[Template:Merge from](/wiki/Template:Merge_from" \o "Template:Merge from) [Template:Drugbox](/wiki/Template:Drugbox) [Template:Spoken Wikipedia](/wiki/Template:Spoken_Wikipedia)

**Fentanyl** (also known as **fentanil**, brand names Sublimaze,[[1]](#cite_note-1) [Actiq](/wiki/Actiq), [Durogesic](/wiki/Durogesic), Duragesic, Fentora, Matrifen, Haldid, Onsolis,[[2]](#cite_note-2) Instanyl,[[3]](#cite_note-3) [Abstral](/wiki/Abstral),[[4]](#cite_note-4) Lazanda[[5]](#cite_note-5) and others[[6]](#cite_note-6)) is a potent, synthetic [opioid analgesic](/wiki/Opioid_analgesic) with a rapid onset and short duration of action.[[7]](#cite_note-7) It is a strong [agonist](/wiki/Agonist) at the [μ-opioid](/wiki/Mu_opioid_receptor) receptors. Fentanyl is approximately 80 to 100 times more potent than [morphine](/wiki/Morphine) and roughly 40 to 50 times more potent than pharmaceutical grade (100% pure) [heroin](/wiki/Heroin).[[8]](#cite_note-8)[[9]](#cite_note-9) Fentanyl was first synthesized by [Paul Janssen](/wiki/Paul_Janssen) in 1960,[[10]](#cite_note-10) following the medical inception of [pethidine](/wiki/Pethidine) (also known as meperidine, marketed as Demerol) several years earlier. Janssen developed fentanyl by [assaying](/wiki/Assay) analogues of the structurally related drug pethidine for opioid activity.[[11]](#cite_note-11) The widespread use of fentanyl triggered the production of fentanyl citrate (the salt formed by combining fentanyl and citric acid in a 1:1 [stoichiometry](/wiki/Stoichiometry)),[[12]](#cite_note-12) which entered the [clinical practice](/wiki/Clinical_practice) as a general anaesthetic under the trade name Sublimaze in the 1960s. Following this, many other fentanyl analogues were developed and introduced into medical practice, including [sufentanil](/wiki/Sufentanil), [alfentanil](/wiki/Alfentanil), [remifentanil](/wiki/Remifentanil), and [lofentanil](/wiki/Lofentanil).

In the mid-1990s, fentanyl was first introduced for widespread palliative use with the clinical introduction of the [Duragesic](/wiki/Duragesic) patch, followed in the next decade by the introduction of the first quick-acting prescription formulations of fentanyl for personal use, the [Actiq](/wiki/Actiq) [lollipop](/wiki/Lollipop) and Fentora dissolving tablets, which are resorbed through the [buccal mucosa](/wiki/Oral_mucosa). [Template:As of](/wiki/Template:As_of) fentanyl was the most widely used synthetic opioid in clinical practice,[[13]](#cite_note-13) with several new delivery methods now available, including a [sublingual](/wiki/Sublingual) spray for cancer patients.[[14]](#cite_note-14)[[15]](#cite_note-15) In 2013, 1700 kilograms were used globally.<ref name=UN2015>[Template:Cite book](/wiki/Template:Cite_book)</ref>

Fentanyl is also used as a [recreational drug](/wiki/Recreational_drug_use), whereby death is common.[[16]](#cite_note-16) Deaths have also resulted from improper medical use.[[17]](#cite_note-17)

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## Medical uses[[edit](/index.php?title=(none)&action=edit&section=1)]

### Intravenous[[edit](/index.php?title=(none)&action=edit&section=2)]

Intravenous fentanyl is often used for [anesthesia](/wiki/Anesthesia) and [analgesia](/wiki/Analgesia). During anaesthesia it is often used along with a hypnotic agent like [propofol](/wiki/Propofol). Fentanyl may be included in a solution along with local anesthetic for neuraxial administration (epidural or intrathecal/spinal). It is also administered in combination with a [benzodiazepine](/wiki/Benzodiazepine), such as [midazolam](/wiki/Midazolam), to produce [sedation](/wiki/Procedural_sedation_and_analgesia) for procedures such as endoscopy, cardiac catheterization, and oral surgery. It is often used in the [management](/wiki/Pain_management) of [chronic pain](/wiki/Chronic_pain) including [cancer pain](/wiki/Cancer_pain).[Template:Citation needed](/wiki/Template:Citation_needed)

In children intranasal fentanyl is useful for the treatment of moderate and severe pain and is well tolerated.[[18]](#cite_note-18)

### Patches[[edit](/index.php?title=(none)&action=edit&section=3)]

[thumb|right|A fentanyl patch from](/wiki/File:Fentanyl_Patch_from_Israel.jpg) [Israel](/wiki/Israel) Fentanyl [transdermal patch](/wiki/Transdermal_patch) (Durogesic/Duragesic) is used in chronic pain management. The patches work by slowly releasing fentanyl through the skin into the bloodstream over 48 to 72 hours, allowing for long-lasting pain management.[[19]](#cite_note-19) Dosage is based on the size of the patch, since, in general, the transdermal absorption rate is constant at a constant skin temperature.[[19]](#cite_note-19) Rate of absorption is dependent on a number of factors. Body temperature, skin type, amount of body fat, and placement of the patch can have major effects. The different delivery systems used by different makers will also affect individual rates of absorption. Under normal circumstances, the patch will reach its full effect within 12 to 24 hours; thus, fentanyl patches are often prescribed with a fast-acting opiate (such as morphine or [oxycodone](/wiki/Oxycodone)) to handle breakthrough pain.[[19]](#cite_note-19) In [palliative care](/wiki/Palliative_care), transdermal fentanyl has a definite, but limited, role for:

* people already stabilized on other opioids who have persistent swallowing problems and cannot tolerate other parenteral routes such as subcutaneous administration.
* people with moderate to severe [renal failure](/wiki/Renal_failure).
* troublesome side effects of oral morphine, [hydromorphone](/wiki/Hydromorphone), or oxycodone.[Template:Citation needed](/wiki/Template:Citation_needed)

### Intranasal[[edit](/index.php?title=(none)&action=edit&section=4)]

The bioavailability of intranasal fentanyl is about 70-90%, but with some imprecision due to clotted nostrils, pharyngeal swallow and incorrect administration. For both emergency and palliative use, intranasal fentanyl is available in doses of 50, 100, and 200 micrograms. In emergency medicine, safe administration of intranasal fentanyl with a low rate of side effects and a promising pain reducing effect was demonstrated in a prospective observational study in around 900 out-of-hospital patients.[[20]](#cite_note-20)

### Lozenges[[edit](/index.php?title=(none)&action=edit&section=5)]

Fentanyl lozenges ([Actiq](/wiki/Actiq)) are a solid formulation of fentanyl citrate on a [stick](/wiki/Lollipop) in the form of a lollipop that dissolves slowly in the mouth for transmucosal absorption. These lozenges are intended for opioid-tolerant individuals and are effective in treating breakthrough cancer pain.[[21]](#cite_note-21) It has also been used for breakthrough pain for patients with nonmalignant (not cancer related) pain, but this application is controversial.[[22]](#cite_note-22) The unit is a berry-flavored lozenge on a stick swabbed on the mucosal surfaces inside the mouth — inside of the cheeks, under and on the tongue and gums — to release the fentanyl quickly into the system. It is most effective when the lozenge is consumed within 15 minutes. About 25% of the drug is absorbed through the oral mucosa, resulting in a fast onset of action, and the rest is swallowed and absorbed in the small intestine, acting more slowly. The lozenge is less effective and acts more slowly if swallowed as a whole, as despite good absorbance from the small intestine there is extensive first-pass metabolism, leading to an oral bioavailability of about 33% as opposed to 50% when used correctly (25% via the mouth mucosa and 25% via the gut).[[21]](#cite_note-21) However, most people find that it takes 10–15 minutes to use all of one lozenge, and those with a dry mouth cannot use this route. In addition, medical personnel are unable to document how much of a lozenge has been used by a person, making drug records inaccurate.[Template:Citation needed](/wiki/Template:Citation_needed)

The [United States Air Force](/wiki/United_States_Air_Force) [Pararescue](/wiki/United_States_Air_Force_Pararescue) and Swedish armed forces combat medics utilize lollipops with fentanyl.[[23]](#cite_note-23)Navy corpsmen working with the United States Marine Corps in Afghanistan use Fentanyl lollipops on combat casualties from IED blasts and other mechanisms of injury. The lollipop is taped to the casualty's finger and inserted in between the teeth and cheek (buccal area) of the patient. When enough of the medication has been absorbed the finger will generally fall from the patient's mouth, thereby indicating that the medication has become effectively administered.

### Other[[edit](/index.php?title=(none)&action=edit&section=6)]

A wide range of fentanyl preparations are available, including buccal tablets or patches, nasal sprays, inhalers, and active transdermal patches (heat or electrical).[Template:Citation needed](/wiki/Template:Citation_needed) Some preparations such as nasal sprays and inhalers may result in a rapid response, but the fast onset of high blood levels may compromise safety. In addition, the expense of some of these appliances may greatly reduce their cost-effectiveness. In children it is unclear if intranasal fentanyl is as good as or the same as morphine.[[24]](#cite_note-24) Fentanyl is sometimes given [intrathecally](/wiki/Intrathecal_administration) as part of [spinal anesthesia](/wiki/Spinal_anesthesia) or epidurally for [epidural anesthesia](/wiki/Epidural_anesthesia) and [analgesia](/wiki/Epidural_analgesia). Because of fentanyl's high lipid solubility, its effects are more localized than morphine, and some clinicians prefer to use morphine to get a wider spread of analgesia.[Template:Citation needed](/wiki/Template:Citation_needed)

A fentanyl patient-controlled transdermal system (PCTS) is under development, which aims to allow patients to control administration of fentanyl through the skin during the treatment of [perioperative](/wiki/Perioperative) pain.[[25]](#cite_note-25) The [Danish Army](/wiki/Danish_Army) uses the fentanyl stick in military operations as a painkiller. The war documentary [*Armadillo* (2010)](/wiki/Armadillo_(film)) features an interview with a Danish medic who tells of using fentanyl on a severely wounded soldier in Afghanistan.[Template:Citation needed](/wiki/Template:Citation_needed)

## Adverse effects[[edit](/index.php?title=(none)&action=edit&section=7)]

Fentanyl's most common side effects (more than 10% of patients) include diarrhea, nausea, constipation, dry mouth, [somnolence](/wiki/Somnolence), confusion, [asthenia](/wiki/Asthenia) (weakness), sweating, and less frequently (3 to 10% of patients) abdominal pain, headache, fatigue, anorexia and weight loss, dizziness, nervousness, hallucinations, anxiety, depression, flu-like symptoms, [dyspepsia](/wiki/Dyspepsia) (indigestion), [dyspnea](/wiki/Dyspnea) (shortness of breath), [hypoventilation](/wiki/Hypoventilation), [apnea](/wiki/Apnea), and urinary retention. Fentanyl use has also been associated with [aphasia](/wiki/Aphasia).[[1]](#cite_note-1) Despite being a more potent analgesic, fentanyl tends to induce less nausea, as well as less [histamine](/wiki/Histamine)-mediated itching, in relation to morphine.[[26]](#cite_note-26) Fentanyl may produce more prolonged [respiratory depression](/wiki/Respiratory_depression) than other opioid analgesics.[[27]](#cite_note-27)[[28]](#cite_note-28)[[29]](#cite_note-29)[[30]](#cite_note-30)[[31]](#cite_note-31)[[32]](#cite_note-32)[[33]](#cite_note-33) In 2006 the [U.S. Food and Drug Administration](/wiki/U.S._Food_and_Drug_Administration) (FDA) began investigating several respiratory deaths, but doctors in the United Kingdom were not warned of the risks with fentanyl until September 2008.[[34]](#cite_note-34) The FDA reported in April 2012 that young children had died or become seriously ill from accidental exposure to a fentanyl skin patch.[[35]](#cite_note-35) The precise reason for sudden respiratory depression is unclear, but there are several hypotheses:

* Saturation of the body fat compartment in patients with rapid and profound body fat loss (patients with cancer, cardiac or infection-induced [cachexia](/wiki/Cachexia) can lose 80% of their body fat).
* Early carbon dioxide retention causing cutaneous vasodilatation (releasing more fentanyl), together with acidosis, which reduces protein binding of fentanyl, releasing yet more fentanyl.
* Reduced sedation, losing a useful early warning sign of opioid toxicity and resulting in levels closer to respiratory-depressant levels.

Fentanyl has a [therapeutic index](/wiki/Therapeutic_index) of 270.[[36]](#cite_note-36)

## Overdose[[edit](/index.php?title=(none)&action=edit&section=8)]

In July 2014, the [Medicines and Healthcare Products Regulatory Agency](/wiki/Medicines_and_Healthcare_Products_Regulatory_Agency) (MHRA) issued a warning about the potential for life-threatening harm from accidental exposure to transdermal fentanyl patches, particularly in children,[[37]](#cite_note-37) and advised that they should be folded, with the adhesive side in, before being discarded. The patches should be kept away from children, who are most at risk from fentanyl overdose.[[38]](#cite_note-38) Death from fentanyl overdose was declared a public health crisis in Canada in September 2015, and it continues to be a major killer drug.[[39]](#cite_note-39) In 2016, deaths from fatal fentanyl overdoses in British Columbia, Canada, averaged two persons per day.[[40]](#cite_note-40) In April 2016, musician [Prince](/wiki/Prince_(musician)) died from an accidental fentanyl overdose.[[41]](#cite_note-41)

## Analogs[[edit](/index.php?title=(none)&action=edit&section=9)]

[Structural analogs](/wiki/Structural_analog) of fentanyl include:

* [Alfentanil](/wiki/Alfentanil) (trade name **Alfenta**), an ultra-short-acting (five- to 10-minute) analgesic.
* [Sufentanil](/wiki/Sufentanil) (trade name **Sufenta**), a potent analgesic (five to 10 times more potent than fentanyl) for use in specific surgeries and surgery in heavily opioid-tolerant/opioid-dependent patients. Its binding affinity is high enough to theoretically break through a [buprenorphine](/wiki/Buprenorphine) blockade to offer pain relief from acute trauma in patients taking high-dose buprenorphine.
* [Remifentanil](/wiki/Remifentanil) (trade name **Ultiva**), currently the shortest-acting opioid, has the benefit of rapid offset, even after prolonged infusions.
* [Carfentanil](/wiki/Carfentanil) (trade name **Wildnil**) is an analog of fentanyl with an analgesic potency 10,000 times that of morphine and is used in veterinary practice to immobilize certain large animals such as elephants.
* [Lofentanil](/wiki/Lofentanil) is an analog of fentanyl with a potency slightly greater than that of carfentanil.
* [3-Methylfentanyl](/wiki/3-Methylfentanyl) (thought to be the active constituent of [Kolokol-1](/wiki/Kolokol-1), a [chemical weapon](/wiki/Chemical_weapon))
* [3-Methylthiofentanyl](/wiki/3-Methylthiofentanyl)
* [Acetyl-α-methylfentanyl](/wiki/Alphamethylacetylfentanyl)
* [α-Methylfentanyl](/wiki/Alphamethylfentanyl) [(see below)](/wiki/Fentanyl#Illicit_use)
* [α-Methylthiofentanyl](/wiki/Alphamethylthiofentanyl)
* [β-Hydroxy-3-methylfentanyl](/wiki/Beta-hydroxy-3-methylfentanyl)
* [β-Hydroxyfentanyl](/wiki/Beta-hydroxyfentanyl)
* [*p*-Flurorofentanyl](/wiki/Parafluorofentanyl)
* [Thiofentanyl](/wiki/Thiofentanyl)
* [Acetylfentanyl](/wiki/Acetylfentanyl)
* [Butyrfentanyl](/wiki/Butyrfentanyl)
* [Furanyl-fentanyl](/wiki/Furanyl-fentanyl)
* The tropane analog of fentanyl was prepared (2 isomers).
* [Acryloyl](/wiki/Acryloyl) analog of fentanyl 2x potency/duration of regular fentanyl (Egyptian scientist).

## Pharmacology[[edit](/index.php?title=(none)&action=edit&section=10)]

[Template:Main](/wiki/Template:Main) Fentanyl provides some of the effects typical of other opioids through its agonism of the [opioid receptors](/wiki/Opioid_receptors). Its strong potency in relation to that of morphine is largely due to its high [lipophilicity](/wiki/Lipophilicity), per the [Meyer-Overton correlation](/wiki/Theories_of_general_anaesthetic_action#Lipid_solubility-anaesthetic_potency_correlation_(the_Meyer-Overton_correlation)). Because of this, it can more easily penetrate the [CNS](/wiki/Central_Nervous_System).[[26]](#cite_note-26)

## History[[edit](/index.php?title=(none)&action=edit&section=11)]

Fentanyl was first synthesized by [Paul Janssen](/wiki/Paul_Janssen) under the label of his relatively newly formed [Janssen Pharmaceutica](/wiki/Janssen_Pharmaceutica) in 1959.<ref name=JanssenHist>[Template:Cite journal](/wiki/Template:Cite_journal)</ref> In the 1960s, fentanyl was introduced as an intravenous anesthetic under the trade name of Sublimaze.[Template:Citation needed](/wiki/Template:Citation_needed) In the mid-1990s, Janssen Pharmaceutica developed and introduced into clinical trials the Duragesic patch, which is a formation of an inert alcohol gel infused with select fentanyl doses, which are worn to provide constant administration of the opioid over a period of 48 to 72 hours. After a set of successful clinical trials, Duragesic fentanyl patches were introduced into medical practice.

Following the patch, a flavored [lollipop](/wiki/Lollipop) of fentanyl citrate mixed with inert fillers was introduced under the brand name of Actiq, becoming the first quick-acting formation of fentanyl for use with chronic breakthrough pain. More recently, fentanyl has been developed into an effervescent tab for [buccal](/wiki/Cheek) absorption much like the Actiq lollipop, followed by a buccal spray device for fast-acting relief and other delivery methods currently in development.

A fentanyl product has been approved by the US [Food and Drug Administration](/wiki/Food_and_Drug_Administration) (FDA) for breakthrough cancer pain called Onsolis. It uses a drug delivery technology called BEMA (fentanyl buccal soluble film) on a small disc placed in the mouth. Unlike many other fentanyl products, the drug cannot be abused by crushing and inhaling.

Fentanyl has a US DEA ACSCN of 9801 and a 2013 annual aggregate manufacturing quota of 2108.75 kilos, unchanged from the prior year.

## Society and culture[[edit](/index.php?title=(none)&action=edit&section=12)]

### Recreational use[[edit](/index.php?title=(none)&action=edit&section=13)]

[Template:Globalize/US](/wiki/Template:Globalize/US) [thumb|right|Fentanyl powder seized by a](/wiki/Image:deafentanyl.jpg) [Lake County](/wiki/Lake_County,_Ohio) Deputy Sheriff in [Painesville, Ohio](/wiki/Painesville,_Ohio), where a male subject had been discovered unresponsive and struggling to breathe.[[42]](#cite_note-42) [Illicit use](/wiki/Substance_abuse) of pharmaceutical fentanyl and its analogues first appeared in the mid-1970s in the medical community and continues in the present. United States authorities classify fentanyl as a [narcotic](/wiki/Narcotic) and an [opioid](/wiki/Opioid). To date, more than 12 different analogues of fentanyl have been produced [clandestinely](/wiki/Clandestine_chemistry) and identified in the U.S. drug traffic. The biological effects of the fentanyl analogues are similar to those of [heroin](/wiki/Heroin), with the exception that many users report a noticeably less euphoric "high" associated with the drug and stronger sedative and analgesic effects.[Template:Citation needed](/wiki/Template:Citation_needed)

Fentanyl analogues may be hundreds of times more potent than street heroin, and tend to produce significantly more [respiratory depression](/wiki/Respiratory_depression), making it somewhat more dangerous than heroin to users. Fentanyl is used orally, smoked, snorted, or injected. Fentanyl is sometimes sold as heroin, often leading to overdoses. Many fentanyl overdoses are initially classified as heroin overdoses.[[43]](#cite_note-43) [Estonia](/wiki/Estonia) has the highest rate of [3-methylfentanyl](/wiki/3-methylfentanyl) overdose deaths in the EU, due to its high rate of recreational use.[[44]](#cite_note-44) Fentanyl is sometimes sold on the black market in the form of transdermal fentanyl patches such as [Duragesic](/wiki/Duragesic), diverted from legitimate medical supplies. The gel from inside the patches may be ingested or injected.<ref name=DEA2015/>

Another dosage form of fentanyl that has appeared on the streets is the Actiq fentanyl lollipops, which are sold under the street name of "percopop". The pharmacy retail price ranges from US$15 to US$50 per unit (based on strength of lozenge), with the black market cost anywhere from US$20 to US$80 per unit, depending on the strength.[Template:Fact](/wiki/Template:Fact)

Non-medical use of fentanyl by individuals without opiate tolerance can be very dangerous and has resulted in numerous deaths.<ref name=DEA2015>[Template:Cite web](/wiki/Template:Cite_web)</ref> Even those with opiate tolerances are at high risk for overdoses. Once the fentanyl is in the user's system, it is extremely difficult to stop its course because of the nature of absorption. Illicitly synthesized fentanyl powder has also appeared on the United States market. Because of the extremely high strength of pure fentanyl powder, it is very difficult to dilute appropriately, and often the resulting mixture may be far too strong and, therefore, very dangerous.[Template:Fact](/wiki/Template:Fact)

Some heroin dealers mix fentanyl powder with heroin to increase potency or compensate for low-quality heroin. In 2006, illegally manufactured, non-pharmaceutical fentanyl often mixed with [cocaine](/wiki/Cocaine) or [heroin](/wiki/Heroin) caused an outbreak of overdose deaths in the United States and Canada, heavily concentrated in the cities of [Dayton, Ohio](/wiki/Dayton,_Ohio); [Chicago](/wiki/Chicago); [Detroit](/wiki/Detroit); and [Philadelphia](/wiki/Philadelphia).[[45]](#cite_note-45) The mixture of fentanyl and heroin is known as "magic" or "the bomb", among other names, on the street.[[46]](#cite_note-46) Several large quantities of illicitly produced fentanyl have been seized by U.S. law enforcement agencies. In June 2006, 945 grams of 83%-pure fentanyl powder was seized by [Border Patrol](/wiki/United_States_Border_Patrol) agents in California from a vehicle that had entered from Mexico.[[47]](#cite_note-47) Mexico is the source of much of the illicit fentanyl for sale in the U.S. However, in April 2006, there was one domestic fentanyl lab discovered by law enforcement in [Azusa, California](/wiki/Azusa,_California). The lab was a source of counterfeit 80-mg [OxyContin](/wiki/Oxycodone) tablets containing fentanyl instead of oxycodone, as well as bulk fentanyl and other drugs.[[48]](#cite_note-48)[[49]](#cite_note-49) The "China White" form of fentanyl refers to any of a number of clandestinely produced analogues, especially [α-methylfentanyl](/wiki/Alphamethylfentanyl) (AMF).[[50]](#cite_note-50) This Department of Justice document lists "China White" as a synonym for a number of fentanyl analogues, including 3-methylfentanyl and α-methylfentanyl,[[51]](#cite_note-51) which today are classified as [Schedule I drugs](/wiki/Schedule_I_drug) in the United States.[[52]](#cite_note-52) Part of the motivation for AMF is that, despite the extra difficulty from a synthetic standpoint, the resultant drug is relatively more resistant to metabolic degradation. This results in a drug with an increased duration.[[53]](#cite_note-53) In June 2013, the United States' [Centers for Disease Control and Prevention](/wiki/Centers_for_Disease_Control_and_Prevention) (CDC) issued a health advisory[[54]](#cite_note-54) to emergency departments alerting to 14 overdose deaths among intravenous drug users in Rhode Island associated with [acetylfentanyl](/wiki/Acetylfentanyl), a synthetic opioid analog of fentanyl that has never been licensed for medical use.

Beginning in 2015, Canada has seen a widespread issue of fentanyl overdoses country-wide. Authorities suspect that the drug is being imported from Asia to the western coast by organized crime groups in powder form and being pressed into pseudo-OxyContin tablets.[[55]](#cite_note-55) Traces of the drug have also been found in other recreational drugs including cocaine, MDMA, and heroin. The drug has been implicated in multiple deaths from the homeless to young professionals, including multiple teens and young parents.[[56]](#cite_note-56) Due to the rising deaths across the country, [Health Canada](/wiki/Health_Canada) is putting a rush on a review of the prescription-only status of [Naloxone](/wiki/Naloxone) in an effort to combat overdoses of the drug.[[57]](#cite_note-57)

### Incapacitating agent[[edit](/index.php?title=(none)&action=edit&section=14)]

[Template:Main](/wiki/Template:Main)

Russian [spetsnaz](/wiki/Spetsnaz) security forces used a "fentanyl gas" to incapacitate people rapidly in the [Moscow theater hostage crisis](/wiki/Moscow_theater_hostage_crisis). The siege was ended, but about 130 of the 850 hostages died from the gas. Most of the deaths were attributed to lack of medical intervention: the unconscious hostages were left to suffocate instead of being repositioned in a [recovery position](/wiki/Recovery_position)). The Russian Health Minister later stated that the gas was based on fentanyl,[[58]](#cite_note-58) but the exact chemical agent has not been identified.

## Veterinary use[[edit](/index.php?title=(none)&action=edit&section=15)]

Fentanyl in injectable formulation is commonly used for analgesia and as a component of balanced sedation and general anesthesia in small animal patients. Its potency and short duration of action make it particularly useful in critically ill patients. In addition, it tends to cause less vomiting and regurgitation than other pure-opioid agonists (morphine, hydromorphone) when given as a continuous post-operative infusion. As with other pure opioids, fentanyl can be associated with [dysphoria](/wiki/Dysphoria) in both dogs and cats.

[Transdermal](/wiki/Transdermal) fentanyl has also been used for many years in dogs and cats for post-operative analgesia. This is usually done with off-label fentanyl patches manufactured for humans with chronic pain. In 2012 a highly concentrated (50 mg/ml) transdermal solution, trade name *Recuvyra*, has become commercially available for dogs only. It is FDA approved to provide four days of analgesia after a single application prior to surgery. It is not approved for multiple doses or other species.[[59]](#cite_note-59) The drug is also approved in Europe.[[60]](#cite_note-60)==See also==

* [3-Methylbutyrfentanyl](/wiki/3-Methylbutyrfentanyl)
* [3-Methylfentanyl](/wiki/3-Methylfentanyl)
* [4-Fluorofentanyl](/wiki/4-Fluorofentanyl)
* [α-Methylfentanyl](/wiki/Α-Methylfentanyl)
* [Acetylfentanyl](/wiki/Acetylfentanyl)
* [Butyrfentanyl](/wiki/Butyrfentanyl)
* [Furanylfentanyl](/wiki/Furanylfentanyl)
* [List of fentanyl analogues](/wiki/List_of_fentanyl_analogues)

## References[[edit](/index.php?title=(none)&action=edit&section=17)]

[Template:Reflist](/wiki/Template:Reflist)

## External links[[edit](/index.php?title=(none)&action=edit&section=18)]

* [National Institute of Health (NIH) Medline Plus: Fentanyl Buccal (Transmucosal)](http://www.nlm.nih.gov/medlineplus/druginfo/meds/a605043.html)
* [RxList: Fentanyl](http://www.rxlist.com/cgi/generic/fentanyl.htm)
* [US DEA information: fentanyl](http://www.usdoj.gov/dea/concern/fentanyl.html)
* [08/16/2007 News Release: Cephalon Announces Positive Results from a Pivotal Study of FENTORA in Opioid-tolerant Patients with Non-cancer Breakthrough Pain](http://www.cephalon.com/newsroom/news_reader.aspx?ID=1041238)
* [BBC news report on Russian siege story](http://news.bbc.co.uk/1/hi/world/europe/2377563.stm)
* [Fentanyl: Emergency Response Database](http://www.cdc.gov/niosh/ershdb/EmergencyResponseCard_29750022.html). National Institute for Occupational Safety and Health.
* [U.S. National Library of Medicine: Drug Information Portal - Fentanyl](http://druginfo.nlm.nih.gov/drugportal/dpdirect.jsp?name=Fentanyl)

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