



## Morbidity and Mortality Weekly Report

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### Nonpharmaceutical Fentanyl-Related Deaths — Multiple States, April 2005–March 2007

On April 21, 2006, increases in overdoses were reported among illicit drug users in Camden, New Jersey, via the CDC Epidemic Information Exchange (Epi-X). This alert elicited reports of similar increases in overdoses in other parts of New Jersey, and in Maryland; Chicago, Illinois; Detroit, Michigan; and Philadelphia, Pennsylvania. The increases in Chicago and Detroit had been recognized several months earlier but attributed to heroin overdoses until fentanyl was detected in the blood or urine of some decedents. Illicitly manufactured nonpharmaceutical fentanyl (NPF), a synthetic opioid 30–50 times more potent than heroin (1), also was found by law enforcement personnel and medical examiner staffs at the scene of some overdoses. In May 2006, to identify NPF-related deaths in six state and local jurisdictions, CDC implemented an ad hoc case-finding and surveillance system, later managed by the Drug Enforcement Administration (DEA). This report summarizes the results of that effort, which identified 1,013 NPF-related deaths that occurred during April 4, 2005–March 28, 2007. As a result, on April 23, 2007, DEA began regulating access to N-phenethyl-4-piperidone, a chemical used to make illicit NPF (1). Increased public health efforts are needed to improve epidemiologic data collection on drug overdoses, enable early detection of increases in drug overdoses, educate illicit drug users regarding the risks for overdose, and help users obtain treatment for their addictions.

Since 1990, pharmaceutical fentanyl (e.g., Duragesic transdermal patches) has been approved for patient use to relieve severe or chronic pain. However, pharmaceutical fentanyl also has been misused and associated with fatal drug overdoses (2). In addition, since the 1970s, NPF and various fentanyl analogs (e.g., alphamethylfentanyl) have been produced illicitly, sold in street drug markets for their heroin-like effect, and implicated in fatal overdoses (3). One gram of pure fentanyl can be cut into approximately 7,000 doses for street

sale (1). Manufacture of NPF requires minimal technical knowledge, and recipes for making NPF are available on the Internet (1). Testing of drug samples containing fentanyl can distinguish between pharmaceutical and illicitly manufactured NPF. However, testing of biologic samples (e.g., serum) cannot distinguish between pharmaceutical fentanyl and NPF (4).

In May 2006, in response to concern over reports of increased NPF-related deaths, CDC collaborated with medical examiners, law enforcement agencies, and public health departments in six state and local jurisdictions\* to establish an ad hoc surveillance system for NPF-related deaths. In each jurisdiction, reports from participating medical examiners were reviewed. An NPF-related death was defined as one in which 1) fentanyl caused or contributed to the death, 2) no evidence was found of the involvement of pharmaceutical fentanyl products, and 3) toxicology testing confirmed fentanyl in the body, in unused drugs of the decedent, or in a specimen from a person with whom the decedent shared drugs. Public health departments and law enforcement agencies collaborated with participating medical examiners, initially identifying NPF-related deaths that

\* All of Delaware and New Jersey and parts of Illinois, Michigan, Missouri, and Pennsylvania.

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occurred during April 2005–May 2006 and adding new NPF-related deaths as they were identified. In September 2006, DEA took over the surveillance system, using the same case definition; data collection ended in May 2007.

Testing of street drugs found samples consisting of NPF alone and NPF mixed with other drugs. Most of the implicated NPF was mixed with heroin or cocaine, sold as a street drug, and used as an injection. During April 4, 2005–March 28, 2007, the CDC/DEA surveillance system identified 1,013 NPF-related deaths (Table). The monthly incidence of NPF deaths peaked in June 2006 at 150 cases and decreased to one death in February 2007 and one death in March 2007 (Figure 1). Among the 984 decedents whose sex and age were known, 577 (58.6%) were aged 35–54 years (Figure 2), and 788 (80.1%) were male. Among the 984 decedents whose race/ethnicity were known, 545 (55.4%) were white, 392 (39.8%) were black, and 41 (4.2%) were Hispanic.

In response to the NPF-related deaths, public health agencies formed task forces; alerted health-care providers, law enforcement, and drug users; and intensified community outreach to drug users (including hiring additional outreach workers). In some areas, outreach activities included training drug users and others in overdose prevention and cardiopulmonary resuscitation and providing “take-home” parenteral or intranasal naloxone, an antagonist used to reverse opioid overdoses (5). Law enforcement agencies (e.g., DEA and local and state police) responded by identifying and arresting sellers of NPF, seizing NPF, and closing NPF production facilities, including one in Toluca, Mexico, in May 2006. In April 2007, DEA began regulating access to N-phenethyl-4-piperidone, a chemical used to manufacture NPF (1).

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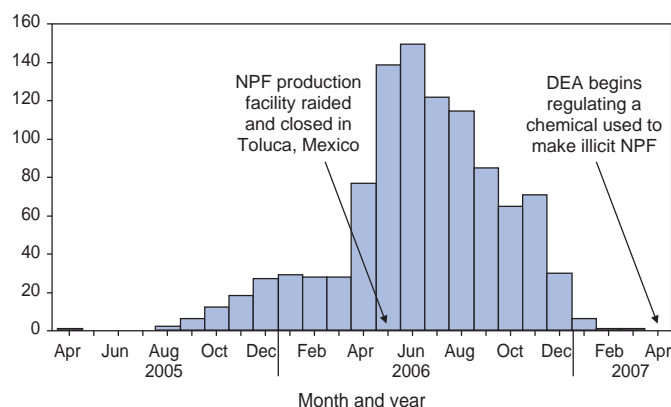
**TABLE. Number of reported nonpharmaceutical fentanyl-related deaths, by jurisdiction — CDC/Drug Enforcement Administration surveillance system, United States, April 4, 2005–March 28, 2007**

State	Jurisdiction	Deaths meeting case definition*
Delaware	Entire state	19
Illinois	Cook County	349
Michigan	Wayne County	230
Missouri	City of St. Louis, St. Louis County	60†
New Jersey	Entire state	86
Pennsylvania	Philadelphia	269
<b>Total</b>		<b>1,013</b>

\* Deaths in which 1) fentanyl caused or contributed to the death, 2) no evidence was found of the involvement of pharmaceutical fentanyl products, and 3) toxicology testing confirmed fentanyl in the body, in unused drugs of the decedent, or in a specimen from a person with whom the decedent shared drugs.

† City of St. Louis (21 deaths); St. Louis County (39 deaths).

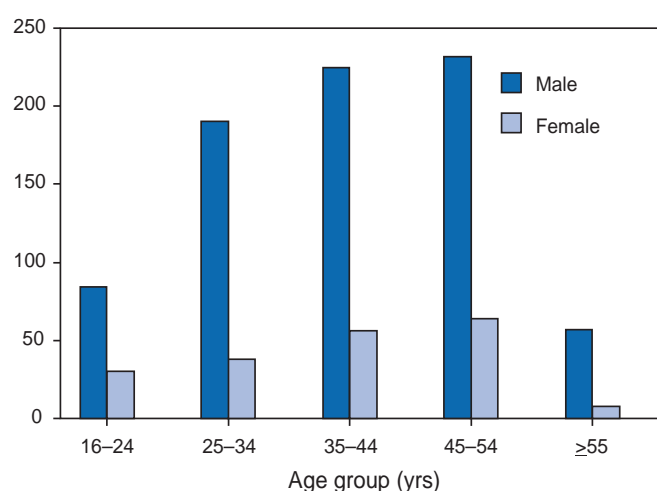
**FIGURE 1. Number of reported deaths (N = 1,013) related to nonpharmaceutical fentanyl (NPF), by month of death — CDC/Drug Enforcement Administration (DEA) surveillance system, United States, April 2005–April 2007**



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**Editorial Note:** The findings in this report indicate that, during April 4, 2005–March 28, 2007, a total of 1,013 deaths in six jurisdictions were attributed to NPF, making this the largest NPF epidemic ever reported. An earlier epidemic in the 1980s resulted in at least 110 fatal overdoses caused by 10 different fentanyl analogs (3). The NPF epidemic described in this report was multifocal, with the largest numbers of deaths occurring in metropolitan Chicago, Detroit, and Philadelphia. In addition to the NPF-related deaths identified by the CDC/DEA surveillance system, other NPF-related deaths were reported in suburban and rural areas of Illinois, Michigan, and Pennsylvania and in Kentucky, Maine, Maryland, Massachusetts, New Hampshire, Ohio, and Virginia during the same period (1).

**FIGURE 2. Number of reported nonpharmaceutical fentanyl-related deaths (n = 984\*), by sex and age group — CDC/Drug Enforcement Administration surveillance system, United States, April 4, 2005–March 28, 2007**



\* Data not available for 29 deaths.

The pattern of NPF overdoses likely was related to illicit drug distribution networks. For example, the NPF used in Chicago and Detroit is believed to have come from clandestine production at a site in Mexico (1). However, why active surveillance in other areas with high rates of heroin use (e.g., New York City) did not find NPF-related deaths is unknown.

The NPF epidemic described in this report was part of a larger pattern of drug overdoses and poisonings in the affected jurisdictions. For example, in 2006, in Wayne County, Michigan, fentanyl contributed to 195 (32.4%) of 602 deaths resulting from drug use (C. Schmidt, MD, Wayne County Medical Examiner's Office, personal communication, 2007). Although the number of NPF-related deaths identified by the CDC/DEA surveillance system declined substantially in 2007, the relative ease of illicit production and low cost of NPF compared with heroin suggest that future epidemics of NPF overdoses are likely to occur (3).

Nationally, drug overdoses and deaths are well documented among users of heroin and other illicit drugs (5). In the United States, from 1999 to 2005, the age-adjusted death rate from unintentional drug poisoning (primarily overdoses associated with pharmaceutical and/or nonpharmaceutical drugs) increased 87.5%, from 4.0 to 7.5 per 100,000 population; the corresponding number of deaths increased from 11,155 to 22,448, including a substantial increase in the number of deaths attributed to poisoning with opioid prescription medications (6–8).

The findings in this report are subject to at least four limitations. First, the number of NPF-related deaths was likely

underreported because 1) the surveillance system captured events from participating medical examiners in only six jurisdictions and 2) for some participating medical examiners, not all NPF-related deaths were included. For example, the surveillance system identified 86 NPF-related deaths from New Jersey. However, a later review of New Jersey medical examiner reports found an additional 92 NPF-related deaths in 2006 that had not been recorded by the surveillance system. Second, for fatal drug overdoses, interpretation of toxicology findings and medical examiner determination of cause of death have not been standardized (2). Third, some pharmaceutical fentanyl-related deaths might have been misclassified as NPF-related deaths because no evidence of pharmaceutical fentanyl use was found and because testing cannot determine whether fentanyl found in body fluids came from NPF or pharmaceutical fentanyl. Finally, in addition to fentanyl, some decedents had consumed other drugs and/or alcohol that might have contributed to their deaths.

The fentanyl outbreak described in this report suggests a need to improve methods for identifying and reporting of drug-related deaths to detect increases in drug overdoses and enable prompt response by law enforcement (e.g., seizing implicated drugs) and by public health agencies (e.g., providing intensified outreach) (9). The findings further support 1) development of national standards to guide toxicologic testing and cause-of-death determination in drug overdoses and poisonings; 2) establishment of professional norms, modeled on those for attempted suicide, to refer drug overdose survivors for drug addiction treatment and education regarding overdose prevention; and 3) expansion of public health programs to help drug users obtain addiction treatment, understand overdose risks, and learn strategies for avoiding and responding to overdoses (10).

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## Use of Mass Tdap Vaccination to Control an Outbreak of Pertussis in a High School — Cook County, Illinois, September 2006–January 2007

On September 6, 2006, the Cook County Department of Public Health (CCDPH) was notified that a local high school student aged 17 years had pertussis. During September 2006–January 2007, 36 pertussis cases directly linked to the high school were identified. Because *Bordetella pertussis* immunity from childhood vaccinations wanes over time, outbreaks of pertussis can periodically occur among students and staff at middle and high schools. School settings facilitate transmission of pertussis, disrupting school and community activities and putting vulnerable populations, such as unvaccinated infants, at risk (1–4). A pertussis booster vaccine suitable for adolescents and adults became available in the United States in 2005, when two new tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccines were licensed for persons aged 10–18 years and 11–64 years, respectively. In 2006, the Advisory Committee on Immunization Practices (ACIP) recommended that all adolescents and adults receive a one-time Tdap booster vaccination (5,6). This report summarizes strategies used to control the pertussis outbreak in Cook County, Illinois, including efforts to increase Tdap vaccination coverage. Despite multiple communications recommending Tdap vaccination and implementation of a cough exclusion policy during the pertussis outbreak, student vaccination rates did not increase substantially until a school-based Tdap vaccination clinic was implemented. Because persons at risk for pertussis might not seek vaccination from their usual health-care provider, even during an outbreak, local health departments might consider early implementation of a cough exclusion policy and on-site Tdap vaccination clinic as control measures.

At the time of the pertussis outbreak, the high school in Cook County had 4,154 students and 651 staff members on two campuses. The index patient at the school was a symptomatic student epidemiologically linked to the primary