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## Illicit fentanyls in the opioid street market: desired or imposed?

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### Abstract

**Background**—Illicitly manufactured fentanyl and its analogues are appearing in countries throughout the world, often disguised as heroin or counterfeit prescription pills, with resulting high overdose mortality. Possible explanations for this phenomenon include reduced costs and risks to heroin suppliers, heroin shortages, user preferences for a strong, fast-acting opioid and the emergence of Dark Web cryptomarkets. This paper addresses these potential causes and asks three questions: (1) can users identify fentanyl; (2) do users desire fentanyl; and (3) if users want fentanyl, can they express this demand in a way that influences the supply?

**Argument/analysis**—Existing evidence, while limited, suggests that some users can identify fentanyl, although not reliably, and some desire it, but because fentanyl is frequently marketed deceptively as other drugs, users lack information and choice to express demand effectively. Even when aware of fentanyl's presence, drug users may lack fentanyl-free alternatives. Cryptomarkets, while difficult to quantify, appear to offer buyers greater information and competition than offline markets. However, access barriers and patterns of fentanyl-related health consequences make cryptomarkets unlikely sources of user influence on the fentanyl supply. Market condition data indicate heroin supply shocks and shortages prior to the introduction of fentanyl in the United States and parts of Europe, but the much lower production cost of fentanyl compared with heroin may be a more significant factor

**Conclusion**—Current evidence points to a supply-led addition of fentanyl to the drug market in response to heroin supply shocks and shortages, changing prescription opioid availability and/or reduced costs and risks to suppliers. Current drug users in affected regions of the United States, Canada and Europe appear largely to lack both concrete knowledge of fentanyl's presence in the drugs they buy and access to fentanyl-free alternatives.

### Keywords

Demand-led; fentanyl; heroin; illicit opioids; markets; supply-led; supply shock; prescription opioids

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Declaration of interests

None.

## INTRODUCTION

Fentanyl was first synthesized in 1960 by Paul Janssen at his family's pharmaceutical company in Belgium. Since Dr Janssen originated this opioid many analogues of varying potency have emerged, ranging from approximately three times the strength of morphine (acetyl-alpha-methyl fentanyl) to 10 000 times stronger (carfentanil) [1]. Like all opioids, fentanyl relieves pain and induces pleasure so, unsurprisingly, after its clinical introduction as an intravenous anesthetic in the early 1970s, diverted non-medical use followed and then illicit manufacture. Compared to heroin, fentanyl is 30–40 times more potent [2], has a faster onset and shorter half-life, characteristics important to its unfolding story.

Unfortunately, it is often through overdose deaths that the presence of fentanyl in the drug supply becomes known, as was the case in the United States in 1979, when its illicit manufacture was first determined [3]. Where fentanyl testing is not routine in postmortem toxicology, or an unusual or novel analogue is involved, these occurrences may go undetected.

Fentanyls represent a positive supply shock and a significant shift in the structural risk environment for opioid users [2]. In 2017 an estimated 29 000 people died from overdoses related to synthetic opioids,<sup>1</sup> predominantly illicitly produced fentanyl, in the United States alone and the number may be higher [4–7]. The current largest wave of fentanyl in the street supply, dating from 2013 in the United States [8,9], is mostly illicitly manufactured with a far smaller contribution from diverted pharmaceutical supplies [10]. Fentanyl is now being found in European countries, Russia, Brazil and Canada [10–15]. In Europe, both illicitly manufactured and diverted sources are in play [12,14] but, with the exception of Estonia's endemic supply, less widely distributed than in North America. Fentanyl deaths in Australia, while also rising, have been attributed to diverted pharmaceutical supplies [16]. This paper focuses solely on illicitly manufactured fentanyl and its analogues, referred to here simply as 'fentanyl'.

While opioids are not all created equal, for the purposes of dependent users they can substitute for each other; whether naturally occurring, such as morphine, semi-synthetic, such as heroin, or entirely synthetic, such as fentanyl, they all relieve withdrawal symptoms and pain, produce tolerance, depress respiration and a host of other desired and undesired effects. Some claim that users' preference for fentanyl in North America has increased, driving demand, while also pointing to increased profits for suppliers as a motivating factor for their spread [17]. With the availability of a more potent, faster-acting substitute, are opioid users choosing fentanyl or is it being imposed upon them? Is it 'demand-led' or 'supply-led'?

By 'demand-led', we mean that producers think that at least some people will prefer and choose a product over existing substitutes; iPods could be argued to be 'demand-led' in the sense that Apple thought consumers wanted a better portable music-playing device. When proposing that the supply of fentanyl is 'demand-led', we mean that illicit opioid producers

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<sup>1</sup>Excluding methadone.

think that consumers prefer a stronger drug than what is available and thus manufactured fentanyl to fill that demand. If producers see a high demand for heroin and are substituting heroin with fentanyl as a cheaper, inferior product but are marketing it falsely as heroin, then fentanyl is not demand-led in this sense.

Supply defines the other side of the market: for any price, firms are willing to sell a certain quantity of a product. In a competitive market, the higher the price, the more they would like to produce and sell. If suppliers are able to lower their costs of production by finding a cheaper input, firms will produce more at any given price. When one proposes that fentanyl's emergence was 'supply-led', we take that to mean that it was adopted to reduce the costs of production and/or distribution.

Where studied, the data show an unusual feature of the sale of fentanyl in both North America and parts of Europe: it is generally sold as 'heroin', as if fentanyl itself were an insignificant adulterant or not present at all [18–21]. Sometimes the ambiguous term 'China White' is used, which can refer to either heroin, historically from Southeast Asia, or a synthetic replacement. Chemical analysis shows that in some drug samples sold as heroin both heroin and fentanyl are present; in others, and possibly increasingly so, only fentanyl [10,22]. Fentanyl is sometimes also the active ingredient in counterfeit branded prescription opioid and benzodiazepine pills [13,23,24].

This disguised sale complicates our ability to determine whether users like these drugs or not, but also suggests that those supplying them are relying on demand for the named drug to sell their products, i.e. heroin, *OxyContin*, *Xanax*, etc. By contrast, in some markets, such as Estonia, fentanyl appears to be sold as such, with users aware of what they are consuming [25]. Fentanyl is also found mixed with cocaine, crystal methamphetamine and other drugs [20,26].

To answer the question of whether demand from users is spurring suppliers to sell fentanyl or users are being supplied with something they would not select, given the choice, requires three further questions. (1) Can users identify fentanyl? To some degree, but not reliably. (2) Do users desire fentanyl? The evidence is mixed. (3) If users want fentanyl, can they express this demand in a way that influences the supply? For the most part, we consider that the answer is 'no'. These conclusions are preliminary, as the quantity and geographical coverage of data on which they are based is somewhat limited and the picture rapidly shifting.

## EVIDENCE FOR A SUPPLY-LED PHENOMENON

### Can users identify fentanyl?

Most of the qualitative research on this question has been undertaken on the United States' East Coast [18,27–29], where some users are employing a range of techniques to detect fentanyl in the heroin supply, including their embodied experiences of the drug, its taste and the color of the drug in solution and as dry powder. They also gather information from peers' experiences and sometimes from dealers [18,27,28], expressing varying levels of confidence regarding their ability to identify fentanyl [18,29]. Supporting the more confident assertions are their descriptions of fentanyl's effects as short-acting, with a fast and powerful onset,

corresponding to the pharmaceutical's known profile. On the more doubtful side, a majority of drug users tested in Canadian research were unaware that they had been exposed to fentanyl when using heroin and other drugs [26], although this could change as users become more experienced and informed about identification and use over time. Further complicating matters, there are non-fentanyl synthetic opioids in circulation, e.g. U47700, which may be mistaken for fentanyl.

In the case of counterfeit pharmaceuticals, visual detection of fentanyl before use may be difficult. Imitations can be convincing and, even where poorly reproduced, their ingredients are still unknown to most buyers. Fake oxycodone and benzodiazepine tablets containing fentanyl or other synthetic opioids have caused deaths in Canada and the United States, markets characterized by high levels of opioid pill prescribing [10,24,30,31].

The addition of fentanyl to the heroin supply appears to occur at a wholesale level, with regional distribution; consequently, retail dealers often lack knowledge of the content of the products they sell [18,27,32]. Hence, users may regard dealers' knowledge or claims with skepticism [18], although some believe they can avoid fentanyl through loyalty to a known, reliable dealer, either because he/she refuses to sell fentanyl or because they warn users of its presence. Whether this trust is well placed is unknown [28].

Point-of-use testing, more commonly associated with dance drugs such as 3,4-methylenedioxymethamphetamine (MDMA), has also become possible with fentanyl test strips. Although they can reliably detect fentanyl in drug solutions [33] and users have shown interest in trying them [34] they are extremely sensitive, and do not quantify the fentanyl present or distinguish between analogues of differing potency [35]. Along with most sensory methods of identifying fentanyl, using test strips is generally only feasible after purchase and learning that a particular source sold a drug containing fentanyl on one occasion does not necessarily predict that this will be the case next time. In sum, after purchase, a portion of experienced heroin users can probably determine with some accuracy that what they are using is not heroin and that it is an opioid, perhaps fentanyl, but it is less likely that they can determine which fentanyl analogue or other synthetic opioid it actually is.

### **Do users desire fentanyl?**

Previous findings have shown users preferring to buy the strongest available heroin, sometimes regardless of purity, even to the point of seeking heroin implicated in overdoses [36–38]. However, in the current fentanyl wave, with its enormous death toll, regional US studies suggest that attitudes have polarized: some users seek out fentanyl despite the risks and others try hard to avoid it [18,27–29].

Enthusiastic users describe fentanyl as having a more intense onset or 'rush' than heroin, bringing back an opioid euphoria lost to tolerance; a subset favored a cocktail where heroin provided the longer duration ('legs'), complementing fentanyl's rush [18]. For some using medications intended to block the effects of opioids, e.g. buprenorphine, fentanyl's ability to 'break through' allows users to experience an opioid high. Others vehemently dislike perceived fentanyl's effects, and its heightened overdose dangers. Its short duration was also

mentioned as a drawback making it less cost-effective [18,27,28]. There are hints that, among some dependent heroin users, fentanyl's higher potency has increased their opioid tolerance, making regular heroin alone insufficient to satisfy the demands of their addiction, leading them to favor fentanyl over heroin regardless of their initial preference. There is, therefore, evidence of some demand for fentanyl, but this does not mean that its availability is 'demand-led'.

Fentanyl is cheaper to produce dose-for-dose than heroin [2], wholesaling at approximately one-tenth of heroin's price by weight [39]. Given that fentanyl is approximately 30–40 times stronger than heroin, an equivalent dose would be therefore be 1/300 or 1/400 of the wholesale price of heroin. For stronger analogues, the difference may be even greater. However, these cost savings appear to accrue largely to the suppliers. When sold as heroin, at least in the United States, indications are that the same price is charged per unit sold as if it were heroin, unsurprising if the intention is to deceive retail sellers and buyers into thinking they are trading heroin. In markets such as Estonia, where fentanyl is sold under its own name, insufficient evidence exists to show whether users are buying it due to preference or simply as a substitute amid a heroin shortage [40].

### **If users want fentanyl, can they express this demand in a way that influences the supply?**

A perfectly competitive market exists only in theory, but would consist of many buyers and sellers, each with perfect information about the products on sale. Illicit drug markets differ in two key ways: monopolies and duopolies dominate and they suffer from asymmetric information problems, with buyers lacking information about the quality or content of products [41].

Information-sharing between buyers regarding drug availability and quality can differ depending on the type of market in which drugs are sold. A wide range of distribution methods flourish in illicit drug sales. Initial contact may be made in person at an open-air street market, at a store front, by telephone or over the internet. Transactions may take place on the street, at a user or dealer's home, petrol stations, fast-food restaurants, clubs or other retail businesses, in parks or abandoned buildings.

Street-based heroin users in many national contexts commonly discuss current drug availability, potency, adulteration and other characteristics of interest in their quest to obtain drugs. Both information and rumours spread more or less efficiently depending upon the type of drug distribution involved. A study of heroin sales in two US cities found that in a street market with multiple competing sellers, buyers were able to gather and act upon information about drug quality on a given day more quickly and easily than buyers whose dealers operated by cellphone contact [36]. However, even where there is an appearance of competition between retail sellers, monopolies and duopolies at the wholesale level abound in drug markets, making real competition rare [42].

Just as the internet has revolutionized the speed and accessibility of information while linking geographically distant markets, a similar development has taken place in drug distribution. Although connections have been made in internet chat rooms for many years, the emergence of Darkweb cryptomarkets and digital currency offers anonymized

transactions and an efficient method of information- and opinion-sharing. The use of cryptomarkets requires sophisticated online access, a reliable mailing address and bitcoin currency [43]. Unlike the immediacy of hand-to-hand sales, cryptomarkets mail their products to customers, so dependent opioid users would need either to stockpile drugs, plan their purchases and consumption very carefully or face periods of withdrawal between deliveries.

When consumers have access to both knowledge and choice, they can express their preference for one product over others. Cryptomarket customers can compare the price of goods offered for sale between several vendors, read consumer reviews and ratings and leave their own feedback [44]. A customer wanting to buy fentanyl rather than heroin could find it advertised as such and in a range of delivery systems, including pills, nasal sprays and blotter paper [45]. However, substances sold in cryptomarkets as heroin have also turned out to be adulterated with fentanyl [46]. In some respects, cryptomarkets resemble licit online market-places, but opioid consumers remain at an informational disadvantage.

We do not know what volume of drugs cryptomarkets distribute or what proportion of purchases are wholesale for subsequent distribution rather than personal use [45]. However, given the frequency of dependence associated with opioid use and the barriers to accessing cryptomarkets, it seems unlikely that enough opioid users are buying fentanyl in this way to significantly influence the supply and the addition of fentanyl to heroin supplies. Furthermore, if retail cryptomarket fentanyl purchases were common, we would expect a wider, less uneven distribution of fentanyl and its adverse consequences. The sporadic and unpredictable appearance of fentanyl analogues of wildly varying potency in different US locations, singly or combined, suggests that consumer preference is not taking the lead, but instead suppliers are using whatever is convenient or lower legal risk. The regulation of fentanyl analogues tends to be reactive and, once controlled, new unregulated ones emerge [8].

Information about opioids on sale and choice between different options vary considerably between types of drug markets, whether online or among the different offline models, but even if users desire fentanyl and can identify it before purchase, for most retail sales they do not have sufficient choice to produce a demand-led change in the opioid supply.

### **Do market conditions explain the spread of fentanyl?**

In addition to users' preferences and sellers' sales methods, researchers have considered heroin market conditions to determine the reasons behind the rapid upswing in fentanyl supply. Economic theory would predict that the adulteration or replacement of heroin with fentanyl might occur where demand for heroin is outstripping supply, either as a result of reduced heroin supply—a 'supply shock'—or a rise in demand. Despite complexity and some contradictory evidence, existing data suggest heroin shortages prior to European and North American fentanyl waves. Bedeviling any analysis is uncertainty over estimates of the size of the heroin using population, the production of opium and local variations in drug distribution.

Regarding a 2005–06 US fentanyl episode, when approximately 1000 people died, research indicates that fentanyl was introduced as a supply-side response to low heroin purity alongside competition from prescription opioid pills [47]. This corresponds with findings that fentanyl has been added to the heroin supply in certain European countries experiencing heroin shortages [14]. In 2010–11, such shortages occurred in Bulgaria, Ireland, Hungary, Slovenia, Slovakia, the United Kingdom and Croatia, while in Finland and Estonia the heroin markets had already largely disintegrated before 2010, with substitute opioids taking their place [48].

Leading up to the current North American fentanyl phenomenon, the US heroin-using population was increasing in the wake of an opioid pill epidemic [49,50]. However, estimates vary widely, ranging from 281 000 current heroin users for 2011 (almost doubling from 2002) to 1.5 million current heroin users for 2010 [51,52]. This increase in demand may have caused a heroin shortage, but the evidence is unclear.

Mixed evidence for a supply shock comes from changing heroin source-country production. Since the mid-1990s almost all US heroin originated in Mexico and Colombia [53], but between 2000 and 2009, estimated Colombian production of opium, the raw ingredient that is refined into heroin, fell by 90%. Meanwhile, estimated Mexican opium production rose by more than 1900% from its low point in 2000 to dominate the US market, with total production for the US market quadrupling [10,54]. This rise was followed by a 46% decline in combined estimated opium production in 2009–13, leading up to the current US fentanyl wave.

Even during the period of increased overall production of heroin destined for the United States, the major logistical transition required to distribute Mexican-sourced heroin to markets previously supplied by Colombian sources suggests potential for shortfalls or distribution gaps. Together, these supply shocks may have spurred the introduction of fentanyl-as-substitute in 2013, which occurred in the US Northeast and Midwest regions formerly supplied by Colombian-sourced heroin. Despite a recovery in total opium production in 2015 to above 2009 levels, fentanyl and other synthetic substitutes persist.

As well as the rising user population and changes in production, heroin's price and purity can indicate relative supply and demand. Between 2007 and early 2010, US Drug Enforcement Administration (DEA) data show heroin price per pure gram doubling, with a spike in 2009–10. Despite no evidence of a fall in demand post-2010, prices settled down to 2007 levels by late 2013, indicating that supply increased enough to satisfy demand. DEA price data, however, are gathered predominantly from larger cities, potentially missing heroin shortages and price variation further down the supply chain in small towns and rural areas.

Overall, market conditions appear to point to supply shocks and heroin shortages before the introduction of fentanyl to the opioid supply, both in the United States and parts of Europe, with the United States experiencing rising demand and increasing prices. However, such market conditions are not a necessary condition for fentanyl adulteration if it offers suppliers greater profitability through cheaper substitution or distribution.



### Towards total substitution?

Motivations for suppliers to add fentanyl to street opioids are probably profit-oriented with an eye towards future sustainability. By dose-equivalency, fentanyl is orders of magnitude cheaper to produce than heroin [39] and entirely synthetic, protected from the vicissitudes of climate and plant diseases. In 2010 a fungus damaged the Afghanistan poppy crop, suspected to be the result of infection with a US-deployed biological weapon [55], a threat which may have stimulated wider consideration of sustainable synthetic alternatives to heroin among suppliers.

For the purposes of efficient smuggling, fentanyl is more concentrated than heroin [56], which may be particularly important as the world heroin trade has increasingly broken into 'exclusive markets' with regional supply lines from producer countries more vulnerable to interruption [57–59]. From a cold-hearted business perspective, high fentanyl-related mortality would seem to counter the advantages of a robust, lower-cost supply, but new users may be replacing or exceeding those lost from the market.

Instead of appearing in intermittent waves, fentanyl may become a permanent addition to [2], or even replacement of, the heroin street supply. Synthetic opioids have already taken heroin's place in Estonia and Finland after a shortage caused by the Taliban's opium poppy ban in 2001 [48] and recent data show that, while at the outset of the current US wave fentanyl entered the market as an adulterant of heroin, fentanyl is increasingly being sold as heroin with no heroin in the product [10,22].

## CONCLUSION

Without a full understanding of the forces behind major changes in the drug supply, it is challenging to predict their trajectory or design effective policy interventions. Policies that punish the powerless, such as dependent heroin users or low-level retail suppliers, will make no inroads in this crisis. Any determination of whether the current wave of fentanyl in the opioid street supply is demand- or supply-led relies on understanding sales methods, its reception among users and market conditions in specific national contexts. More data are needed in all these areas, particularly as the epidemic evolves, but existing evidence points to heroin supply shocks and shortages, changing prescription opioid availability and/or reduced costs and risks to suppliers as explanations.

For a product to be demand-led, users must have both knowledge and choice. These are lacking in the parts of the United States, Canada, and Europe studied to date. False marketing of fentanyl of widely varying strengths as heroin or prescription pills in monopolistic markets mean that users cannot effectively express demand for fentanyl even if they prefer it. Even when able to detect fentanyl's presence after purchase, drug users may be unable to find a fentanyl-free alternative. In countries where fentanyl is sold as such, an absence of alternatives may mean that, while these consumers have knowledge, they lack the choice to exert effective demand in the market.



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