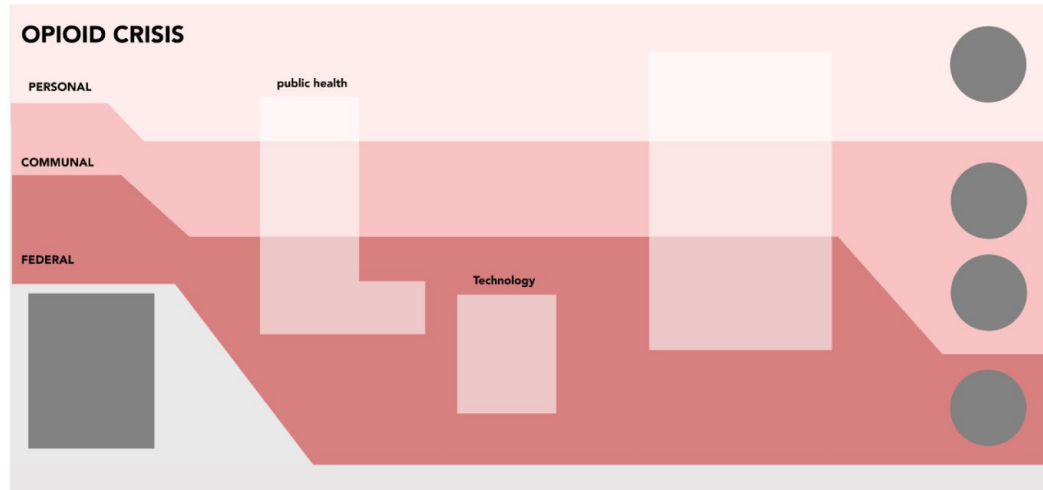
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## Incorporating Subcategories



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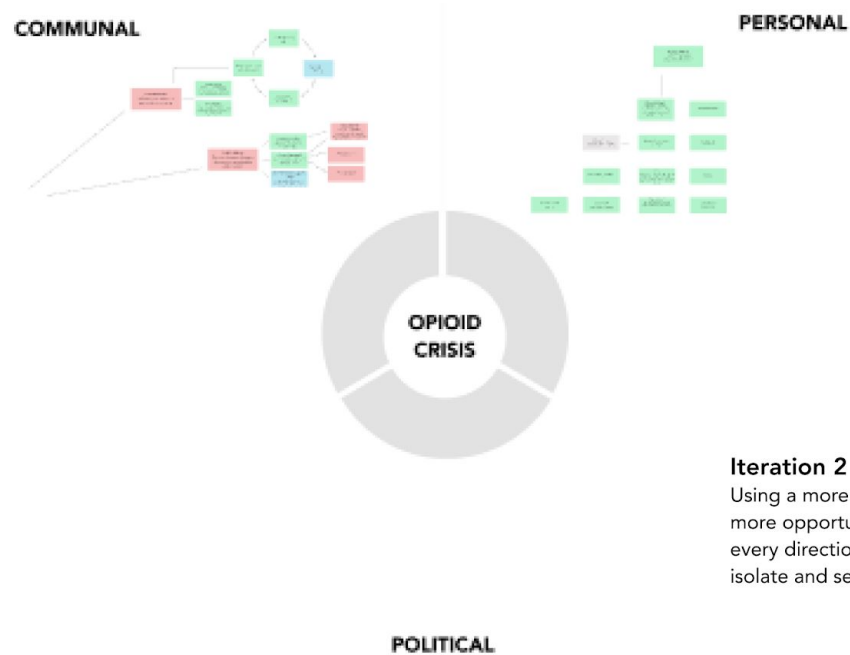
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## Iteration 2 Concentric

Using a more concentric layout so we have more opportunities to branch all topics in every direction. However, this seemed to isolate and separate each category.

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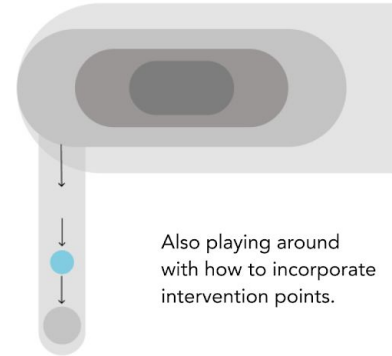
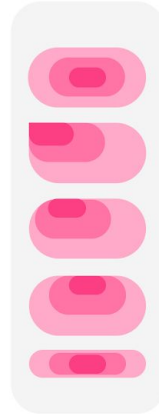
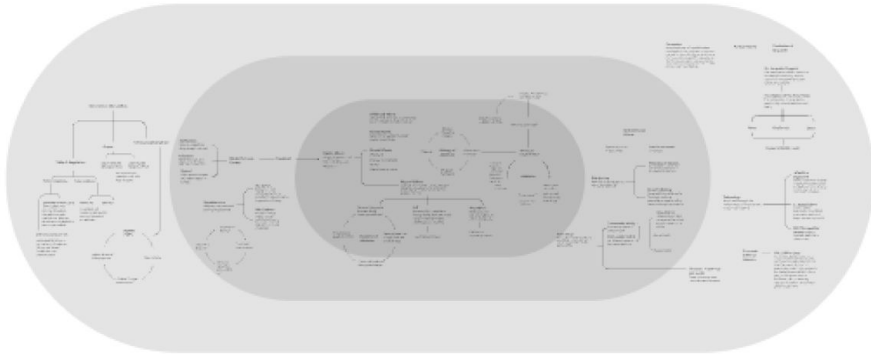
## OPIOID CRISIS



## HISTORY



## OPIOIDS BY NUMBERS

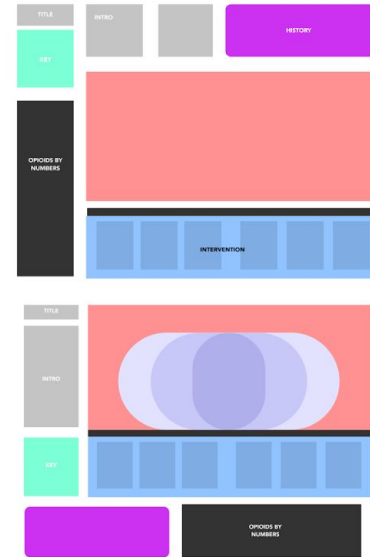
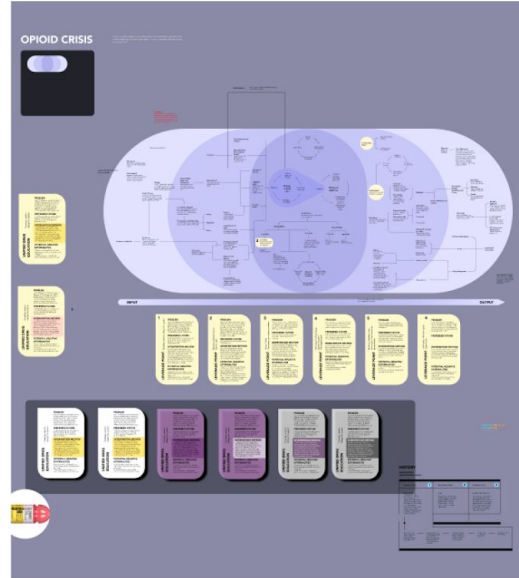
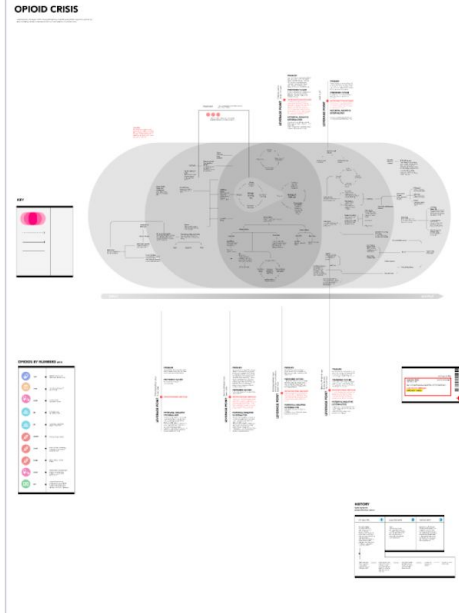


## Iteration 3: Pill Shape

Using a pill shaped layout so we have more opportunities to branch all categories in every direction, as well as show scalar complexities in our map. We also wanted to better visualize input and output.

Also playing around with how to incorporate intervention points.

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# DESIGN

## LEVERAGE POINT

Behavioral Feedback Loops  
Information Flow Structures  
System Rules

**PROBLEM**  
The consequences of illicit substances perpetuate stigma around addiction and reinforce corrupt cycles within the criminal justice system.

**PREFERRED FUTURE**  
A world where addiction is seen as an illness rather than a weakness, and getting help is accessible and free of shame. People can come forward about their struggle without fear of legal prosecution.

**INTERVENTION METHOD**  
Diversify the prosecution and use of ILD offenders. In 2005, Portugal took a major step by decriminalizing all drugs. This drastic measure paved the way for a 2015 record low of the lowest overdose death rates in Europe.

**POTENTIAL NEGATIVE EXTERNALITIES**

- Initial spike in drug use (as was seen in Portugal)
- Controversy may polarize political parties and create societal unrest

**3**  
**PROBLEM**  
Opioid crises are a higher risk of overdose than other substances. The general population is unaware of the danger of drug use, but they also perpetuate the stigmatized discourse that feeds this crisis.

**PREFERRED FUTURE**  
A well-informed public that understands and avoids the risks of drug use, but shows sympathy toward those struggling with Opioid Use Disorder.

**INTERVENTION METHOD**  
A unified drug education system that is implemented in schools and job training networks would help improve the quality of common knowledge about this crisis.

**POTENTIAL NEGATIVE EXTERNALITIES**

- Parents may be uncomfortable with their children being exposed to these topics at too early an age
- Could be deemed as "inappropriate" similar to the way that sex education is seen

**PROBLEM**  
Lack of knowledge surrounding the nature of addiction creates confusion in the general population about the dangers of drug use. Not only do those mischaracterizing substances as the stigma that alienates addicts, but they also perpetuate the stigmatized discourse that feeds this crisis.

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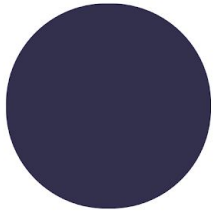
**INTERVENTION METHOD**  
A unified drug education system that is implemented in schools and job training networks would help improve the quality of common knowledge about this crisis.

**POTENTIAL NEGATIVE EXTERNALITIES**

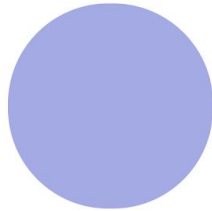
- Parents may be uncomfortable with their children being exposed to these topics at too early an age
- Could be deemed as "inappropriate" similar to the way that sex education is seen



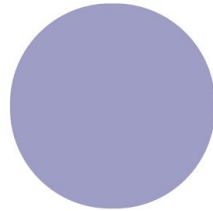
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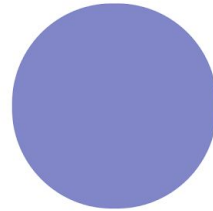
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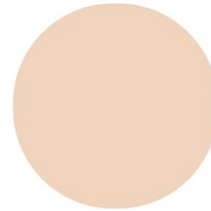
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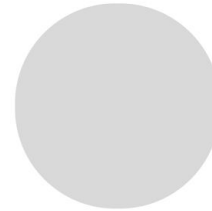
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# OPIOID CRISIS

Joseph Kim • Maggie Ma • Teresa Lourie • Elysha Tsai • Zimny Kang

## HISTORY

### Setting the Scene

#### Pain-Relieving Medications

In the 1980s, pain became increasingly recognized as a condition that required ongoing treatment. The US began to see remarkable pain-management work, which improved the lives of patients with controlled substance. Before the 1990s epidemic, controlled substances were prescribed mainly for short-term issues such as pain relief after surgery or to relieve advanced cancer or terminal patients. Hypothetically, this also meant controlled substances were less addictive than some previous thought began to take root.

#### System Vulnerability

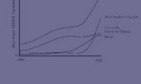
The structure of the healthcare system in the United States also contributed to this overprescription of opioids. Because many doctors are on-leave specialists, they are benefit financially by prescribing the number of controlled substances that they can bill for. This creates a disincentive to the overprescription of pain medications. Prescription opioids are also cheap in the short term, and generic, high-dose pain pills often contain pain medications but low pain-management approaches such as physical therapy.

#### Racial & Socio-Economic Attitudes

Public Perceptions became the main barrier of controlled substance use. The overprescription of a drug would be an obvious driver on the financial side. The industry suggested doctors who were "over-prescribing" had more of a stigma to be an enforcer for addiction. "My friend's father, an orthopedic and sportsdoc at a large hospital in New York City, "there was a definite stigma attached to that."

#### Overdose Death Rates (rising)

#### Opioids by Type



### Opioid Epidemics Occurred in Three Waves:

#### First Wave (1991)

##### Prevalence Opioids

A long timeline to the increasing of opioid use, which contributed to the prevalence of the epidemic. The increase in opioid prescriptions, particularly in the form of controlled substances, pharmaceutical companies and medical societies during the 1990s is a reflection of a system going very wrong.

#### Second Wave (2010)

##### Painkillers

Early efforts to decrease opioid prescribing further by state officials, making prescribers' records more visible. Doctors' records, however, are often, highly variable, and patient record-based.

#### Third Wave (2013)

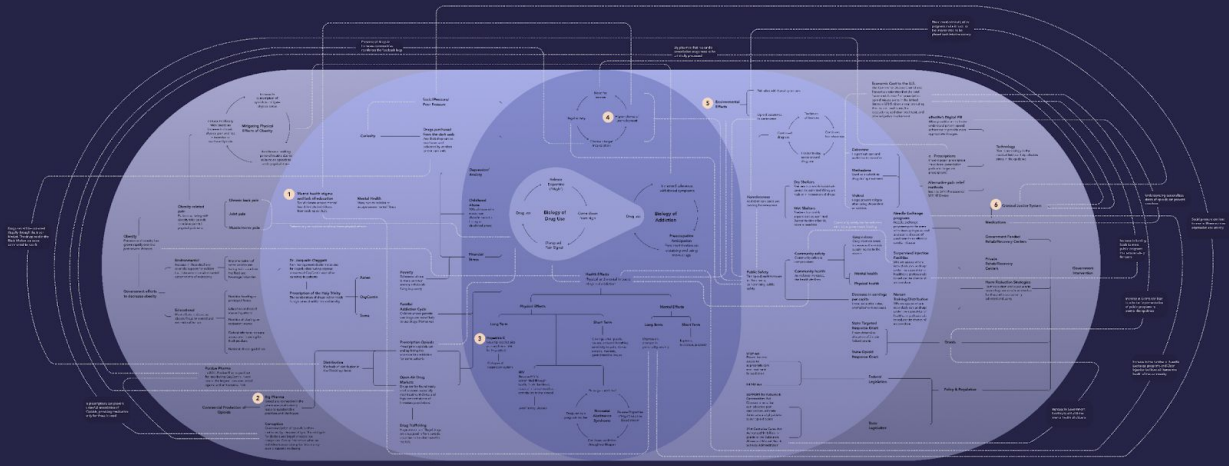
##### Synthetic Opioids (#opioids)

The decrease in pharmaceutical drugs, especially in 2010 with over 20,000 deaths from heroin and overdose drugs. The increase in synthetic opioids, however, led to the rise of medical benefit funds to reduce or eliminate chronic drug use.

Opioids are defined as drugs/meds that are largely known for reducing severe pain but can become highly addictive. Some types are considered legal and are prescribed by a doctor in various amounts (heroin, morphine, etc.), while others, like heroin, are illegal. These types of drugs have gained popularity in medical contexts for their ability to manage pain caused by physical injury, trauma, and other ailments, however when administered over long periods of time, patients become at great risk for addiction. Over the course of the last few decades, the more addition evidence in the United States history has emerged, demonstrating a dramatic increase in the number of opioid-related deaths per year, especially in areas such as Massachusetts and Western Pennsylvania. As pharmaceutical companies began to promote the use of opioids for nonsevere-related pain with little regard for research on the risks, more and more people became addicted and being highly prescribed opioids by their doctors.

The opioid-related mortality rate rose and became more commonly tied with heroin and synthetic drugs such as fentanyl in the record and first waves of the epidemic. Although efforts have been made by the U.S. government to prevent consumption of opioids and seek legislation supporting treatment, the opioid crisis is still considered a **wicked problem**. Due to the widespread nature of the issue and the ways it connects with the different sectors of STEEP (social, technological, economic, environmental, political), there exists no all-encompassing solutions that can completely solve the problem. Our grant and only aims to illustrate the interconnectedness between each of the sectors, effects, and feedback loops in our problem, but also suggests leverage points that could be implemented to help manage the crisis. These intervention methods introduce ideas our team has generated in efforts to address individual issues at different levels in the wicked problem.

## OPIOIDS BY NUMBERS



INPUT → OUTPUT

<p><b>1</b></p> <p><b>PROBLEM</b></p> <p>United Drug Education</p> <p><b>PREFERRED FUTURE</b></p> <p><b>INTERVENTION METHODS</b></p> <p>POTENTIAL NEGATIVE EXTERNALITIES</p>	<p><b>2</b></p> <p><b>PROBLEM</b></p> <p>Legal Prescriptions</p> <p><b>PREFERRED FUTURE</b></p> <p><b>INTERVENTION METHODS</b></p> <p>POTENTIAL NEGATIVE EXTERNALITIES</p>	<p><b>3</b></p> <p><b>PROBLEM</b></p> <p>Needle Exchange Programs</p> <p><b>PREFERRED FUTURE</b></p> <p><b>INTERVENTION METHODS</b></p> <p>POTENTIAL NEGATIVE EXTERNALITIES</p>	<p><b>4</b></p> <p><b>PROBLEM</b></p> <p>Increase in Job Opportunities</p> <p><b>PREFERRED FUTURE</b></p> <p><b>INTERVENTION METHODS</b></p> <p>POTENTIAL NEGATIVE EXTERNALITIES</p>	<p><b>5</b></p> <p><b>PROBLEM</b></p> <p>Wastewater Filtering</p> <p><b>PREFERRED FUTURE</b></p> <p><b>INTERVENTION METHODS</b></p> <p>POTENTIAL NEGATIVE EXTERNALITIES</p>	<p><b>6</b></p> <p><b>PROBLEM</b></p> <p>Decriminalization</p> <p><b>PREFERRED FUTURE</b></p> <p><b>INTERVENTION METHODS</b></p> <p>POTENTIAL NEGATIVE EXTERNALITIES</p>
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### KEY

- PERSONAL
- COMMERCIAL
- NATIONAL
- INTERNATIONAL
- INTRACONNECTIONS
- INTERCONNECTIONS
- LEVERAGE POINTS

# SUPPLEMENTAL RESEARCH

## OPIOIDS BY NUMBERS

Distilling complex information for viewers



130+

People died everyday from opioid-related drug overdoses



10.3M

People misused prescription opioids in 2018



47,600

People died from overdosing on opioids



2M

People had an opioid use disorder in 2018



2M

People misused prescription opioids for the first time



808,000

People used heroin in 2018



15,349

Deaths attributed to overdosing on heroin (in 12-month period ending Feb. 2019)



81,000

People used heroin for the first time



32,656

Deaths attributed to overdosing on synthetic opioids other than methadone (in 12-mo period ending Feb 2019)



2.5T

Cost of the opioid crisis—lost lives, healthcare and substance abuse treatment, criminal justice, and reductions in productivity

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# SUPPLEMENTAL RESEARCH

## HISTORY

Providing **social** context  
for viewers

### 1 Pre-Existing Conditions

In the 1980s, Society began to move towards prescribing controlled substances for terminal patients.

### 2 System Vulnerability

The pre-existing Structure of health-care system allows private practitioners to prescribe opioids for financial gain.

### 3 Racial & Socio-Economic Attitudes

Purdue Pharma focused the initial marketing of OxyContin on suburban and rural white communities, targeting doctors who were "serving patients that were not thought to be at risk for addiction."

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# SUPPLEMENTAL RESEARCH

## HISTORY

Providing **historical** context for viewers

**1** **First Wave (1991)**  
**Prescription Opioids**

Sharp increase in opioid prescriptions due to public misconception of the risk of addiction.

**2** **Second Wave (2010)**  
**Heroin**

Decrease in opioid prescribing, thus addicts turned to heroin.

**3** **Third Wave (2013)**  
**Synthetic Opioids (Fentanyl)**

Rise in drug-related deaths due to fentanyl related drugs manufactured illegally.

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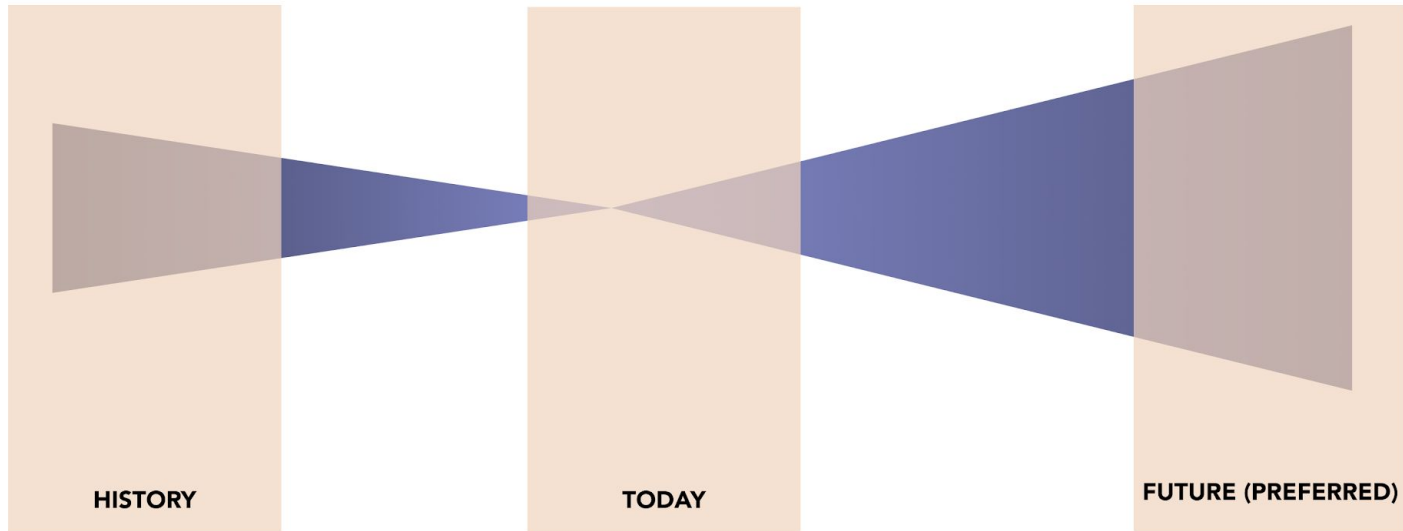
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# SUPPLEMENTAL RESEARCH

## PLACING

Placing our current society



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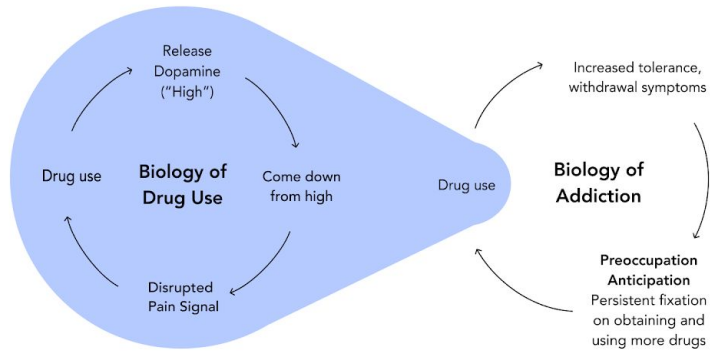
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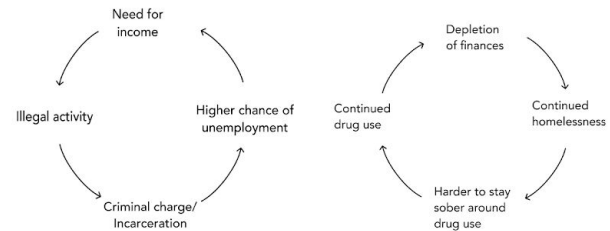
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# FEEDBACK LOOPS



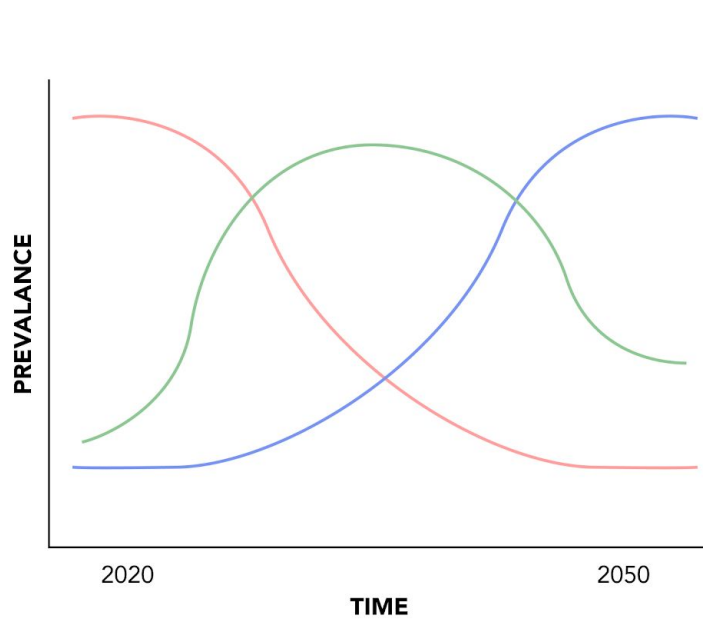
We centered our map around two main feedback loops: the biology of drug use and the biology of addiction. The biology of drug use details the physical process of an instance of drugs use, which is one of the nodes in the other feedback loop, the biology of addiction, which shows the larger cycle of addiction/repeated use.

These two loops serve as a hub for many of our major connections. This was important for grounding our map and giving clear order to our main concepts.



Two more extremely important loops show how opioid addiction can create devastating self-reinforcing cycles when an individual falls victim to either the criminal justice system or homelessness.

# THREE HORIZONS



- H1**
- High opioid addiction rates
  - Corruption
  - Stigma
  - Homelessness
  - Poor criminal justice system
  - Spread of disease

- H2**
- Needle exchange programs
  - Education system
  - Shift in stigma
  - Better implementation
  - Increase in federal funding

- H3**
- Low opioid addiction rates
  - Streamlined implementation
  - Effective legislation
  - Rehabilitation facilities
  - Improved technology
  - No stigma



# INTERVENTION METHODS

1

UNIFIED DRUG  
EDUCATION

2

LEGAL  
PRESCRIPTIONS

3

NEEDLE EXCHANGE  
PROGRAMS

4

INCREASE IN JOB  
OPPORTUNITIES

5

WASTEWATER  
FILTERING

6

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# INTERVENTION 1

1

## UNIFIED DRUG EDUCATION

### LEVERAGE POINT

Paradigm used to design the system

### PROBLEM

- Lack of knowledge/confusion in the general population about the dangers of drug use
- Misunderstandings contribute to stigma that alienates addicts

### PREFERRED FUTURE

- Well-informed public that understands and avoids the risks of drug use
- Sympathy toward those struggling with Opioid Use

### INTERVENTION METHOD

- Unified drug education system that is thoroughly implemented nationwide
- Would improve the quality of common knowledge about the crisis and lessen the stigma

### POTENTIAL NEGATIVE EXTERNALITIES

- Parents may be uncomfortable with their children being exposed to these topics
- Could be deemed as “taboo” similar to the way that sex education is seen

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# INTERVENTION 4

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## INCREASE IN JOB OPPORTUNITIES

### LEVERAGE POINTS

Balancing feedback loops  
System structure  
The system goal

### PROBLEM

- Poor criminal justice system thwarts prisoner's streamlined integration back into the public
- Increases chances of homelessness as addicts struggle to obtain professional jobs

### PREFERRED FUTURE

- Addicts integrate back into society and professional fields so they don't experience financial insecurity and fall into the loop of homelessness

### INTERVENTION METHOD

- Increased programs that find and match job opportunities with those out of rehab from Opioid Use Disorder
- Jobs that are designated and reserved for past addicts.

### POTENTIAL NEGATIVE EXTERNALITIES

- Stigma against addiction and mental illness can discourage customers from supporting these businesses
- Possibility of relapse might hinder performance of employee

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# INTERVENTION 6

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## DECRIMINALIZATION

### LEVERAGE POINTS

Balancing feedback loops  
Information flow structures  
System rules

### PROBLEM

- The criminalization of illicit substances perpetuates stigma around addiction and reinforces corrupt cycles within the criminal justice system.

### PREFERRED FUTURE

- A world where addiction is seen as an illness rather than a weakness, and getting help is free of shame.
- People come forward about their struggle and addiction without fear of legal prosecution.

### INTERVENTION METHOD

- Decriminalize the possession and use of illicit substances
- In 2001, Portugal took a major step by decriminalizing all drugs; in 2015 they reported one of the lowest overdose death rates in Europe.

### POTENTIAL NEGATIVE EXTERNALITIES

- Initial spike in drug use (as was seen in Portugal)
- Controversy may polarize political parties and create societal unease

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# CONCLUSION

Although we have conducted various levels of research analyzing the Opioid Crisis through different lenses, we understand the limitation in completely addressing the complexity of a Wicked Problem. Despite the challenges, through copious amounts of research and iterative visual design, we were able to deliver a final map that allows viewers to better understand the Opioid Epidemic.

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***end scene***