

Vital Signs: Overdoses of Prescription Opioid Pain Relievers — United States, 1999–2008

Abstract

Background: Overdose deaths involving opioid pain relievers (OPR), also known as opioid analgesics, have increased and now exceed deaths involving heroin and cocaine combined. This report describes the use and abuse of OPR by state.

Methods: CDC analyzed rates of fatal OPR overdoses, nonmedical use, sales, and treatment admissions.

Results: In 2008, drug overdoses in the United States caused 36,450 deaths. OPR were involved in 14,800 deaths (73.8%) of the 20,044 prescription drug overdose deaths. Death rates varied fivefold by state. States with lower death rates had lower rates of nonmedical use of OPR and OPR sales. During 1999–2008, overdose death rates, sales, and substance abuse treatment admissions related to OPR all increased substantially.

Conclusions: The epidemic of overdoses of OPR has continued to worsen. Wide variation among states in the nonmedical use of OPR and overdose rates cannot be explained by underlying demographic differences in state populations but is related to wide variations in OPR prescribing.

Implications for Public Health Practice: Health-care providers should only use OPRs in carefully screened and monitored patients when non-OPR treatments are insufficient to manage pain. Insurers and prescription drug monitoring programs can identify and take action to reduce both inappropriate and illegal prescribing. Third-party payers can limit reimbursement in ways that reduce inappropriate prescribing, discourage efforts to obtain OPR from multiple health-care providers, and improve clinical care. Changes in state laws that focus on the prescribing practices of health-care providers might reduce prescription drug abuse and overdoses while still allowing safe and effective pain treatment.

Introduction

In 2007, nearly 100 persons per day died of drug overdoses in the United States (1). The death rate of 11.8 per 100,000 population in 2007 was roughly three times the rate in 1991. Prescription drugs have accounted for most of the increase in those death rates since 1999 (2). In 2009, 1.2 million emergency department (ED) visits (an increase of 98.4% since 2004) were related to misuse or abuse of pharmaceuticals, compared with 1.0 million ED visits related to use of illicit drugs such as heroin and cocaine (3). Prominent among these prescription drug–related deaths and ED visits are opioid pain relievers (OPR), also known as narcotic or opioid analgesics, a class of drugs that includes oxycodone, methadone, and

hydrocodone, among others. OPR now account for more overdose deaths than heroin and cocaine combined. OPR frequently are diverted for nonmedical use by patients or their friends or sold on the street. In 2010, 4.8% of the U.S. population aged ≥ 12 years used OPR nonmedically (4). Nonmedical use of OPR costs insurance companies up to \$72.5 billion annually in health-care costs (5).

States regulate the use of prescription drugs, such as OPR, and the practices of prescribers and pharmacists. States also finance and regulate health care for Medicaid populations, which are at greater risk for overdose (6). States therefore have a central role in ensuring that OPR are used legally and safely.



Comparisons among jurisdictions in drug overdose mortality, nonmedical use of OPR, and OPR sales can help identify risk factors and effective prevention measures. Among the states, OPR sales varied fourfold in 2002 (7), and death rates for overdoses involving OPR varied from 1.8 to 15.6 per 100,000 population in 2006 (2). More rural and more impoverished counties tend to have higher prescription drug overdose death rates (8,9).

Methods

For this report, death rates are based on the National Vital Statistics System multiple cause of death files (10). Rates were age-adjusted to the 2000 U.S. Census population using bridged-race* population figures. Drug poisoning deaths, referred to as drug overdose deaths in this report, were defined as those with an underlying cause of death classified by the *International Classification of Diseases, 10th Revision* (ICD-10) external cause of injury codes as X40–X44, X60–X64, X85, or Y10–Y14. Rates include injury deaths of any intent (unintentional, suicide, homicide, or undetermined) for U.S. residents. Among deaths with drug overdose as the underlying cause, CDC identified the type of drug involved using ICD-10 codes: prescription drugs (T36–T39, T40.2–T40.4, T41–T43.5, and T43.7–T50.8), including prescription opioid pain relievers (T40.2–T40.4); illicit drugs (T40.1, T40.5, T40.7–T40.9, and T43.6); or only unspecified drugs (T50.9 alone). The prescription drug category includes some over-the-counter medications. Some deaths involved prescription and illicit drugs and are counted in both drug categories. Years of potential life lost (YPLL) before age 65 years were calculated by subtracting age at death from 65 years and summing to get the total YPLL.

Rates of nonmedical OPR use in the past year by state were obtained from the 2008–2009 National Surveys on Drug Use and Health (NSDUH) (11). Nonmedical use was defined as use of a prescription pain reliever without a prescription belonging to the respondent or use for the experience or feeling the drug causes. The prescription pain reliever category includes OPR and selected barbiturate combination products used for headaches.

Annual drug sales for 1999–2010 were determined from the Automation of Reports and Consolidated Orders System (ARCOS) of the Drug Enforcement Administration (DEA) (12). For this report, ARCOS sales data were used as a surrogate for OPR use. DEA provided data on sales to pharmacies, hospitals, and practitioners for codeine, fentanyl, hydrocodone, hydromorphone, meperidine, methadone, morphine, and oxycodone (Kyle Wright, personal communication,

April 11, 2011). Sales of drugs to substance abuse treatment programs were not included. Amounts of drugs were standardized to morphine milligram equivalents (13).

The percentage of the state population below the federal poverty level by race and ethnicity during 2007–2008 was provided by the Kaiser Family Foundation (Rachel Licata, personal communication, August 10, 2011). Trends in substance abuse treatment admission rates were based on the Treatment Episode Data Set (14). Rates were calculated for admissions for treatment of substance abuse where the primary substance was an OPR.

Spearman's correlation coefficient was used to correlate the absolute increase in the non-Hispanic white overdose death rate during 1999–2008 with poverty level by state. Fisher's exact test was used to compare the proportions of states above and below national rates. Test results are statistically significant at $p < 0.05$.

Results

In 2008, a total of 36,450 deaths were attributed to drug overdose, a rate of 11.9 per 100,000 population (Table 1), among which a drug was specified in 27,153 (74.5%) deaths. One or more prescription drugs were involved in 20,044 (73.8%) of the 27,153 deaths, and OPR were involved in 14,800 (73.8%) of the 20,044 prescription drug overdose deaths. Rates varied by sex, race/ethnicity, and age. For deaths involving OPR, the rate among non-Hispanic whites and American Indians/Alaska Natives was three times higher than the rates in blacks and Hispanic whites. All death rates were highest among persons aged 35–54 years. Overdose resulted in 830,652 YPLL before age 65 years, a number comparable to the YPLL from motor vehicle crashes.

Rates for all outcomes studied varied widely by state (Table 2, Figure 1)[†] Overdose death rates ranged from 5.5 per 100,000 population in Nebraska to 27.0 in New Mexico. The prevalence of nonmedical use of OPR during 2008–2009 ranged from 3.6% in Nebraska to 8.1% in Oklahoma. The rate of OPR sales ranged from 3.7 kg per 10,000 population in Illinois to 12.6 kg in Florida. The highest sales rates were clustered in the Southeast and the Northwest. Among the 27 states with overdose death rates above the national rate, 21 (77.8%) had rates of nonmedical use above the national rate. Among the 24 states with death rates at or below the national rate, six (25.0%) had rates of nonmedical use above the national rate ($p < 0.001$). Among the 27 states with death rates above the national rate, 21 (77.8%) had rates of OPR sales above the national rate. Among the 24 states with death rates at or below the national rate, five (20.8%) had rates of OPR sales above the national rate ($p < 0.001$).

* Information about bridged-race categories is available at http://www.cdc.gov/nchs/nvss/bridged_race.htm.

[†] For this report, District of Columbia is grouped with the states.

TABLE 1. Drug overdose death rates by selected characteristics — National Vital Statistics System, United States, 2008

Characteristic	Age-adjusted rate*			
	All drugs [†]	Prescription drugs [§]	Opioid pain relievers [¶]	Illicit drugs ^{**}
Overall	11.9	6.5	4.8	2.8
Sex				
Men	14.8	7.7	5.9	4.3
Women	9.0	5.3	3.7	1.4
Race/Ethnicity				
White	13.2	7.4	5.6	2.8
Hispanic ^{††}	6.1	3.0	2.1	2.5
Non-Hispanic	14.7	8.4	6.3	2.9
Black	8.3	3.0	1.9	4.0
Asian/Native Hawaiian or Pacific Islander	1.8	1.0	0.5	0.6
American Indian/Alaska Native	13.0	8.4	6.2	2.7
Age group (yrs)				
0–14	0.2	0.2	0.1	— ^{§§}
15–24	8.2	4.5	3.7	2.2
25–34	16.5	8.8	7.1	4.4
35–44	20.9	11.0	8.3	5.3
45–54	25.3	13.8	10.4	6.0
55–64	13.0	7.3	5.0	2.5
≥65	4.1	3.0	1.0	0.3
Intent				
Unintentional	9.2	4.8	3.9	2.6
Undetermined	1.1	0.6	0.5	0.2
Suicide	1.6	1.1	0.5	0.1

* Rate per 100,000 population age-adjusted to the 2000 U.S. standard population using the vintage 2008 population. Because deaths might involve both prescription and illicit drugs, some deaths are included in both categories.

[†] Deaths with underlying causes of unintentional drug poisoning (X40–44), suicide drug poisoning (X60–64), homicide drug poisoning (X85), or drug poisoning of undetermined intent (Y10–Y14), as coded in the *International Classification of Diseases, 10th Revision*.

[§] Drug overdose deaths, as defined, that have prescription drugs (T36–T39, T40.2–T40.4, T41–T43.5, and T43.7–T50.8) as contributing causes.

[¶] Drug overdose deaths, as defined, that had other opioids (T40.2), methadone (T40.3), and other synthetic narcotics (T40.4) as contributing causes.

^{**} Drug overdose deaths, as defined, that have heroin (T40.1), cocaine (T40.5), hallucinogens (T40.7–T40.9), or stimulants (T43.6) as contributing causes.

^{††} Non-white Hispanics are included in the other racial groups.

^{§§} Rate is not presented when the estimate is unstable because the number of deaths is less than 20.

During 1999–2008, overdose death rates, sales, and substance abuse treatment admissions related to OPR increased in parallel (Figure 2). The overdose death rate in 2008 was nearly four times the rate in 1999. Sales of OPR in 2010 were four times those in 1999. The substance abuse treatment admission rate in 2009 was almost six times the rate in 1999. The rate of sales of OPR in 2010, 7.1 kg per 10,000 population, was equivalent to 710 mg per person in the United States. The percentage of the non-Hispanic white population below the poverty level during 2007–2008 correlated positively with the increase in overdose death rates among non-Hispanic whites from 1999 to 2008 by state ($r = 0.54$; $p < 0.001$). Louisiana, Mississippi,

Kentucky, and West Virginia had some of the largest mortality increases and some of the highest poverty levels among non-Hispanic whites.

Conclusions and Comment

The epidemic of prescription drug overdoses in the United States has worsened over the last decade, and by 2008, drug overdose deaths (36,450) were approaching the number of deaths from motor vehicle crashes (39,973), the leading cause of injury death in the United States. Parallel trends in deaths and OPR sales between 1999 and 2008, combined with continuing upward trends in ED visits (4), OPR abuse treatment admissions (14), and OPR sales after 2008 suggest that the death rate also has increased since 2008. Preliminary 2009 death data are consistent with such an increase (15). These increases occurred despite numerous warnings and recommendations over the past decade for voluntary education of providers about more cautious use of OPR (16).

Differences in OPR overdose mortality by race/ethnicity match the pattern for medical and nonmedical use of OPR, with the lowest rates for medical and nonmedical use among Asians and blacks and the highest rates among American Indians/Alaska Natives and non-Hispanic whites (4,17). Differences in OPR overdose mortality by race and ethnicity cannot explain the wide variation in death rates among states, given the equally large differences in non-Hispanic white mortality between states. Nor can demographic differences fully explain the wide variations among states in the nonmedical use and sales of OPR. Montana and Iowa, for example, have largely non-Hispanic white populations but widely varying rates of nonmedical use and sales of OPR.

By 2010, enough OPR were sold to medicate every American adult with a typical dose of 5 mg of hydrocodone every 4 hours for 1 month. Increased use of OPR has contributed to the overall increases in rates of overdose death and nonmedical use, and variation among states in OPR sales probably contributes to state variation in these outcomes. Given that 3% of physicians accounted for 62% of the OPR prescribed in one study (18), the proliferation of high-volume prescribers can have a large impact on state use of OPR and overdose death rates. Large increases in overdoses involving the types of drugs sold by illegitimate pain clinics (i.e., “pill mills”) have been reported in Florida (19) and Texas (20). Such clinics provide OPR to large volumes of patients without adequate evaluation or follow-up. Another possible contributor to state disparities is poverty, which was associated with greater increases in state death rates during 1999–2008. Medicaid populations are at greater risk of OPR overdose than non-Medicaid populations (6).

The findings in this report are subject to at least four limitations. First, vital statistics underestimate the rates of

TABLE 2. Rates of drug overdose death, nonmedical use of opioid pain relievers (OPR), and OPR sales, by state — United States

State	Drug overdose deaths*				OPR			
	Overall		Non-Hispanic whites		Nonmedical use [†]		Sales [§]	
	Rate	(SE)	Rate	(SE)	%	(SE)	Rate	(SE)
National	11.9	(0.1)	14.7	(0.1)	4.8	(0.1)	7.1	(0.0)
New Mexico	27.0	(1.2)	25.1	(1.7)	5.7 [¶]	(0.6)	6.7	(0.2)
West Virginia	25.8	(1.2)	26.6	(1.3)	5.9 [¶]	(0.6)	9.4	(0.2)
Nevada	19.6	(0.9)	27.5	(1.3)	5.9 [¶]	(0.4)	11.8	(0.2)
Utah	18.4	(0.9)	20.4	(1.0)	5.3 [¶]	(0.4)	7.4 [¶]	(0.2)
Alaska	18.1	(1.6)	18.1 [¶]	(2.1)	5.2 [¶]	(0.8)	8.2	(0.3)
Kentucky	17.9	(0.7)	19.6	(0.7)	6.0	(0.3)	9.0	(0.1)
Rhode Island	17.2	(1.3)	19.5	(1.5)	6.1	(0.6)	5.9	(0.2)
Florida	16.5	(0.3)	23.9	(0.5)	4.1	(0.2)	12.6	(0.1)
Oklahoma	15.8	(0.7)	17.5	(0.8)	8.1	(0.3)	9.2	(0.2)
Ohio	15.1	(0.4)	16.0	(0.4)	5.5	(0.2)	7.9	(0.1)
Louisiana	15.0	(0.6)	19.2	(0.8)	5.3 [¶]	(0.3)	6.8	(0.1)
Pennsylvania	15.1	(0.4)	15.6	(0.4)	4.1	(0.2)	8.0	(0.1)
Tennessee	14.8	(0.5)	17.2	(0.6)	4.9 [¶]	(0.2)	11.8	(0.1)
Washington	14.7	(0.5)	16.1	(0.6)	6.1	(0.2)	9.2	(0.1)
Colorado	14.6	(0.5)	15.0 [¶]	(0.6)	5.7 [¶]	(0.3)	6.3	(0.1)
Delaware	14.5	(1.3)	18.7	(1.8)	5.6 [¶]	(0.7)	10.2	(0.3)
Wyoming	14.4 [¶]	(1.8)	14.6 [¶]	(2.0)	3.9 [¶]	(0.9)	6.0	(0.3)
Montana	14.1 [¶]	(1.2)	13.7 [¶]	(1.3)	5.3 [¶]	(0.6)	8.4	(0.3)
Indiana	13.2	(0.5)	14.4 [¶]	(0.5)	5.7 [¶]	(0.2)	8.1	(0.1)
Alabama	13.1	(0.5)	17.6	(0.7)	5.1 [¶]	(0.3)	9.7	(0.1)
Arizona	13.1	(0.5)	17.1	(0.7)	6.0 [¶]	(0.2)	8.4	(0.1)
Arkansas	13.1 [¶]	(0.7)	15.6 [¶]	(0.9)	5.1 [¶]	(0.4)	8.7	(0.2)
Missouri	13.1	(0.5)	14.2 [¶]	(0.5)	4.4 [¶]	(0.2)	7.2 [¶]	(0.1)
North Carolina	12.9	(0.4)	17.1	(0.5)	5.0 [¶]	(0.2)	6.9	(0.1)
South Carolina	12.6 [¶]	(0.5)	16.7	(0.8)	4.7 [¶]	(0.3)	7.2 [¶]	(0.1)
Maine	12.3 [¶]	(1.0)	12.2	(1.0)	4.7 [¶]	(0.5)	9.8	(0.3)
Michigan	12.2 [¶]	(0.4)	13.0	(0.4)	5.7	(0.2)	8.1	(0.1)
Maryland	11.9 [¶]	(0.5)	15.3 [¶]	(0.7)	3.8	(0.2)	7.3 [¶]	(0.1)
Massachusetts	11.8 [¶]	(0.4)	12.9	(0.5)	5.3 [¶]	(0.2)	5.8	(0.1)
Oregon	11.7 [¶]	(0.6)	12.8	(0.6)	6.8	(0.3)	11.6	(0.2)
Vermont	10.9 [¶]	(1.4)	10.9	(1.4)	4.6 [¶]	(0.7)	8.1	(0.4)
Connecticut	10.8 [¶]	(0.6)	12.5	(0.7)	3.8	(0.3)	6.7	(0.1)
Mississippi	10.6	(0.6)	16.1 [¶]	(1.0)	4.7 [¶]	(0.3)	6.1	(0.1)
Illinois	10.5	(0.3)	11.7	(0.4)	4.1	(0.1)	3.7	(0.1)
Wisconsin	10.5	(0.4)	10.4	(0.5)	4.8 [¶]	(0.2)	6.5	(0.1)
California	10.4	(0.2)	16.1	(0.3)	4.8 [¶]	(0.1)	6.2	(0.0)
Idaho	9.7	(0.8)	10.7	(0.9)	5.8 [¶]	(0.4)	7.5 [¶]	(0.2)
Georgia	9.5 ^{**}	(0.3)	13.4 ^{**}	(0.5)	4.6 [¶]	(0.2)	6.5	(0.1)
District of Columbia	9.4 [¶]	(1.4)	— ^{††}	—	3.7	(0.7)	3.9	(0.3)
Hawaii	9.4	(0.9)	16.4 [¶]	(2.3)	5.1 [¶]	(0.4)	5.9	(0.2)
New Hampshire	9.3	(0.8)	9.5	(0.9)	5.9	(0.4)	8.1	(0.3)
Virginia	9.1	(0.3)	11.9	(0.5)	4.6 [¶]	(0.2)	5.6	(0.1)
Texas	8.6	(0.2)	13.2	(0.3)	4.6 [¶]	(0.1)	4.2	(0.0)
New York	8.4	(0.2)	10.0	(0.3)	4.4 [¶]	(0.1)	5.3	(0.1)
Kansas	8.0	(0.5)	8.6	(0.6)	5.0 [¶]	(0.3)	6.8 [¶]	(0.2)
New Jersey	8.0	(0.3)	10.5	(0.5)	3.8	(0.2)	6.0	(0.1)
North Dakota	7.6	(1.3)	7.5	(1.4)	3.9 [¶]	(0.6)	5.0	(0.3)
South Dakota	7.3	(1.1)	6.2	(1.1)	3.8	(0.6)	5.5	(0.3)
Minnesota	7.2	(0.4)	7.2	(0.4)	4.4 [¶]	(0.2)	4.2	(0.1)
Iowa	7.1	(0.5)	7.5	(0.5)	3.6	(0.3)	4.6	(0.1)
Nebraska	5.5	(0.6)	5.8	(0.7)	3.6	(0.3)	4.2	(0.2)

Abbreviation: SE = standard error.

* Deaths per 100,000 population in 2008; age-adjusted to the 2000 U.S. standard population using the vintage 2008 population.

† Percentage of persons aged ≥12 years using OPR nonmedically during 2008–2009.

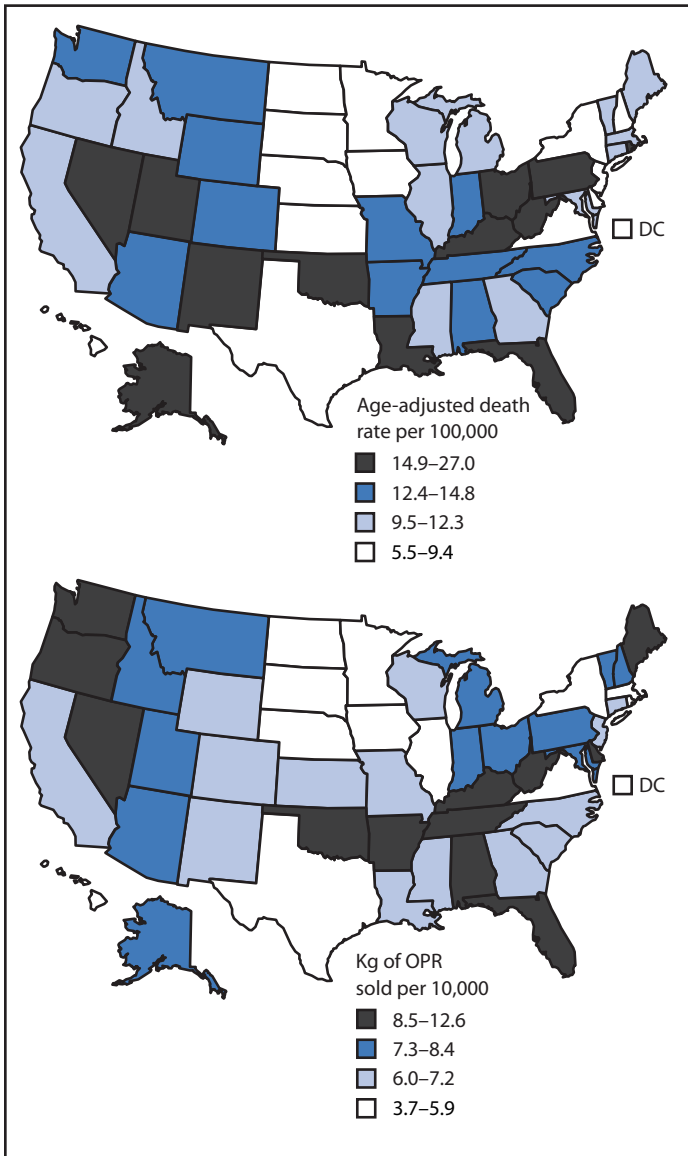
§ Kilograms of OPR sold per 10,000 population in morphine equivalents in 2010.

¶ Rate is not significantly different from the national rate.

** Death rates from Georgia are based on preliminary numbers of deaths and might be underestimates.

†† The rate is not presented when the estimate is unstable because the number of deaths is less than 20.

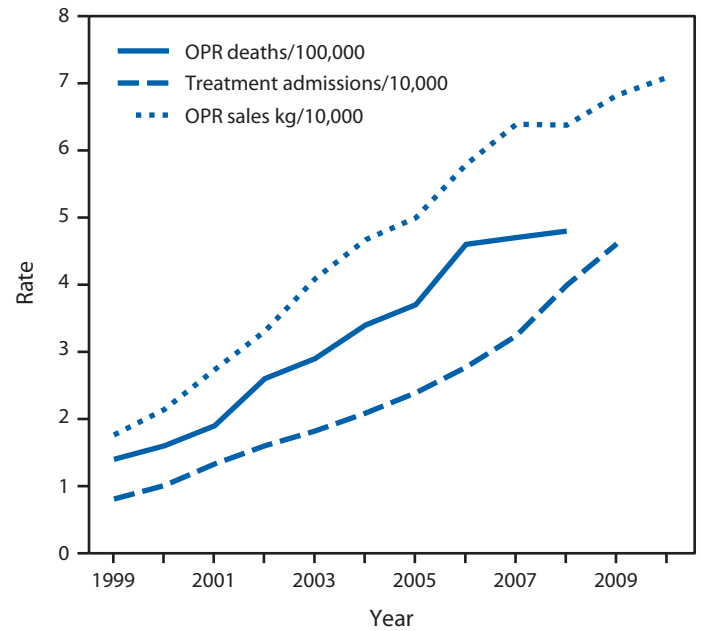
FIGURE 1. Drug overdose death rate in 2008 and rate of kilograms (kg) of opioid pain relievers (OPR) sold in 2010 — United States



prescription and illicit drugs because the type of drug is not specified on many death certificates. Second, respondents might underreport nonmedical use of OPR in surveys such as the NSDUH. Third, ARCOS data reflect sales to retail outlets by state, but some drugs might have been used by nonstate residents or sent to other states by mail-order pharmacies or otherwise not used by state residents. Finally, sales data did not include buprenorphine, an opioid primarily used for substance abuse treatment, though sometimes prescribed for pain. Its inclusion with drugs primarily used to treat pain would have inappropriately increased sales rates.

Public health interventions to reduce prescription drug overdose must strike a balance between reducing misuse

FIGURE 2. Rates* of opioid pain reliever (OPR) overdose death, OPR treatment admissions, and kilograms of OPR sold — United States, 1999–2010



* Age-adjusted rates per 100,000 population for OPR deaths, crude rates per 10,000 population for OPR abuse treatment admissions, and crude rates per 10,000 population for kilograms of OPR sold.

and abuse and safeguarding legitimate access to treatment. To find this balance, health-care providers should only use OPR in carefully screened and monitored patients when non-OPR treatments have not been sufficient to treat pain, as recommended in evidence-based guidelines (21). States, as regulators of health-care practice, have the responsibility and authority to monitor and correct inappropriate and illegal prescribing. Data from state prescription drug monitoring programs, which collect records of prescription drugs prone to abuse from pharmacies, and Medicaid claims data can be used to identify and address OPR misuse and abuse. State Medicaid programs and other public insurers can use economic measures to hold providers accountable for their prescribing of OPR and other controlled prescription drugs. State professional licensing boards can take action against prescribers misusing their licenses, and law enforcement agencies can take action against illegal activities. State policies that focus on providers operating outside of normal medical practice, such as laws prohibiting so-called “pill mills,” are a promising approach (19). All interventions need to be evaluated further and new interventions developed. Concerted attempts to address this problem, especially in states with high rates of OPR sales, nonmedical use, or overdose mortality, might help control the epidemic.

Key Points

- Death from opioid pain relievers (OPR) is an epidemic in the United States.
- Sales of OPR quadrupled between 1999 and 2010. Enough OPR were prescribed last year to medicate every American adult with a standard pain treatment dose of 5 mg of hydrocodone (Vicodin and others) taken every 4 hours for a month.
- Abuse of OPR costs health insurers approximately \$72.5 billion annually in health-care costs.
- State-based prescription drug monitoring program records and insurance claims information can identify and address inappropriate prescribing and use by patients. State laws and regulations based on these data need to be enacted, enforced, and rigorously evaluated.
- Additional information is available at <http://www.cdc.gov/vitalsigns>.

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