

California Fatal Opioid Overdose and HIV or Hepatitis C Virus (HCV) Vulnerability Assessment

BACKGROUND

Deaths related to opioid overdose have dramatically increased in recent years in California and nationwide. Prescription opioid-related overdose deaths (excluding synthetics)* in California peaked in 2009 at 1,483 deaths.¹ However, increases in overdose deaths related to heroin and fentanyl increased by 107 percent and 806 percent, respectively, between 2012 and 2018. In 2018 alone, there were 749 heroin-related overdose deaths and 743 fentanyl-related overdose deaths in California.² Nationally, opioid-related overdose deaths rose nearly six-fold from 8,048 in 1999 to 47,600 in 2017. And in 2016, illicitly manufactured fentanyl surpassed prescription opioids as the most common cause of opioid deaths in the United States.³

In 2015, Scott County, Indiana, a town with less than 25,000 population that had five HIV infections diagnosed in the past 10 years, experienced an unprecedented HIV outbreak, with 181 new HIV infections attributed to the outbreak in three months.^{4,5} Public health investigators found the rapid increase in HIV infections was largely tied to sharing of syringes and drug injection equipment in a setting with no access to sterile syringes.⁶ Among 135 people with new HIV infections, 84 percent were also found to be coinfecting with hepatitis C, a bloodborne viral infection transmitted primarily through sharing injection drug use equipment.⁶

As opioid use has increased, so have newly reported hepatitis C infections in California and nationwide. An analysis by the U.S. Centers for Disease Control and Prevention (CDC) found that increases in acute hepatitis C rates mirrored increases in drug treatment admission rates in which clients reported injection drug use.⁷ In California rates of newly reported chronic hepatitis C infections and heroin-related emergency department visits among young adults (25 to 29 years of age) are increasing together, at a similar rate: rates of newly reported cases of chronic hepatitis C increased 159 percent and heroin-related emergency department visits increased 139 percent, respectively, between 2012 and 2016, likely due to increases in injection drug use.^{8,9,10} Nationally and in California there is no evidence of an increase in newly acquired HIV among people who inject drugs (PWID), but transmission through unsterile injection drug

* Prescription opioid-related overdose deaths (excluding synthetics) are defined as drug overdose deaths caused by acute poisonings (i.e., a person's adverse response to a drug or combination of drugs) that involve prescription opioid pain relievers as a contributing cause of death, regardless of intent (e.g., suicide, unintentional or undetermined). Prescribed opioid pain relievers include drugs such as hydrocodone, oxycodone, and morphine. This definition includes methadone but excludes other synthetic prescription opioids such as fentanyl.

use is possible and clusters of injection-mediated HIV infection have been documented in Boston, Massachusetts; Northern Kentucky and the Greater Cincinnati Region of Ohio; Multnomah County, Oregon; Seattle, Washington; and West Virginia.^{11,12,13,14,15} In California, in 2017, eight percent of new diagnosis of HIV were among PWID.¹⁶

Following the Scott County HIV outbreak, CDC conducted a national analysis assessing the county-level vulnerability to a rapid increase in HCV or HIV infections related to injection drug use. Two counties in California (Lake County and Plumas County) were identified as having high vulnerability, which was defined as being in the top five percent among all counties nationwide.

CDC's analysis was informative, and prompted reflection among a number of high vulnerability counties. However, CDC's vulnerability assessment analysis had important limitations. For example, CDC used acute hepatitis C infections as a marker for injection drug use in the county. However, acute hepatitis C infections are vastly underreported because people with recent hepatitis C infection often do not have symptoms; PWID often do not seek care due to fear of stigma; and clinicians who diagnose acute hepatitis C infection may be unaware that they are required to report these infections to the local health department. CDC estimates there are 13.9 acute hepatitis C infections for every one acute case actually reported to public health.¹⁷

CDC's vulnerability assessment for counties was also national in scope and so did not reflect data from public health surveillance and other data sources specific only to California; it also did not examine county-level vulnerability to a rapid increase in deaths related to opioid overdose.

In 2017, the California Department of Public Health (CDPH) conducted preliminary analysis to determine the feasibility of developing a state-specific vulnerability assessment. In 2018, CDC granted opioid crisis cooperative agreement funds to CDPH to conduct a California-specific analysis of county-level vulnerability to a rapid increase in i) fatal opioid overdose; and HIV or HCV infections associated with injection drug use ii). (This analysis assessed for risk of a rapid increase in HIV or HCV infections associated with injection drug use; the term "HIV/HCV" is used only when needed for clarity between the fatal opioid overdose and HIV or HCV models.) This report describes the findings of that analysis, and is part of a larger set of tools (including detailed technical notes, a resource list, and an action planning checklist) for use by local health officials and their community partners to guide public health action.

The vulnerability assessment findings presented in this report are not predictive—counties with high, medium, or some fatal opioid overdose or HCV/HIV vulnerability may or may not experience a rapid increase in opioid overdose deaths or HIV/HCV infections related to injection drug use. The purpose of the vulnerability assessment project, including this report and related materials, is to 1) identify California counties at risk for a rapid increase of fatal opioid overdose or HIV or HCV infections associated with injection drug use; 2) develop tools and resources for

local health officials to prevent and respond to these overlapping epidemics; and 3) share findings to inform local public health action.

ANALYSIS METHODS

Research has shown that a number of factors are independently associated with high risk for fatal opioid overdose, HIV, and/or HCV at an individual or community level. For this analysis, CDPH reviewed the HIV/HCV vulnerability assessments conducted by CDC, Tennessee, and other jurisdictions, as well as an exploratory analysis for California conducted by the Harm Reduction Coalition and Health Management Associates; referenced peer reviewed journal articles; drew upon local and statewide public health surveillance data specific to California; and consulted with internal and external subject matter experts. Collectively, these sources provided information on factors that may be associated with individual or community level fatal opioid overdose, HIV, and/or HCV risk, and for which data were available at the county level for California. (Data sources were not consistently available for the three city health jurisdictions of Berkeley, Long Beach, and Pasadena; analysis was limited to the 58 counties in California.) A detailed description of the analysis methods is available in the **technical notes**.

Factors associated with fatal opioid overdose or HIV/HCV were assessed for each county in California in two separate models: one for fatal opioid overdose risk, and one for HIV or HCV risk related to injection drug use. After using statistical methods to narrow down the variables for each mode, each model contained a short list of variables that continued to make a meaningful statistical contribution to the final model; those variables are listed in **Table 1**.

Table 1: Variables included in the Final Models for Fatal Opioid Overdose and HIV or HCV Vulnerability—California, 2017

Fatal Opioid Overdose	HIV or HCV
Gender distribution	Race/ethnicity distribution
Percentage of county population living alone	Rate of heroin emergency department visits among persons 15-29 years of age
Rate of heroin hospitalizations	Estimated hepatitis C prevalence among persons 40 years of age and older
Rate of residents on high dose opioids (greater than 90 morphine milligram equivalents)	Number of felony drug arrests
High intensity drug trafficking area	Percentage of households with no vehicle access

Separate analyses were conducted because the risk factors and dynamics of these epidemics are overlapping but distinct. Injecting opioids alone increases the risk of fatal opioid overdose—because no one is there to witness and respond to the overdose—but does not increase HIV or HCV risk if the person injecting is using injection equipment that has not been previously used by another person. Likewise, receptive sharing of injection equipment increases HIV or HCV risk but does not necessarily increase fatal opioid overdose risk because other people present may be able to witness the overdose and provide assistance. However, use of opioids such as heroin and fentanyl may be associated with increased risk for both fatal overdose and HIV or HCV infection since the potency of street drugs is unpredictable and people often lack access to sufficient sterile injection equipment.

Within each analysis, counties were sorted from highest to lowest risk in relation to each other county in California. Risk levels by county were analyzed using a statistical approach that looks for natural break points in risk levels to define three groups, which were categorized as High Risk, Medium Risk, and Some Risk. While counties with some risk had the lowest risk score relative to other counties in California, CDPH opted to use the term *some* risk, rather than *low* risk to describe these counties. Recent experience in other jurisdictions has shown clusters and outbreaks of fatal fentanyl overdoses or HIV infections among PWID can and do occur even in counties not identified as highly vulnerable by CDC. The experiences of jurisdictions experiencing unexpected increases in HIV among PWID suggest all communities may have *some* fatal opioid overdose, HIV, and HCV risk and could benefit from exploring local strategies for prevention.

COUNTY-LEVEL VULNERABILITY CATEGORIES

County-level vulnerability groupings for the fatal opioid overdose model are shown in **Figure 1**; vulnerability groupings for the HIV or HCV model are shown in **Figure 2**.

Figure 1. Counties with High, Medium, or Some Vulnerability to a Rapid Increase in Fatal Opioid Overdose—California, 2017

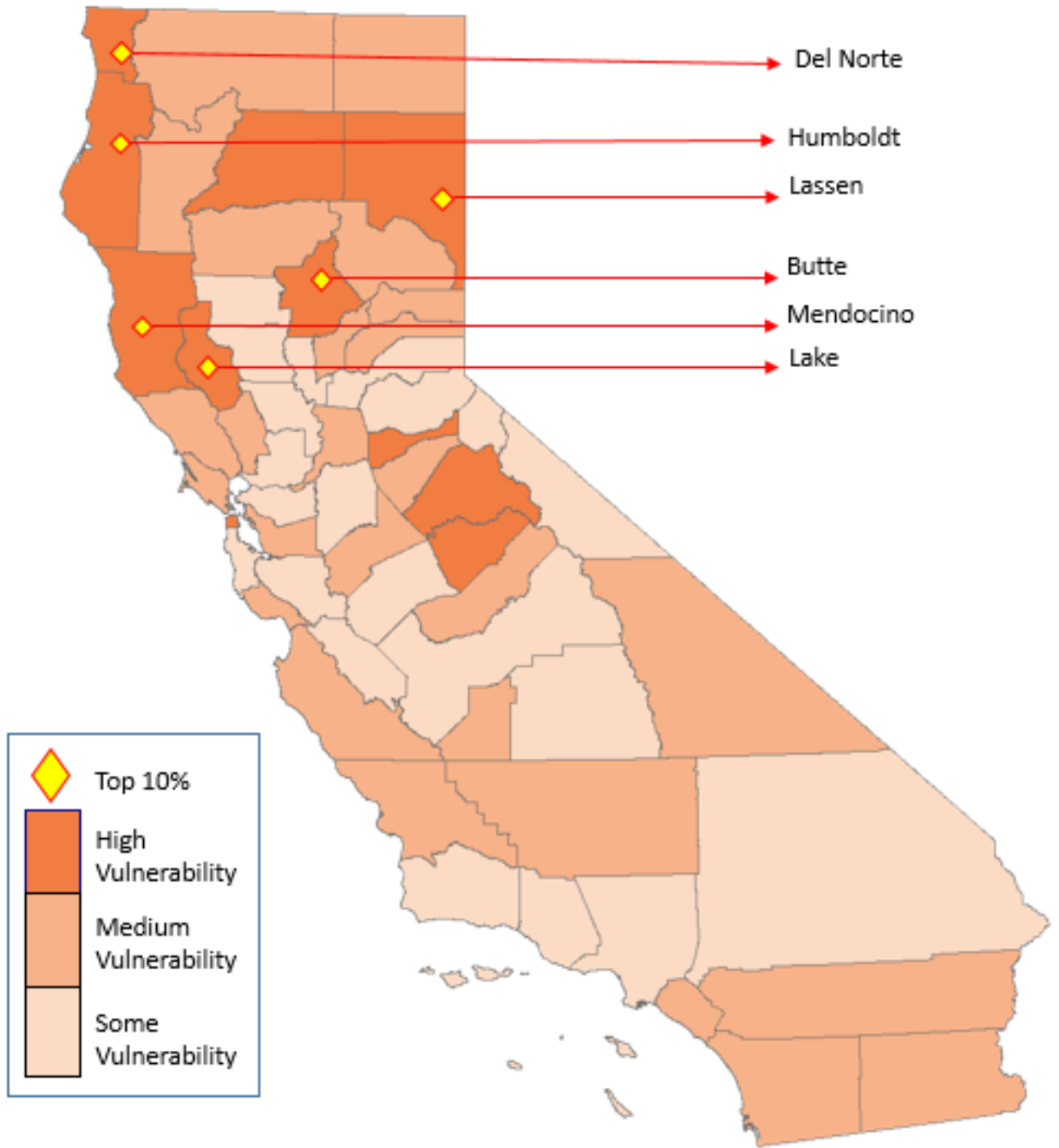


Figure 2. Counties with High, Medium, or Some Vulnerability to a Rapid Increase in HIV or Hepatitis C Virus Infections Associated with Injection Drug Use—California, 2017

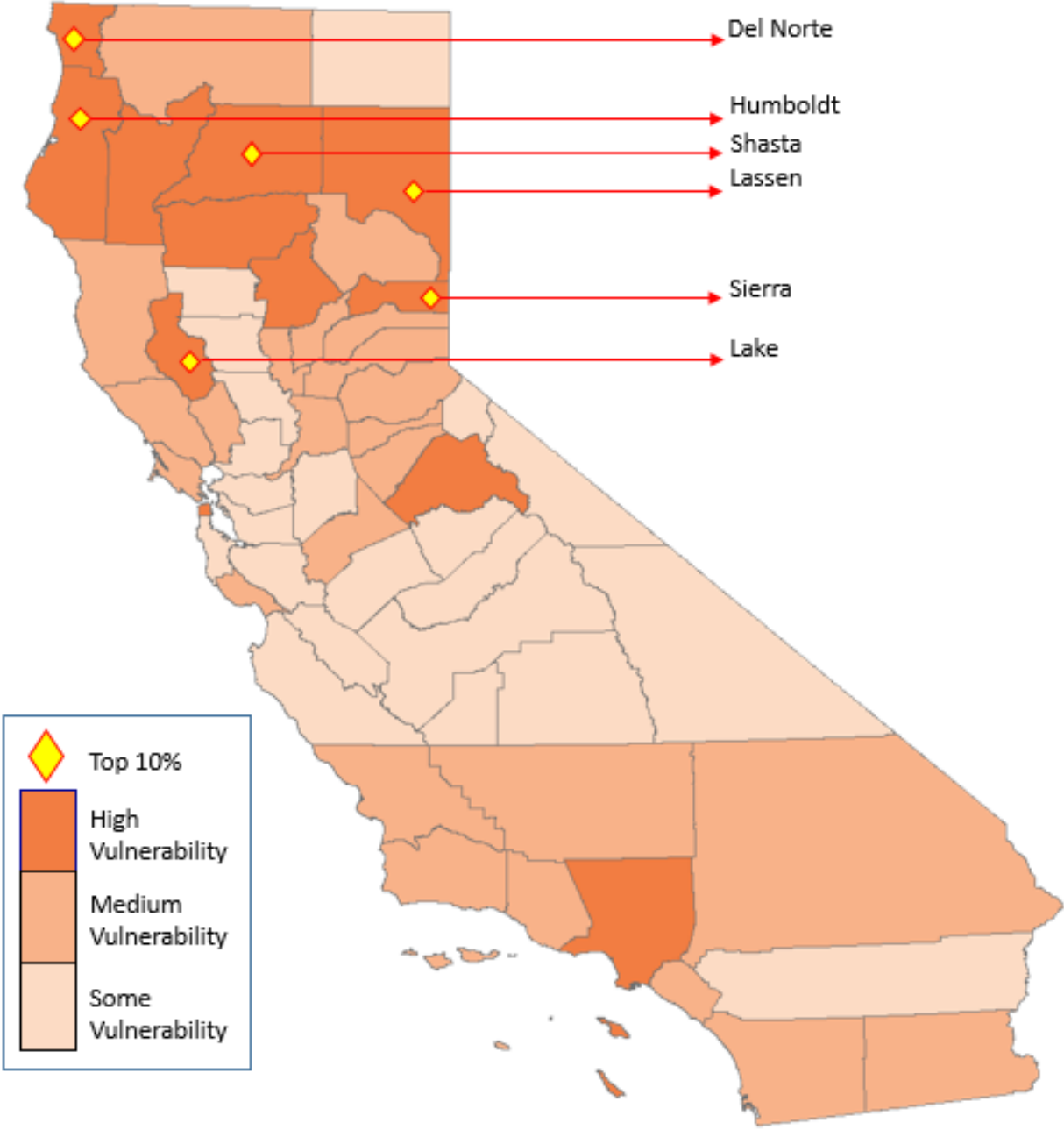


Table 2 shows the vulnerability categories for both the fatal opioid overdose and HIV or HCV models by county.

Table 2: Fatal Opioid Overdose and HIV or HCV Vulnerability Categories (High, Medium, or Some Vulnerability), by County—California, 2017

County	Fatal Opioid Overdose	HIV or HCV		County	Fatal Opioid Overdose	HIV or HCV
Alameda	Medium	Some		Orange	Medium	Medium
Alpine	Some	Some		Placer	Some	Medium
Amador	High	Medium		Plumas	Medium	Medium
Butte	High	High		Riverside	Medium	Some
Calaveras	Medium	Medium		Sacramento	Medium	Medium
Colusa	Some	Some		San Benito	Some	Some
Contra Costa	Some	Some		San Bernardino	Some	Medium
Del Norte	High	High		San Diego	Medium	Medium
El Dorado	Some	Medium		San Francisco	High	High
Fresno	Some	Some		San Joaquin	Some	Some
Glenn	Some	Some		San Luis Obispo	Medium	Medium
Humboldt	High	High		San Mateo	Some	Some
Imperial	Medium	Medium		Santa Barbara	Some	Medium
Inyo	Medium	Some		Santa Clara	Some	Some
Kern	Medium	Medium		Santa Cruz	Medium	Medium
Kings	Medium	Some		Shasta	High	High
Lake	High	High		Sierra	Medium	High
Lassen	High	High		Siskiyou	Medium	Medium
Los Angeles	Some	High		Solano	Some	Some
Madera	Medium	Some		Sonoma	Medium	Medium
Marin	Medium	Medium		Stanislaus	Medium	Medium
Mariposa	High	Some		Sutter	Some	Medium
Mendocino	High	Medium		Tehama	Medium	High
Merced	Some	Some		Trinity	Medium	High
Modoc	Medium	Some		Tulare	Some	Some
Mono	Some	Some		Tuolumne	High	High
Monterey	Medium	Some		Ventura	Some	Medium
Napa	Medium	Medium		Yolo	Some	Some
Nevada	Medium	Medium		Yuba	Medium	Medium

PRIMARY FINDINGS

For the fatal opioid overdose model, 11 counties had the highest level of risk compared with other counties in California: seven with a population less than 100,000 (Amador, Del Norte, Lake, Lassen, Mendocino, Mariposa, and Tuolumne), and four with a population of 100,000 or greater (Butte, Humboldt, San Francisco, and Shasta). Two thirds of counties (38 of 58) had the same level of risk for fatal opioid overdose and HIV or HCV (Figure 1 and Figure 2); the remaining counties had different levels of risk for fatal opioid overdose and HIV or HCV.

In the HIV or HCV analysis, 12 counties out of 58 total counties in California (21 percent) were categorized as having high risk for a rapid increase in HIV or HCV infections related to injection drug use; 24 (41 percent) as medium risk; and 22 (38 percent) as having some risk. In the opioid overdose risk model, 11 counties (19 percent) were categorized as having high risk for a rapid increase in fatal opioid overdoses; 26 counties (45 percent) as having medium risk; and 21 counties (36 percent) as having some risk.

The counties with the highest level of risk for both fatal opioid overdose and HIV or HCV were primarily located in northern California, with the top 10 percent of counties all located in northern California (Figure 1 and Figure 2). For the HIV or HCV model, 12 counties had the highest level of risk compared with other counties in California: seven with a county population of less than 100,000 (Del Norte, Lake, Lassen, Sierra, Tehama, Trinity, and Tuolumne), and five with a county population of 100,000 or greater (Butte, Humboldt, San Francisco, Shasta and Los Angeles).

DISCUSSION

CDC conducted an assessment of county-level vulnerability to a rapid increase in HIV or HCV infections related to injection drug use, using nationally available data, with acute hepatitis C infections as a marker of injection drug use, and identified two counties in California as having high vulnerability – Lake County and Plumas County. A number of jurisdictions nationally used CDC’s analysis as a catalyst for starting new HIV, HCV, and/or overdose prevention programs, including Plumas County, California, and Kentucky.^{18,19}

CDPH built upon and adapted CDC’s methods using California specific data sources to assess county-level vulnerability to a rapid increase in fatal opioid overdoses and using newly reported cases of chronic hepatitis C among persons 15-39 years of age in California as a marker for injection drug use, to assess county-level HIV or HCV vulnerability.

CDPH grouped counties into categories of high, medium, or some risk. While some counties may have lower risk compared with other high and medium risk counties, all counties in California have some level of risk to a rapid increase in fatal opioid overdoses or HIV/HCV related to injection drug use. In the fatal opioid overdose risk model, 11 counties (19 percent) were categorized as having high risk for a rapid increase in fatal opioid overdoses; 26 counties (45 percent) as having medium risk; and 21 counties (36 percent) as having some risk. Nearly two-thirds of the counties with high fatal opioid overdose risk had less than 100,000 population or were in Northern California, with three remaining counties (27 percent) in the Central Valley, and one (9 percent) in the Bay Area.

In the HIV or HCV risk model, 12 counties out of 58 total counties in California (21 percent) were categorized as having high risk; 24 (41 percent) as medium risk; and 22 (38 percent) as having some risk. Seven of the 12 counties (58 percent) with high HIV or HCV vulnerability had less than 100,000 population; nine of the 12 (75 percent) were in Northern California; with one each in the Bay Area, Central Valley, and Southern California.[†] The results show a concentration in Northern California and low population counties but also include urban counties in the Bay Area and Southern California, some of which have robust harm reduction infrastructure but nonetheless face high fatal opioid overdose, HIV, and/or HCV vulnerability.

Two-thirds of counties in California had the same level of vulnerability to a rapid increase in both fatal opioid overdoses and HIV or HCV related to injection drug use, highlighting the interrelated nature of these epidemics.

Fortunately, a number of evidence-based prevention strategies can mitigate individual and community-level risk for fatal opioid overdose HIV, and/or HCV.

- 1) **Medication assisted treatments (MAT)** for opioid use disorder (such as buprenorphine) can reduce fatal overdose risk; prevent HIV by reducing injecting; and have been shown to reduce hepatitis C rates among young PWID by as much as 50 percent.^{20,21,22}
- 2) **Naloxone**, a medication used to reverse an opioid overdose, can be safely administered by lay persons, and is available from multiple different sources for distribution to PWID, who are both at highest risk for a fatal opioid overdose and likely to witness and respond to an overdose among peers.
- 3) **Syringe services programs (SSPs)** effectively reduce HIV and HCV transmission among PWID; SSPs are most effective at preventing HCV transmission when offered at scale and in combination with other harm reduction services, such as MAT.²³ SSPs are ideal

[†] U.S. Census North Coast and Superior California regions are referred to collectively as Northern California; U.S. Census Northern San Joaquin Valley and Southern San Joaquin Valley are referred to collectively as Central Valley; U.S. Census Los Angeles region is referred to as being located in Southern California. More information on U.S. Census regions for California, visit <https://census.ca.gov/regions/>.

locations for distributing naloxone to PWID, and for serving as a health hub for other health services, including MAT, wound care, hepatitis A and hepatitis B vaccination, and HCV and HIV testing and treatment.^{24,25,26,27,28,29,30,31,32,33}

4) HIV testing, linkage to care, and treatment can keep people with HIV healthy for many years and viral suppression helps reduce their risk of transmitting HIV to others, although the effect of HIV viral load suppression on preventing transmission via sharing syringes is not well understood.²² HIV pre-exposure prophylaxis (PrEP) reduces the risk of getting HIV by at least 74 percent when taken daily.³⁴

5) HCV testing, linkages to care, treatment, and cure among PWID, in combination with expanded access to SSPs and MAT, has the potential to dramatically reduce community-level hepatitis C prevalence.^{35,36}

Many of the most vulnerable counties have existing efforts with the potential to reduce their fatal opioid overdose, HIV, and/or HCV risk, including opioids safety coalitions; MAT and naloxone expansion initiatives; SSPs; HIV and HCV prevention, testing, linkage to care, and treatment programs; and HIV and HCV elimination campaigns.^{37,38,39,40,41,42,43} Specialists offer training for rural primary care providers to prescribe MAT and treat HIV and HCV infections and in primary care.^{44,45,46} Broader efforts to address social determinants of health, including homelessness and incarceration, are also underway and have the potential to help reduce overdose, HIV, and/or HCV risk.^{47,48,49} Despite these advancements, no county has fully scaled up all of these services, and rates of fatal fentanyl overdoses and hepatitis C cases continue to climb among young PWID.⁸ The findings from this vulnerability assessment can and should serve as a catalyst for each county to assess its unique local resources, strengths, gaps, and opportunities for reducing fatal opioid overdose, HIV, and HCV risk. Health officials and local partners in all counties can and do work together to expand evidence based practices for fatal opioid overdose, HIV, and/or HCV prevention and improve the health and well-being of their communities.

Assessing county-level vulnerability to a rapid increase in fatal overdose deaths related to amphetamines was beyond the scope of this report. However, amphetamine-related overdose deaths[‡] in California increased 198 percent from 777 in 2012 to 2,316 in 2018, and many people who use opioids also use cocaine, methamphetamine, and other stimulants.^{50,51,52} Local responses to assessing and mitigating local vulnerability would also benefit from incorporating strategies for addressing amphetamines, stimulants, and other drugs with a risk of fatal overdose.

[‡] Amphetamine-related overdose deaths are defined here and by the California Opioid Surveillance Dashboard as drug overdose deaths caused by acute poisonings that involve psychostimulants with abuse potential (excluding cocaine T40.5) such as amphetamines, regardless of intent (e.g., unintentional, suicide, assault, or undetermined).

REFERENCES

- ¹ California Department of Public Health - Safe and Active Communities Branch. Prescription Drug Overdose Prevention Initiative. <https://www.cdph.ca.gov/Programs/CCDPHP/DCDIC/SACB/Pages/PrescriptionDrugOverdoseProgram.aspx>. Accessed September 2, 2019.
- ² California Department of Public Health. California Opioid Surveillance Dash Board. <https://discovery.cdph.ca.gov/CDIC/ODdash/>. Accessed October 13, 2019.
- ³ National Institute on Drug Abuse. <https://www.drugabuse.gov/related-topics/trends-statistics/infographics/fentanyl-other-synthetic-opioids-drug-overdose-deaths>. Accessed September 2, 2019.
- ⁴ United State Census Bureau. QuickFacts. <https://www.census.gov/quickfacts/scottcountyindiana>. Accessed September 2, 2019.
- ⁵ Gonsalves GS, Crawford FW. Dynamics of the HIV outbreak and response in Scott County, IN, USA, 2011–15: a modelling study. *Lancet*. 2018;5(10):PE569-E577.
- ⁶ Conrad C, Bradley HM, Broz D, et al. Community Outbreak of HIV Infection Linked to Injection Drug Use of Oxymorphone—Indiana, 2015. *MMWR Morbidity and mortality weekly report*. 2015;64(16):443-444.
- ⁷ Zibbell JE, Asher AK, Patel RC, et al. Increases in Acute Hepatitis C Virus Infection Related to a Growing Opioid Epidemic and Associated Injection Drug Use, United States, 2004 to 2014. *American journal of public health*. 2018;108(2):175-181.
- ⁸ California Department of Public Health, Office of Viral Hepatitis Prevention. Infographic: Hepatitis C and Opioid Use Rates Among Young Adults in California. 2018.
- ⁹ California Department of Public Health, Office of Viral Hepatitis Prevention. Chronic Hepatitis C in California 2016 Executive Summary. 2018.
- ¹⁰ California Department of Public Health, Office of Viral Hepatitis Prevention. Infographic: Hepatitis C in Youth. 2018.
- ¹¹ Golden MR, Lechtenberg R, Glick SN; et al. Outbreak of Human Immunodeficiency Virus Infection Among Heterosexual Persons Who Are Living Homeless and Inject Drugs — Seattle, Washington, 2018. *MMWR*. April 19, 2019;68(15):344–349
- ¹² Massachusetts Department of Public Health / Boston Public Health Commission. Health Care Advisory. http://www.bphc.org/whatwedo/infectious-diseases/Documents/Joint_HIV_outbreak_in_PWID_advisory_012519.pdf. Accessed September 4, 2019.
- ¹³ Northern Kentucky Health Department. News Release: Health Officials See Increase in HIV Infection Among Individuals Who Inject Drugs. <https://nkyhealth.org/2018/01/09/health-officials-see-increase-in-hiv-infection-among-individuals-who-inject-drugs/>. Accessed September 19, 2019.
- ¹⁴ Oregon Health Authority. Health officials alert public to increase in HIV infections among people who use drugs. Accessed September 19, 2019.
- ¹⁵ Evans ME, Labuda SM, Hogan V; et al. Notes from the field: HIV infection investigation in a rural area – West Virginia, 2017. *MMWR*. March 2, 2018/67(8):257-258.
- ¹⁶ California Department of Public Health, Office of AIDS. HIV Surveillance Report, 2017. 2019.
- ¹⁷ Centers for Disease Control and Prevention. Disease burden from viral hepatitis A, B, and C in the United States. <https://www.cdc.gov/hepatitis/statistics/DiseaseBurden.htm>. Accessed September 2, 2019.
- ¹⁸ Personal communication. Plumas County Public Health Agency syringe exchange program certification application to the California Department of Public Health, December 18, 2017.
- ¹⁹ Kentucky Cabinet for Health and Family Services, HIV/AIDS Branch. Why does Kentucky need SSPs? <https://chfs.ky.gov/agencies/dph/dehp/hab/Pages/kyseps.aspx>. Accessed September 19, 2019.
- ²⁰ Auriacombe M1, Fatséas M, Dubernet J, Daulouède JP, Tignol J. French field experience with buprenorphine. *Am J Addict*. 2004;13 Suppl 1:S17-28.
- ²¹ Platt L, Minozzi S, Reed J; et al. Needle syringe programmes and opioid substitution therapy for preventing hepatitis C transmission in people who inject drugs (Review). *Cochrane Database of Systematic Reviews* 2017, Issue 9. Art. No.: CD012021.

-
- ²² Centers for Disease Control and Prevention. HIV among people who inject drugs. <https://www.cdc.gov/hiv/group/hiv-idu.html>. Accessed September 5, 2019.
- ²³ Fernandes RM, Cary M, Duarte G, et al. Effectiveness of needle and syringe programmes in people who inject drugs – An overview of systematic reviews. *BMC Public Health*. 2017;17(1):309. doi:10.1186/s12889-017-4210-2.
- ²⁴ HIV and Injection Drug Use – Vital Signs – CDC. 2016. Centers for Disease Control and Prevention. <https://www.cdc.gov/vitalsigns/hiv-druguse/index.html>.
- ²⁵ Des Jarlais DC, Nugent A, Solberg A, Feelemyer J, Mermin J, Holtzman D. Syringe service programs for persons who inject drugs in urban, suburban, and rural areas — United States, 2013. *MMWR*. 2015;64(48):1337-1341. doi:10.15585/mmwr.mm6448a3.
- ²⁶ Seal KH, Thawley R, Gee L. Naloxone distribution and cardiopulmonary resuscitation training for injection drug users to prevent heroin overdose death: A pilot intervention study. *J Urban Health*. 2005;82(2):303–311.
- ²⁷ Galea S, Worthington N, Piper TM, Nandi VV, Curtis M, Rosenthal DM. Provision of naloxone to injection drug users as an overdose prevention strategy: Early evidence from a pilot study in New York City. *Addict Behav*. 2006;31(5):907-912.
- ²⁸ Tobin KE, Sherman SG, Beilenson P, Welsh C, Latkin CA. Evaluation of the Staying Alive programme: Training injection drug users to properly administer naloxone and save lives. *Int J Drug Policy*. 2009;20(2):131-136.
- ²⁹ Doe-Simkins M, Walley AY, Epstein A, Moyer P. Saved by the nose: Bystander-administered intranasal naloxone hydrochloride for opioid overdose. *Am J Public Health*. 2009;99(5):788-791.
- ³⁰ Bennett AS, Bell A, Tomedi L, Hulsey EG, Kral AH. Characteristics of an overdose prevention, response, and naloxone distribution program in Pittsburgh and Allegheny County, Pennsylvania. *J Urban Health*. 2011;88(6):1020-1030.
- ³¹ Leece PN, Hopkins S, Marshall C, Orkin A, Gassanov MA, Shahin RM. Development and implementation of an opioid overdose prevention and response program in Toronto, Ontario. *Can J Public Health*. 2013;104(3):e200-204.
- ³² Wheeler E, Jones TS, Gilbert MK, Davidson PJ. Opioid Overdose Prevention Programs Providing Naloxone to Laypersons - United States, 2014. *MMWR*. 2015 Jun 19;64(23):631-5.
- ³³ Behar E, Santos GM, Wheeler E, Rowe C, Coffin PO. Brief overdose education is sufficient for naloxone distribution to opioid users. *Drug Alcohol Depend*. 2015 Mar 1;148:209-12.
- ³⁴ Centers for Disease Control and Prevention. HIV Basics. <https://www.cdc.gov/hiv/basics/livingwithhiv/newly-diagnosed.html>. Accessed September 5, 2019.
- ³⁵ Vickerman P; et al. Impact and cost-effectiveness of scaling up HCV treatment and prevention interventions for PWID in the U.S. University of Bristol; 2017.
- ³⁶ Martin NK, Vickerman P, Foster GR, Hutchinson SJ, Goldberg DJ, Hickman M. Can antiviral therapy for hepatitis C reduce the prevalence of HCV among injecting drug user populations? A modeling analysis of its prevention utility. *J Hepatology*. 2011;54:1137–1144.
- ³⁷ California Department of Health Care Services. Medication assisted treatment expansion project. <http://www.californiamat.org/mat-projects/>. Accessed September 5, 2019.
- ³⁸ California Department of Health Care Services. Drug Medi-Cal Organized Delivery System. <https://www.dhcs.ca.gov/provgovpart/Pages/Drug-Medi-Cal-Organized-Delivery-System.aspx>. Accessed September 5, 2019.
- ³⁹ California Health Care Foundation. Naloxone access options in California. <https://www.chcf.org/wp-content/uploads/2018/10/NaloxoneAccessCA2018.pdf>. Accessed September 5, 2019.
- ⁴⁰ California Department of Public Health, Office of AIDS. Syringe Exchange Programs in California. https://www.cdph.ca.gov/Programs/CID/DOA/Pages/OA_prev_sep.aspx.
- ⁴¹ McLean R. Hepatitis C virus testing and linkage to care demonstration projects, California. Oral presentation at the 12th National Harm Reduction Conference, New Orleans, LA, October 18-21, 2018.
- ⁴² Nelson R. San Francisco's ambitious plan to eliminate hepatitis C. *The Lancet*. 2018;3(6):378.
- ⁴³ Ramers C. Sowing the Seeds of an HCV Elimination Movement in San Diego County. *HIV Specialist*. 2019; April: 14-19.
- ⁴⁴ University of California San Francisco AIDS Education Training Center, HIV Learning Network. <http://paetc.org/contact-us/hiv-learning-network/>. Accessed September 19, 2019.
- ⁴⁵ University of California San Francisco Hepatitis C Project Extension for Community Healthcare Outcomes (ECHO). <http://echo.ucsfhealth.org/>. Accessed September 19, 2019.

-
- ⁴⁶ Providers Clinical Support System. Overview of medication assisted treatment. <https://pcssnow.org/medication-assisted-treatment/>. Accessed September 19, 2019.
- ⁴⁷ Office of Governor Gavin Newsom. In Oakland, Governor Gavin Newsom Announces the Formation of the Homeless and Supportive Housing Advisory Task Force. <https://www.gov.ca.gov/2019/05/21/in-oakland-governor-gavin-newsom-announces-the-formation-of-the-homeless-and-supportive-housing-advisory-task-force/>. Accessed September 19, 2019.
- ⁴⁸ San Francisco Department of Public Health. Law enforcement assisted diversion San Francisco. <https://www.sfdph.org/dph/comupg/knowlcol/leadSF/Law-Enforcement-Assisted-Diversion-SF.asp>. Accessed September 19, 2019.
- ⁴⁹ Los Angeles County Supervisor Sheila Kuehl. Supervisors Expand Effective New Jail Diversion Program. <https://supervisorkuehl.com/supervisors-expand-effective-new-jail-diversion-program/>. Accessed September 19, 2019.
- ⁵⁰ California Department of Public Health, Safe and Active Communities Branch. Program Information. <https://www.cdph.ca.gov/Programs/CCDPHP/DCDIC/SACB/Pages/PrescriptionDrugOverdoseProgram.aspx>. Accessed September 19, 2019.
- ⁵¹ Jones CM, Logan J, Gladden RM, Bohm MK. Vital Signs: Demographic and Substance Use Trends Among Heroin Users — United States, 2002–2013. *MMWR*. July 10, 2015; 64(26):719-725.
- ⁵² Gladden RM, O'Donnell J, Mattson CL, Seth P. Changes in opioid-involved overdose deaths by type and presence of benzodiazepines, cocaine, and methamphetamine — 25 states, July-December 2017 to January-June 2018. *MMWR*. August 30, 2019;68(34):737-744.