

# Trends in Medical Use and Abuse of Opioid Analgesics

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**U**NRELIEVED PAIN, WHETHER DUE to trauma, surgery, cancer or noncancer conditions, and including pain occurring at the end of life, continues to be a major public health concern.<sup>1-4</sup> Although numerous nonpharmacologic treatments can be used to relieve pain, the use of opioids in the class of morphine is the cornerstone of pain management.<sup>5-8</sup>

However, because opioids have the potential to be abused, they are regulated under international and national narcotics and controlled substances laws.<sup>9,10</sup> International and US federal drug laws embody a dual imperative to ensure the availability of controlled substances for medical and scientific purposes, while at the same time to prevent their diversion and abuse.<sup>11</sup>

Concerns related to drug abuse permeate efforts to treat pain with opioids. Patients are concerned about becoming addicted to opioids.<sup>6,12,13</sup> Health care professionals may be reluctant to prescribe, administer, dispense, or stock controlled substances for fear of causing addiction or contributing to the drug abuse problem.<sup>14-17</sup> There are few studies of the extent to which prescription opioid analgesics contribute to the national drug abuse problem.<sup>18</sup> In this descriptive study, we examine the abuse of opioid analgesics in relationship to their medical use.

**See also Patient Page.**

**Context** Pain often is inadequately treated due in part to reluctance about using opioid analgesics and fear that they will be abused. Although international and national expert groups have determined that opioid analgesics are essential for the relief of pain, little information has been available about the health consequences of the abuse of these drugs.

**Objective** To evaluate the proportion of drug abuse related to opioid analgesics and the trends in medical use and abuse of 5 opioid analgesics used to treat severe pain: fentanyl, hydromorphone, meperidine, morphine, and oxycodone.

**Design and Setting** Retrospective survey of medical records from 1990 to 1996 stored in the databases of the Drug Abuse Warning Network (source of abuse data) and the Automation of Reports and Consolidated Orders System (source of medical use data).

**Patients** Nationally representative sample of hospital emergency department admissions resulting from drug abuse.

**Main Outcome Measures** Medical use in grams and grams per 100 000 population and mentions of drug abuse by number and percentage of the population.

**Results** From 1990 to 1996, there were increases in medical use of morphine (59%; 2.2 to 3.5 million g), fentanyl (1168%; 3263 to 41 371 g), oxycodone (23%; 1.6 to 2.0 million g), and hydromorphone (19%; 118 455 to 141 325 g), and a decrease in the medical use of meperidine (35%; 5.2 to 3.4 million g). During the same period, the total number of drug abuse mentions per year due to opioid analgesics increased from 32 430 to 34 563 (6.6%), although the proportion of mentions for opioid abuse relative to total drug abuse mentions decreased from 5.1% to 3.8%. Reports of abuse decreased for meperidine (39%; 1335 to 806), oxycodone (29%; 4526 to 3190), fentanyl (59%; 59 to 24), and hydromorphone (15%; 718 to 609), and increased for morphine (3%; 838 to 865).

**Conclusions** The trend of increasing medical use of opioid analgesics to treat pain does not appear to contribute to increases in the health consequences of opioid analgesic abuse.

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## METHODS

We evaluated abuse trends for opioid analgesics as a class, as well as the medical use and abuse of 5 specific Schedule II opioids: fentanyl, hydromorphone, meperidine, morphine, and oxycodone. We chose these 5 drugs because they are effective in treating se-

vere pain and are marketed as analgesics.<sup>5-7,19</sup> We excluded opioid analgesics classified in lower schedules (ie, Schedules III and IV), such as hydrocodone and codeine combinations because they are not indicated for severe pain. We also excluded opioid analgesics for which consumption data would in-

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clude amounts used for other major indications (such as codeine for cough and diarrhea, and drugs used for treatment of opioid addiction such as methadone).

### Data on Drug Abuse Trends

We used the Drug Abuse Warning Network (DAWN) as the source for data on opioid abuse. DAWN, sponsored by the Substance Abuse and Mental Health Services Administration in the US Department of Health and Human Services, provides estimates of the health consequences of the nonmedical use of individual drugs. It is a large-scale, ongoing retrospective survey of medical records that is used to monitor national drug abuse trends. The system collects information from DAWN-affiliated hospital emergency departments (EDs) to identify substances that are abused; monitor drug abuse patterns and trends and detect new drug entities and combinations; assess health hazards associated with drug abuse; and provide data for national, state, and local drug abuse policy and program planning.

Data are collected on patients 6 years and older from the EDs of approximately 500 US hospitals in 21 metropolitan and other nonmetropolitan areas. Hospitals eligible to participate in DAWN are non-federal, short-stay general hospitals with 24-hour EDs that are located in the conterminous United States. DAWN has been in existence since 1972, and began collecting data from a nationally representative sample of EDs in 1990.<sup>20,21</sup> For our analysis, we used data from the 7-year period from 1990 to 1996 (the most recent year for which data were available at the time this study was begun).

Each hospital has a designated reporter, usually a member of the ED or medical records department, who is responsible for obtaining information from medical records each time a patient visits the ED with a presenting problem related to drug use; each visit is defined as an episode. Reported episodes typically involve drug overdoses, but also may be the result of long-term drug use and adverse reactions.

The reporter collects information for each episode, including gender, ethnicity, age, concomitant use of other drugs, motive for use, reason for ED contact, source of substance, dosage form, and route of administration. The national estimates of abuse are derived from these data. Standardized procedures are used to collect DAWN data; however, there may be some variability from facility to facility.<sup>20</sup>

Drug abuse in the DAWN system is defined as the nonmedical use of a substance for psychic effect, dependence, or suicide attempt or gesture. Drug abuse can involve the use of illicit drugs or any other substance (eg, heroin, marijuana, peyote, glue, aerosols); prescription drugs in a manner inconsistent with accepted medical practice; and over-the-counter drugs contrary to approved labeling.<sup>20</sup>

For each episode of drug abuse, as many as 4 different substances, in addition to alcohol, can be recorded. Each is referred to as a drug mention. More than half of DAWN episodes involve multiple drug mentions.<sup>20</sup> If DAWN reporters are not able to classify a drug, these mentions are classified as other/unspecified. DAWN reports do not include information about drugs for which the frequency of annual mentions is less than 200. However, for our study, the Substance Abuse and Mental Health Services Administration performed a special data run to extract annual abuse mentions for one of the study drugs, fentanyl, for which the number of mentions is consistently less than 200 per year.

We renamed several drug categories and reclassified a number of drugs to reflect current medical terminology and pharmacology. The categories designated as narcotic analgesics and non-narcotic analgesics were renamed as opioid analgesics and nonopioid analgesics. Some drugs were reclassified: codeine combinations were recategorized from other drugs to opioid analgesics. Hydrocodone was reclassified from other/unspecified narcotic analgesics to opioid analgesics. Ibuprofen and naproxen were transferred from other drugs to

nonopioid analgesics. Methamphetamine and methaqualone, originally classified as amphetamines and non-barbiturate sedatives, respectively, were moved to the category of illicit drugs. Other/unspecified drugs listed within each subcategory of DAWN reports were aggregated into 1 "other drugs" category.

DAWN reports routinely combine heroin and morphine mentions into a single category, making it impossible to distinguish between the abuse of an illicit drug and an essential pain medication. We requested that the Substance Abuse and Mental Health Services Administration separate morphine from the heroin-morphine category for the period from 1990 to 1996. Morphine mentions accounted for an annual average of 1.9%, and never exceeded 2.5%, of the combined heroin-morphine category.

### Data on Medical Use of Opioids

We obtained data on medical use of opioids from the US Drug Enforcement Administration's Automation of Reports and Consolidated Orders System (ARCOS) for the years 1990 to 1996. ARCOS is a federal, computerized data system, required by the 1970 Controlled Substances Act.<sup>10</sup> ARCOS monitors the lawful distribution of controlled substances in Schedules I and II and narcotic substances in Schedule III from manufacturers to the retail level of consumption, including hospitals, pharmacies, and licensed practitioners. The Drug Enforcement Administration makes reports on ARCOS data, providing information on individual states and national totals.<sup>22</sup> Information is provided for each drug in total grams and grams per 100 000 population.<sup>23,24</sup> ARCOS is the only nonproprietary source of information on medical use of opioids.

## RESULTS

The percentage of 1996 total DAWN ED mentions represented by each of the 5 drug categories is shown in TABLE 1. Mentions for opioid analgesics account for less than 4% of total DAWN

mentions, mentions for nonopioid analgesics account for 8.6%, and mentions for illicit drugs account for 33.2%. TABLE 2 presents the abuse levels for the same drug categories as number of mentions and as a percentage of total DAWN mentions for the period 1990 to 1996. From 1990 to 1996, the number of mentions for drug abuse in DAWN increased from 635 460 to 907 561 (42.8% increase), with an in-

crease in total mentions for all drug categories. For opioid analgesics, the total number of mentions increased from 32 430 in 1990 to 34 563 in 1996 (6.6% increase), but declined as a percentage of total mentions from 5.1% in 1990 to 3.8% in 1996. Illicit drugs is the only category of drug abuse that exhibited a continual increase in both number of mentions and percentage of total mentions over the study period.

Trends in the medical use of the 5 selected opioid analgesics from 1990 to 1996 are shown in TABLE 3. Substantial increases were observed in use of fentanyl and morphine, which occurred in both total use and use adjusted for population.

TABLE 4 presents trends for the abuse of the 5 selected opioid analgesics for the same 7-year trend. The number of abuse mentions, as measured by DAWN, for fentanyl, hydromorphone, meperidine, and oxycodone declined during the study period, whereas abuse mentions for morphine increased by 3.2%. The abuse levels for each of the 5 opioid analgesics, as a percentage of total DAWN mentions, were less than 1% and declined during the study period despite substantial increases in medical use.

**COMMENT**

Official Drug Enforcement Administration data indicate that the amounts of fentanyl, oxycodone, hydromorphone, and morphine distributed to the retail level have increased substantially.<sup>25</sup> According to the World Health Organization, increasing medical use of opioids is one indication that progress

is being made to improve pain management.<sup>19</sup> Despite these increases, pain is still inadequately treated due to numerous barriers to pain management.<sup>6,26</sup> In the future, as these barriers are addressed, the medical use of opioid analgesics may be expected to increase further.

In this study, meperidine was the only opioid that decreased in medical use over the study period. This decrease may reflect increasing awareness of the shortcomings of the use of meperidine for chronic pain, which includes short duration of action and accumulation of a long-lived toxic metabolite.<sup>6,27</sup>

These data suggest that opioid analgesics, including the 5 study drugs, are a relatively small part of drug abuse as measured by the DAWN system. Although there are year-to-year variations, the abuse levels have remained low and relatively stable for the past 7 years despite substantial increases in the medical use of opioids. Although abuse of most opioids decreased during the study period, several caveats are needed to place these results in context.

First, these data also indicate that there is some abuse of opioid analgesics. However, compared with the abuse of other drugs, illicit drugs in particular, the abuse of opioid analgesics appears to be relatively low, accounting for 3.8% of total DAWN mentions in 1996. Moreover, even though there were increases in the total number of mentions of abuse for opioid analgesics during the study period, the proportion of mentions for opioid abuse relative to total reports of drug abuse decreased by 25% (from 5.1% to 3.8%).

**Table 1.** Drug Abuse Warning Network Drug Categories as a Percentage of Total Mentions in 1996 (N = 907 561)

Category	Percentage
Opioid analgesics	3.8
Codeine/combinations	
Dextropropoxyphene	
Dihydrocodeine	
Fentanyl	
Hydrocodone combinations	
Hydromorphone	
Levorphanol	
Meperidine	
Methadone	
Morphine	
Oxycodone	
Oxymorphone	
Nonopioid analgesics	8.6
Acetaminophen	
Aspirin	
Butalbital combinations	
Ibuprofen	
Naproxen	
Alcohol in combination with other drugs	18.3
Illicit drugs	33.2
Cocaine	
Heroin	
Lysergic acid diethylamide (LSD)	
Marijuana/hashish	
Methamphetamine	
Methaqualone	
Phencyclidine (PCP)	
Other drugs	36.1
Amphetamines	
Antidepressants	
Antipsychotics	
Benzodiazepines	
Other sedatives/hypnotics	
Other/unknown	

**Table 2.** Abuse Listed by Drug Abuse Warning Network Category\*

Year	Opioid Analgesics	Nonopioid Analgesics	Alcohol in Combination With Other Drugs	Illicit Drugs	Other Drugs	Total
1990	32 430 (5.10)	66 692 (10.50)	115 162 (18.12)	144 032 (22.67)	277 144 (43.61)	635 460
1991	33 408 (4.88)	74 253 (10.84)	123 758 (18.06)	168 636 (24.61)	285 178 (41.62)	685 233
1992	31 790 (4.23)	71 220 (9.47)	141 773 (18.86)	208 186 (27.69)	298 761 (39.74)	751 730
1993	34 233 (4.30)	76 011 (9.54)	143 574 (18.02)	235 716 (29.58)	307 229 (38.56)	796 763
1994	35 529 (3.95)	73 137 (8.12)	160 744 (17.85)	277 008 (30.77)	353 899 (39.31)	900 317
1995	35 807 (3.97)	81 879 (9.09)	166 925 (18.52)	280 760 (31.15)	335 835 (37.27)	901 206
1996	34 563 (3.81)	78 272 (8.62)	166 185 (18.31)	300 819 (33.15)	327 722 (36.11)	907 561

\*Values are expressed as number (percentage) of raw mentions. Columns do not add to 100% due to rounding.

**Table 3.** Medical Use of Selected Opioid Analgesics\*

Year	Fentanyl	Hydromorphone	Meperidine	Morphine†	Oxycodone
1990	3263 (1.30)	118 455 (47.36)	5 223 137 (2087.63)	2 172 006 (868.13)	1 642 400 (656.45)
1991	12 261 (4.91)	126 251 (50.47)	4 879 898 (1950.44)	2 327 881 (926.19)	1 604 605 (641.35)
1992	23 673 (9.37)	129 549 (51.34)	4 407 189 (1746.51)	2 483 756 (984.26)	1 573 106 (623.40)
1993	29 668 (11.75)	129 893 (51.48)	4 075 132 (1614.92)	2 733 332 (1083.18)	1 563 367 (619.55)
1994	28 985 (11.47)	133 428 (52.88)	3 854 929 (1527.66)	2 772 441 (1098.69)	1 448 599 (574.06)
1995	30 640 (11.47)	127 905 (47.94)	3 483 637 (1305.53)	2 869 876 (1075.53)	1 426 883 (534.75)
1996	41 371 (15.49)	141 325 (52.96)	3 380 440 (1266.86)	3 461 618 (1297.29)	2 016 172 (755.58)
Percentage change	1167.88 (1091.54)	19.31 (11.82)	-35.28 (-39.32)	59.37 (49.43)	22.76 (15.10)

\*Values are expressed as grams (grams/100 000 population). Data from the Automation of Reports and Consolidated Orders System.  
 †Data from 1991 interpolated due to reporting anomalies.

Second, the DAWN system may underestimate the extent of the drug abuse problem. The DAWN system measures only those episodes of drug abuse that result in an admission to an ED, and thus underreports the true extent of all drug abuse, such as drug-related overdoses and deaths occurring out of the hospital. We believe that this limitation, which is common to all drug abuse monitoring systems, should not affect the proportional representation of drug categories because it should affect all drug categories equally. Furthermore, our study primarily addresses changes in abuse trends rather than abuse levels at a single point in time. As such, it is important to evaluate these data longitudinally to examine the stability of the incidence frequency, and to detect relative changes in abuse levels. However, the apparent stability of abuse levels over the study period suggests that actual abuse of opioid analgesics, regardless of total prevalence, is also relatively stable.

Third, although the DAWN system collects some information about the severity of adverse events resulting from drug ingestion, such as mortality rates and hospital admissions, we were unable to use the data to detect any trends in the severity of adverse events related to the abuse of opioid analgesics. The mortality data in the DAWN ED system are sparse because most deaths do not occur in the ED. Instead, these deaths appear in the DAWN medical examiner data. However, the DAWN medical examiner reports were not used because drug-related mortality data do not differentiate among deaths related

**Table 4.** Abuse of Selected Opioid Analgesics Listed by Drug Abuse Warning Network Category\*

Year	Fentanyl	Hydromorphone	Meperidine	Morphine	Oxycodone
1990	59 (0.009)	718 (0.113)	1335 (0.210)	838 (0.132)	4526 (0.712)
1991	121 (0.018)	756 (0.110)	2012 (0.294)	915 (0.134)	4001 (0.584)
1992	17 (0.002)	615 (0.082)	1163 (0.155)	937 (0.125)	3750 (0.499)
1993	79 (0.010)	791 (0.099)	1471 (0.185)	1120 (0.141)	3395 (0.426)
1994	0 (0)	896 (0.100)	736 (0.082)	1098 (0.122)	4084 (0.454)
1995	23 (0.003)	576 (0.064)	1034 (0.115)	1286 (0.143)	3393 (0.377)
1996	24 (0.003)	609 (0.067)	806 (0.089)	865 (0.095)	3190 (0.352)
Percentage change	-59.32	-15.18	-39.63	3.22	-29.52

\*Values are expressed as number (percentage) of raw mentions.

to morphine, heroin, and codeine. Moreover, data on hospital admissions related to abuse of opioid analgesics are not available for most of the drugs examined in this study.

Fourth, we used data on abuse of opioids from the DAWN system. Two other sources of drug abuse information were considered but not used. The National Household Survey on Drug Abuse,<sup>28</sup> a widely known survey measuring drug abuse prevalence, was not used because data are not available for specific opioid analgesics. Also, the Toxic Exposure Surveillance System,<sup>29</sup> which tracks exposures to toxic substances from a large sample of regional poison control centers, was not used because it is not nationally representative and because the cost of acquiring the data was prohibitive.

**CONCLUSION**

Conventional wisdom suggests that the abuse potential of opioid analgesics is such that increases in medical use of these drugs will lead inevitably to increases in their abuse. The data from this study with respect to the opioids

in the class of morphine provide no support for this hypothesis. The present trend of increasing medical use of opioid analgesics to treat pain does not appear to be contributing to increases in the health consequences of opioid analgesic abuse. To maintain this trend, manufacturers, pharmacies, clinicians, and patients should continue their efforts to improve pain management while exercising care so that the diversion of opioid medications for non-medical use is minimized. If the abuse of opioid analgesics should increase, the sources of diversion should be addressed directly without interfering with medical availability of opioid analgesics, legitimate medical practices, or patient care.

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Cast aside your allegories  
 And empty hypotheses!  
 Give us straight answers  
 To the accursed questions.  
 —Heinrich Heine (1797-1856)