# Title: Predicting Patients at High Risk of Opioid Crisis

### Executive Summary

Our company recognizes the critical need to address the opioid crisis through proactive intervention. By leveraging predictive analytics, we aim to identify patients at risk of opioid addiction early on, enabling timely intervention and support.

* Objective: Develop a predictive model for opioid risk.
* Key Benefits: Improved patient outcomes, reduced costs.
* Stakeholders: Healthcare providers, patients, insurers

### What is OPIOID CRISIS?

The opioid crisis is a major public health issue characterized by widespread addiction to opioid drugs like painkillers and heroin. It's driven by factors such as over-prescription, aggressive marketing, and the presence of potent synthetic opioids. This crisis leads to devastating consequences including overdose deaths, strained healthcare systems, and societal upheaval.

### Introduction

The opioid crisis has reached alarming proportions globally, with devastating effects on individuals, families, and communities. Despite efforts to combat this crisis, identifying at-risk individuals remains a significant challenge. Our initiative seeks to utilize advanced data analytics to predict patients at risk of opioid addiction, revolutionizing preventive healthcare practices.

### Problem Statement

There is a pressing need to predict patients at risk of opioid addiction to enable early intervention and mitigate the adverse effects of opioid misuse. Current methods often rely on subjective assessments and lack the accuracy and scalability required for effective intervention.

### Objectives

* Develop a predictive model to identify patients at risk of opioid addiction.
* Implement proactive intervention strategies to reduce the incidence of opioid misuse and addiction.
* Improve patient outcomes and reduce healthcare costs associated with opioid-related complications.

### Scope

Our initiative initially targets patients with chronic pain conditions who are at higher risk of opioid dependence. We aim to implement the predictive model in collaboration with healthcare providers within our network, with the potential for broader adoption across healthcare systems.

### Market Analysis

Existing solutions for opioid addiction prevention primarily focus on treatment rather than early intervention. By offering a predictive analytics solution, we aim to fill a critical gap in the market and position ourselves as leaders in proactive healthcare management.

### Business Impact

Implementation of the predictive model is expected to result in:

* Reduced healthcare costs associated with opioid-related complications.
* Improved patient outcomes and quality of life.
* Enhanced reputation and competitive advantage in the healthcare industry.

### Technical Approach

We propose to utilize machine learning algorithms to analyze patient data and identify patterns indicative of opioid addiction risk. Advanced analytics techniques will be employed to ensure the accuracy and reliability of the predictive model.

## Common OPIOIDS USED medically

### Heroin

* **Medical Dose**: Not used medically in the United States.
* **Dose Leading to Overdose**: 50-200 mg, depending on purity and individual tolerance.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (5-20 mg can be dangerous).
  + **Regular Users**: Overdose can occur after increasing the dose due to tolerance (multiple uses, especially if purity varies).

### Fentanyl

* **Medical Dose**:
  + **Transdermal Patch**: 12.5-100 mcg/hour.
  + **Intravenous**: 50-100 mcg/dose.
* **Dose Leading to Overdose**: As low as 2 mg can be fatal.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (2 mg or less).
  + **Regular Users**: Even a slight increase or repeated small doses can lead to overdose.

### Oxycodone

* **Medical Dose**:
  + **Immediate Release**: 5-15 mg every 4-6 hours.
  + **Extended Release**: 10-80 mg every 12 hours.
* **Dose Leading to Overdose**: 40-100 mg or more, depending on tolerance.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (10-20 mg can be dangerous).
  + **Regular Users**: Tolerance may lead to higher single doses, but overdose risk remains with multiple high doses.

### Hydrocodone

* **Medical Dose**: 5-10 mg every 4-6 hours.
* **Dose Leading to Overdose**: 60-120 mg or more, depending on tolerance.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (10-20 mg can be dangerous).
  + **Regular Users**: Higher doses over time increase risk, especially with multiple high doses.

### Morphine

* **Medical Dose**:
  + **Immediate Release**: 10-30 mg every 4 hours.
  + **Extended Release**: 15-200 mg every 12-24 hours.
* **Dose Leading to Overdose**: 60-200 mg or more, depending on tolerance.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (10-30 mg can be dangerous).
  + **Regular Users**: Tolerance can lead to higher single doses; multiple doses increase cumulative risk.

### Codeine

* **Medical Dose**: 15-60 mg every 4-6 hours.
* **Dose Leading to Overdose**: 200-400 mg or more, depending on tolerance.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (30-60 mg can be dangerous).
  + **Regular Users**: Tolerance may increase single-dose thresholds, but multiple doses still pose a risk.

### Hydromorphone

* **Medical Dose**:
  + **Immediate Release**: 2-4 mg every 4-6 hours.
  + **Extended Release**: 8-64 mg once daily.
* **Dose Leading to Overdose**: 25-30 mg or more, depending on tolerance.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (2-4 mg can be dangerous).
  + **Regular Users**: Higher doses over time increase risk, especially with multiple high doses.

### Methadone

* **Medical Dose**:
  + **Pain Management**: 2.5-10 mg every 8-12 hours.
  + **Opioid Addiction Treatment**: 20-120 mg daily.
* **Dose Leading to Overdose**: 30-50 mg or more, depending on tolerance and duration of use.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (2.5-10 mg can be dangerous).
  + **Regular Users**: Methadone accumulates in the body, increasing overdose risk with regular dosing.

### Buprenorphine

* **Medical Dose**:
  + **Pain Management**: 0.3-0.6 mg every 6-8 hours.
  + **Opioid Addiction Treatment**: 4-24 mg daily (sublingual tablets/film).
* **Dose Leading to Overdose**: Higher doses above therapeutic range, especially if combined with other CNS depressants.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (0.3-0.6 mg can be dangerous if opioid-naive).
  + **Regular Users**: Generally safer due to ceiling effect, but risk increases with high doses or combinations.

### Tapentadol

* **Medical Dose**: 50-100 mg every 4-6 hours.
* **Dose Leading to Overdose**: 500-700 mg or more.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (50-100 mg can be dangerous).
  + **Regular Users**: Higher doses over time increase risk, particularly with multiple high doses.

### Tramadol

* **Medical Dose**: 50-100 mg every 4-6 hours, maximum 400 mg per day.
* **Dose Leading to Overdose**: 400-500 mg or more.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (50-100 mg can be dangerous).
  + **Regular Users**: Higher doses over time increase risk, especially with multiple high doses.

### Oxymorphone

* **Medical Dose**:
  + **Immediate Release**: 5-10 mg every 4-6 hours.
  + **Extended Release**: 5-40 mg every 12 hours.
* **Dose Leading to Overdose**: 40-60 mg or more, depending on tolerance.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (5-10 mg can be dangerous).
  + **Regular Users**: Tolerance allows higher doses, but overdose risk remains with multiple high doses.

### Meperidine (Demerol)

* **Medical Dose**: 50-150 mg every 3-4 hours.
* **Dose Leading to Overdose**: 600 mg or more.
* **Number of Doses Before Overdose**:
  + **New Users**: 1 dose (50-150 mg can be dangerous).
  + **Regular Users**: Tolerance allows higher doses, but overdose risk remains with multiple high doses.

### Target Audience (Priority-wise)

1. **Healthcare Providers:** Physicians, nurses, and clinical staff who will use the predictive model to identify and manage at-risk patients.
2. **Healthcare Administrators:** Hospital and clinic administrators responsible for implementing and overseeing the use of the predictive model.
3. **Patients and Families:** Individuals at risk of opioid addiction and their families, who will benefit from early intervention and support.
4. **Insurers:** Health insurance companies interested in reducing costs associated with opioid-related treatments and complications.
5. **Policymakers:** Government and regulatory bodies focused on public health initiatives and policies to combat the opioid crisis.
6. **Researchers and Academics:** Individuals studying opioid addiction and seeking data-driven insights to inform their work.

### Financial Opportunities and Key Stakeholders

**Insurers**

Health insurance companies represent a significant source of funding due to their vested interest in reducing the incidence and severity of opioid addiction among their covered populations. By investing in predictive analytics, insurers can achieve substantial cost savings associated with opioid addiction treatments, emergency room visits, and long-term care. The ability to demonstrate a clear return on investment (ROI) through reduced claims and improved patient outcomes will make this an attractive proposition, resulting in substantial financial support from insurers.

**Healthcare Administrators**

Hospitals and clinics can realize considerable cost savings by implementing predictive analytics to reduce readmissions, enhance patient outcomes, and optimize resource allocation. Administrators are likely to invest in solutions that improve the efficiency and effectiveness of patient care, potentially leading to higher reimbursement rates and additional incentives through value-based care models. Consequently, healthcare administrators are a crucial funding source.

**Policymakers**

Government and regulatory bodies have dedicated budgets for public health initiatives and are potential sources of grants or funding for innovative solutions addressing the opioid crisis. By engaging with policymakers, we can secure substantial financial support for pilot programs and broader implementations, leveraging their commitment to public health improvements.

**Healthcare Providers**

While individual healthcare providers may have limited direct financial contributions, their collective adoption of the predictive model can significantly drive market demand and penetration. By incentivizing providers through the promise of improved patient outcomes and reduced workload, we can indirectly enhance revenue streams through increased utilization and recommendations of the predictive tool.

### Risk Analysis

Key risks include data privacy concerns, model accuracy, and stakeholder resistance to change. Mitigation strategies will involve robust data security measures, continuous model refinement, and stakeholder engagement initiatives.

### Datasets

[2016 National Survey on Drug Use and Health: Detailed Tables (samhsa.gov)](https://www.samhsa.gov/data/sites/default/files/NSDUH-DetTabs-2016/NSDUH-DetTabs-2016.pdf)

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### SAMPLE CODE

<https://nbviewer.org/github/marcotav/machine-learning-classification-projects/blob/master/click-prediction/notebooks/click-predictive-model.ipynb>

EFFECTIVE

[Big data and predictive modelling for the opioid crisis: existing research and future potential - The Lancet Digital Health](https://www.thelancet.com/journals/landig/article/PIIS2589-7500(21)00058-3/fulltext#seccestitle100)