

LETHAL HIGHS ABUSE OF NOVEL DESIGNER DRUGS AND POLICY INTERVENTIONS

Policy Report
March 2019

Nandhakumar Gunasekaran
and Tan Teck-Boon

RSiS

Nanyang Technological University, Singapore

S. RAJARATNAM
SCHOOL OF
INTERNATIONAL
STUDIES



**NANYANG
TECHNOLOGICAL
UNIVERSITY**
SINGAPORE

POLICY REPORT

LETHAL HIGHS

**ABUSE OF NOVEL DESIGNER DRUGS AND POLICY
INTERVENTIONS**

Nandhakumar Gunasekaran and Tan Teck-Boon
March 2019

Citation

Nandhakumar, Gunasekaran, and Teck-Boon, Tan. "Lethal Highs: Abuse of Novel Designer Drugs and Policy Interventions," RSIS Policy Report (Singapore: RSIS Science and Technology Studies Programme, March 2019).

Terms of use

You are free to publish this material in its entirety or in part in your newspaper, wire services, Internet-based information networks and newsletters and you may use the information in your radio-TV discussions or as a basis for discussion in other fora, provided full credit is given to the author(s) and the Science and Technology Studies Programme (STSP), S. Rajaratnam School of International Studies (RSIS). Kindly inform RSIS and provide details of when and where the publication was used.

TABLE OF CONTENTS

Executive Summary	2
Introduction	3
Novel Designer Drugs	4
Synthetic Cannabinoids	4
Synthetic Cathinones	6
Policy Interventions	8
Customs Detection	9
Mail Screening	10
A Comprehensive Ban	10
Public Messaging	11
International Cooperation	12
Conclusion	12
About the Authors	13
About the Science and Technology Studies Programme	13
About the S. Rajaratnam School of International Studies	13

EXECUTIVE SUMMARY

The abuse of novel designer drugs is on the rise. Deadlier than conventional plant-based street drugs, these synthetic psychoactive substances are manufactured and trafficked in such a way as to avoid easy detection. Each year, novel designer drugs cause thousands of deaths globally. Synthetic cannabinoids and synthetic cathinones are two of the most commonly abused novel designer drugs, and their rapid proliferation calls for swift policy intervention. Possible countermeasures against these drugs include deploying new detection technologies, closing loopholes in the mail system, banning designer drugs outright, warning the public of their dangers and strengthening international cooperation.

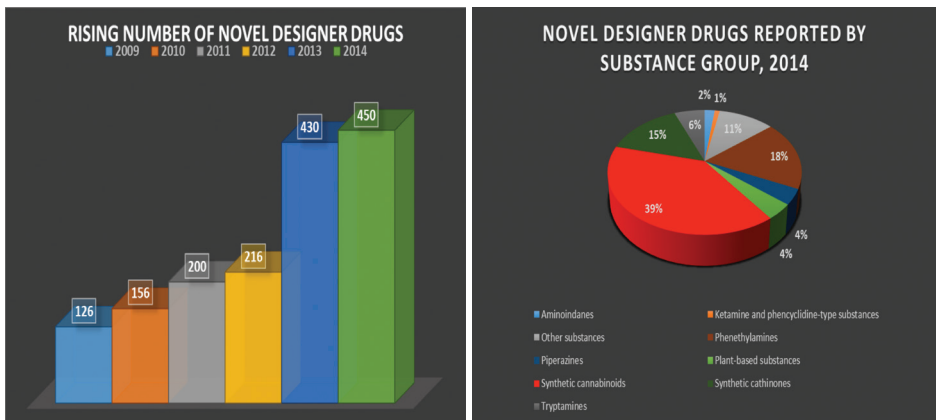
INTRODUCTION

Since 2009, the abuse of novel designer drugs has been on the rise. Two of the most widely reported ones — synthetic cannabinoids and synthetic cathinones — constituted 54 per cent of the total number of new psychoactive substances reported to the United Nations Office of Drugs and Crime or UNODC in 2014 (see Figure 1).

Coupled with the growing use of marijuana in the West and an increasingly liberal attitude among the young in Asia towards drug use, it has become more important than ever for drug enforcement agencies to keep a lookout for synthetic cannabinoids and synthetic cathinones.^{1 2}

Stopping these highly addictive substances will not be easy as they are manufactured and trafficked in a manner that avoids easy detection. Still, curbing their proliferation is not impossible and this policy report offers five possible countermeasures.

Figure 1: Significant increases in new psychoactive substances reported



Source: United Nations Office of Drugs and Crime (UNODC), World Drug Report 2015, UNODC, May 2015, www.unodc.org/documents/wdr2015/World_Drug_Report_2015.pdf

¹ See, for example, Basu, Tanya, “Marijuana Use in America Has Doubled in the Past Decade, Study Says,” *Time*, October 22, 2015, time.com/4082683/us-marijuana-use-increase/

² See, for example, Pei Ting, Wong, “More young people have liberal views towards drugs: Survey,” *Today*, April 27, 2017, www.todayonline.com/singapore/youths-taking-liberal-view-drugs-has-grown-5-percentage-points-survey

NOVEL DESIGNER DRUGS

The last decade has seen an exponential increase in novel designer drug use in the West.³ Shedding light on what these man-made psychoactive substances are, the following sub-sections take a closer look at synthetic cannabinoids and synthetic cathinones.

Synthetic Cannabinoids

Synthetic cannabinoids refer to a class of lab-concocted drugs that reproduce the mind-altering effects of tetrahydrocannabinol or THC — the main psychoactive compound found in marijuana. Known colloquially as “robot weed” or “fake weed” because of their synthetic nature, these psychoactive drugs essentially constitute either dry sage or damiana leaves sprayed with synthetic versions of THC such as JWH-018. They are then packaged into small sachets for sale to drug users (see Figure 2). To evade the attention of authorities, they are often marketed and sold as incense blend or fragrance enhancers and labelled “not for human consumption”. Still, buyers know very well that when smoked, they produce a euphoric sensation very similar to that from smoking marijuana.⁴

Figure 2: Potent “robot weed” comes in small packages



Source: US Drug Enforcement Administration (DEA) Media Galleries, “K2/Spice,” US DEA, July 2, 2018, www.dea.gov/galleries/drug-images/k2spice

³ UNODC, “World Drug Report 2016,” UNODC, May 2016; The Economist, “The expanding universe of synthetic drugs,” *The Economist*, May 20, 2017: 22.

⁴ Daly, Max, “A Guide to Spice: The Drug That’s Putting Kids in Hospital,” *VICE UK*, May 23, 2015, www.vice.com/sv/article/9bgb5a/a-guide-to-spice-the-drug-thats-putting-british-students-in-hospital-218

JWH-018, the main psychoactive compound found in synthetic cannabinoids, was first developed in 1993 by Dr. John William Huffman at Clemson University as a research chemical to help identify cannabinoid receptors in the brain. Like THC, JWH-018 binds to those same receptors to give the equivalent psychoactive effects of marijuana. Soon after Huffman had published the method for synthesising JWH-018, rogue chemists began reproducing the psychoactive compound in underground drug labs for sale or their own use.⁵

Like marijuana, synthetic cannabinoids are highly addictive and can lead to dependency after a brief period of use. However, synthetic cannabinoids are far more potent than marijuana — up to 100 times stronger in some cases — delivering an intoxication more powerful and sustained than the botanical drug.⁶ A study by a group of researchers has even found that synthetic cannabinoid users are 30 times more likely to overdose and require medical attention than marijuana users.⁷ Other side effects include paranoia, seizure, organ failure and even death.⁸ Furthermore, because the chemical compositions of these synthetic drugs are constantly modified to circumvent government bans, it is impossible to fully understand the full range of health effects that synthetic cannabinoids have on users.⁹

Even so, synthetic cannabinoids continued to be popular among users as they were legal, accessible and affordable. When the authorities subsequently sought to ban these psychoactive substances, drug syndicates simply altered their chemical compositions slightly to come up with new variants that are completely unregulated. For instance, when JWH-018 was banned in the United Kingdom in 2010, drug syndicates simply turned to other legal chemical compounds such as JWH-398 and HU-210 to continue production. Complicating government efforts at supply reduction, synthetic

⁵ McCoy, Terrence, “How this chemist unwittingly helped spawn the synthetic drug industry,” *The Washington Post*, August 9, 2015, www.washingtonpost.com/local/social-issues/how-a-chemist-unwittingly-helped-spawn-the-synthetic-drug-epidemic/2015/08/09/94454824-3633-11e5-9739-170df8af8eb9_story.html?utm_term=.9d410f7c0228

⁶ Walton, Alice G., “Why Synthetic Marijuana Is More Toxic to The Brain Than Pot,” *Forbes*, August 28, 2014, www.forbes.com/sites/alicegwalton/2014/08/28/6-reasons-synthetic-marijuana-spice-k2-is-so-toxic-to-the-brain/#40cc103b73b1

⁷ Winstock, Adam, Michael Lynskey, Rohan Borschmann, and Jon Waldron, “Risk of emergency medical treatment following consumption of cannabis or synthetic cannabinoids in a large global sample,” *Journal of Psychopharmacology*, 29 (2015): 698-703.

⁸ Potter, Lucy, “National health alert over ‘legal highs’ after string of deaths,” *The Mirror UK*, July 14, 2015, www.mirror.co.uk/news/technology-science/science/national-health-alert-over-legal-6063068

⁹ Vardakou, I., C. Pistos, and Ch. Spiliopoulou, “Spice drugs as a new trend: Mode of action, identification and legislation,” *Toxicology Letters*, 197 (2010): 157-162.

cannabinoids continue to be available on the Internet after their sale at bricks-and-mortar stores like smoke shops and convenience stores was banned.¹⁰

A matter that ought to be of concern for drug enforcement agencies in this region is that rogue labs in Asia are believed to be the biggest suppliers of synthetic cannabinoids.¹¹ But shutting down these illicit drug labs is almost impossible since many of them are legitimate outfits secretly producing synthetic cannabinoids on the side. Moreover, with an average street price of US\$5 (S\$6.85) a sachet, the drug is easily affordable for young people.¹²

Synthetic Cathinones

Synthetic cathinones belong to a family of lab-produced psychoactive drugs that mimic the drug-like effects of cocaine and methamphetamine — albeit at a fraction of their street prices. Synthetic cathinones are chemically related to cathinone, a stimulant found in Khat, which is a plant found in East Africa and southern Arabia that produces a stimulant effect when chewed.^{13 14} Yet, there is nothing organic about synthetic cathinones as they are synthesised by underground drug labs using chemicals.¹⁵

Although known as “bath salts”, these dangerous drugs are, in fact, foul smelling and usually take the form of a white crystalline powder (see Figure 3). Highly addictive, synthetic cathinones, when consumed, can cause severe hallucinations, violent behaviour, paranoia and even death.¹⁶

Chemically, synthetic cathinones contain components of cocaine as well as methamphetamine. Hence, they can release dopamine into the brain (as in the case of methamphetamine) while inhibiting its reuptake (as in the case of cocaine). This combination results in a greater concentration of the “feel

¹⁰ Ibid.

¹¹ CNN, “Synthetic drug raid reveals scary reality,” CNN, September 12, 2013, edition.cnn.com/videos/us/2013/09/12/ac-pkg-griffin-synthetic-drugs.cnn

¹² Palamar, Joseph J., and Patricia Acosta, “Synthetic cannabinoid use in a nationally representative sample of US high school seniors,” *Drug and Alcohol Dependence* 149 (2015): 194-202.

¹³ Cathinone is an amphetamine-like compound found in Khat and chewing the leaves of Khat causes a reduction in appetite along with euphoria and excitement.

¹⁴ National Institute on Drug Abuse, “Synthetic Cathinones (“Bath Salts”),” National Institute on Drug Abuse, February 2018, www.drugabuse.gov/publications/drugfacts/synthetic-cathinones-bath-salts

¹⁵ Scaccia, Annamarya, “Florida Zombie Drug Flakka: Everything You Need to Know,” *Rolling Stone*, August 19, 2016, www.rollingstone.com/culture/news/florida-zombie-drug-flakka-everything-you-need-to-know-w435074-bath-salts

¹⁶ National Institute on Drug Abuse, “Drug Facts,” National Institute on Drug Abuse, January 2016, www.drugabuse.gov/publications/drugfacts/synthetic-cathinones-bath-salts

Figure 3: Deadly “Bath Salts” in crystalline form



Source: US DEA Media Galleries, “Bath Salts,” US DEA, June 29, 2018, www.dea.gov/galleries/drug-images/bath-salts

good” chemical in the brain. Simply put, using synthetic cathinones is like consuming methamphetamine and cocaine together. This also explains why the effects of synthetic cathinones are so potent and long lasting, with users reporting that they were unable to control their thoughts and actions after taking the drug.¹⁷ Also known as “\$5 insanity”, synthetic cathinones have been blamed for several zombie-like attacks in which intoxicated users of a synthetic cathinone called “flakka” violently attacked innocent victims, even chewing off their faces in some cases.¹⁸

Synthetic cathinones are popular among recreational drug users in the West for several reasons. Like synthetic cannabinoids, synthetic cathinones are marketed as substitutes for more expensive street drugs. It is easy to see why drug users are switching to synthetic cathinones or, at least, including them in their drug use repertoire: a gram of cocaine in the West is priced from US\$62 (S\$85) to US\$80 (S\$110) while a dose of flakka costs only US\$3 (S\$4.10) to US\$5 (S\$6.85).^{19 20} Synthetic cathinones also appeal

¹⁷ PBS News Hour, “Bath Salts Have Dangerous, Bizarre Effects,” PBS News Hour, September 20, 2012, www.youtube.com/watch?v=uj3nE3D7ECw

¹⁸ Scaccia, op. cit.

¹⁹ Ibid.

²⁰ UNODC, op. cit.

to users because they are misperceived to be less harmful than cocaine. But the truth is that they can be ten times stronger than cocaine. In fact, synthetic cathinones are so potent that they can cause irreparable damage to our dopaminergic and serotonergic systems — those aspects of the brain that modulate cognitive function and behaviour.^{21 22}

Until recently, synthetic cathinones could be purchased over the counter in many convenience stores, adult bookstores and tobacco shops in the West.²³ They continue to be available over the Internet today after bricks-and-mortar shops were banned from selling them. Like synthetic cannabinoids, the drug syndicates manufacturing them constantly modify their chemical compositions to keep them unregulated. As soon as a brand of synthetic cathinone is scheduled as a controlled substance by the authorities, drug syndicates would alter its chemical composition slightly to create a new drug that is perfectly legal. As it takes time to schedule that new drug, a window thus emerges for it to be sold openly.²⁴

Another reason recreational drug users are switching to synthetic cathinones is their belief that traces of these drugs would not show up in standard urinalysis and blood screening tests. Indeed, there is some evidence that synthetic cathinones cannot be detected by certain field tests and drug-sniffing dogs.²⁵ Consequently, synthetic cathinones have become particularly appealing to people who must undergo regular drug testing as part of their profession (e.g., military personnel, government employees, professional athletes and parolees).²⁶

POLICY INTERVENTIONS

The increased use of novel designer drugs has prompted government actions. In 2017, a US government-appointed commission on combating

²¹ Scaccia, op. cit.

²² UPROXX, “The Truth: About Bath Salts,” UPROXX, July 15, 2015, www.youtube.com/watch?v=6nqsnck42wA

²³ Gershman, Jennifer A., and Andrea D. Fass, “Synthetic Cathinones (‘Bath Salts’),” *Pharmacy and Therapeutic*, 37 (2012): 571-572.

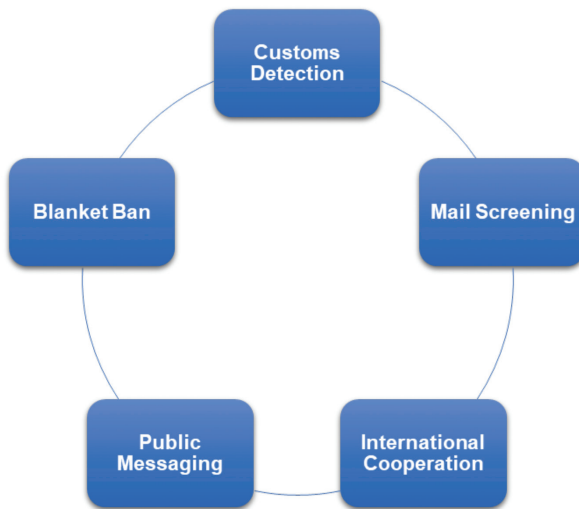
²⁴ Scaccia, op. cit.

²⁵ Wilson, Bryan, Hamid Tavakoli, Daniel DeCecchis and Vimukta Mahadev, “Synthetic Cannabinoids, Synthetic Cathinones and Other Emerging Drugs of Abuse,” *Psychiatric Annals*, 43 (2013): 558-564; “Synthetic Cathinones — Bath Salts Detection,” Kinesis, undated, kinesis.co.uk/knowledgebase/synthetic-cathinones-bath-salts-detection

²⁶ Drug Policy Alliance, “Fact Sheet: Synthetic Cathinones,” Drug Policy Alliance, June 2016, www.drugpolicy.org/sites/default/files/DPA_Fact_Sheet_Synthetic_Cathinones_%28June%202016%29.pdf

drug addiction made recommendations such as the detection and interdiction of illicit drugs entering the country, strengthening law enforcement against drug-related criminal networks, and public education campaigns on drug abuse.²⁷ The European Union has similar policies and a mechanism to swiftly assess and ban new psychoactive substances detected in the drugs market.²⁸ Drawing from such policy interventions, we have identified five countermeasures that can be adopted to curb the rapid proliferation of synthetic cannabinoids and synthetic cathinones. These are depicted in Figure 4.

Figure 4: Possible Countermeasures against Synthetic Cannabinoids and Synthetic Cathinones



Customs detection

In the fight against novel designer drugs, intensifying customs screening at all ports of entry is vitally important. And because some standard screening tests may no longer be effective, on-site screening for novel designer drugs

²⁷ The White House, "The President's Commission on Combating Drug Addiction and the Opioid Crisis," The White House, November 1, 2017, www.whitehouse.gov/sites/whitehouse.gov/files/images/Final_Report_Draft_11-1-2017.pdf

²⁸ European Commission, "EU's response to drugs," European Commission, August 20, 2018, ec.europa.eu/home-affairs/what-we-do/policies/organized-crime-and-human-trafficking/drug-control/eu-response-to-drugs_en

at customs checkpoints will require new detection equipment. State-of-the-art spectrometry technologies will allow customs officials to analyse and identify suspected narcotics without directly handling them, reducing the risk of contamination and exposure.²⁹ Obviously, field testing methods that call for direct handling of suspected designer drugs should also be reviewed. One possibility is that they can be aligned with the protocols for the handling of hazardous substances. To prevent accidental poisoning, it is also vital that customs officials receive comprehensive training to protect them from different types of designer drugs.³⁰

Mail screening

Novel designer drugs are being shipped in very small packages to avoid detection by customs officials. Often labelled as industrial products, these packages are typically subjected to less stringent checks.³¹ Novel designer drugs can also be purchased anonymously online.³² To stop their trafficking, it is necessary to close the mail order loophole. The US government has passed a sweeping measure to close this loophole. Known as the Synthetics Trafficking and Overdose Prevention (STOP) Act, it requires senders of packages to the United States to provide electronic data on their packages (e.g., origin, destination, and content) to US Customs in advance.³³ Even if the sender were to provide false information, the use of advanced data analytics makes it possible to detect suspicious packages and block their delivery.³⁴

A comprehensive ban

An outright ban on all designer drugs will effectively outlaw them before they even appear and put an end to the legal loopholes that drug syndicates

²⁹ Thornton, William, "Portable drug testing equipment cuts into Etowah drug case backlog," *Alabama Media Group*, July 9, 2014, www.al.com/news/anniston-gadsden/index.ssf/2014/07/portable_drug_testing equipmen.html

³⁰ Halliday, Josh, and Donald, Kevin, "Prison officers off sick from inhaling smoke after 5.6kg spice haul," *The Guardian*, July 25, 2017, www.theguardian.com/society/2017/jul/25/prison-officers-off-sick-after-inhaling-spice-drug-haul-holme-house-county-durham

³¹ Sui-Lee, Wee, and Javier C. Hernandez, "Despite Trump's Pleas, China's Online Opioid Bazaar Is Booming," *The New York Times*, November 8, 2017, www.nytimes.com/2017/11/08/world/asia/china-opioid-trump.html

³² UNODC, op. cit.

³³ Office of US Senator Rob Portman, "President Signs Into Law Portman's STOP Act As Part of Landmark Opioid Reforms," Press Release, October 24, 2018, <https://www.portman.senate.gov/public/index.cfm/2018/10/president-signs-into-law-portman-s-stop-act-as-part-of-landmark-opioid-reforms>

³⁴ Rath, Arun, "Lethal Opiates Delivered By Mail from China, Killing Addicts In The U.S.," *NPR*, March 11, 2017, www.npr.org/2017/03/11/519649096/can-china-ban-on-deadly-opioid-save-lives-in-the-u-s

have been exploiting to keep supplying them. With such a ban in place, the authorities will no longer have to ban each newly modified drug as it appears, sending a clear message that there is no such thing as a “legal” alternative to illegal drugs. In May 2016, England and Wales imposed a blanket ban on the production, supply and trade of designer drugs.³⁵ Known as the Psychoactive Substances Act, it gives police new powers to enforce the ban and imposes up to seven years of imprisonment for offenders.³⁶ In the United States, the Federal Analogue Act (1986) allows a designer drug to be scheduled as a controlled substance if it is shown to be substantially similar to a scheduled controlled substance. Likewise, the Synthetic Drug Abuse Prevention Act (2012) permanently places 26 types of synthetic cannabinoids into the most restrictive category of the Controlled Substances Act while the Protecting Our Youth from Dangerous Synthetic Drugs Act (2015) establishes an interagency committee with the power to swiftly schedule and update the federal list of banned synthetic substances.³⁷

Public messaging

Although the long-term side effects of novel designer drugs are unknown, users continue to perceive them as safe. To correct such misconceptions, the US government launched public awareness campaigns with catchy slogans like “Synthetics Kills”, “Fake Weed + U = Zombie” and “Don’t Roll the Dice on Spice”.³⁸ Taking a whole-of-society approach, public messaging campaigns can be crafted to engage the public — and not just the young and vulnerable groups — since parents, teachers, employers, community leaders and healthcare providers can help spot and report drug use. Such campaigns can also address glamourised portrayals of drug use by “soft” media sources that inaccurately create a positive image of drug use. A similar advertising strategy was used by the tobacco industry in the past to sell cigarettes.³⁹

³⁵ Travis, Alan, “Blanket ban on legal highs in England and Wales to begin on 26 May,” *The Guardian*, May 5, 2016, www.theguardian.com/politics/2016/may/05/blanket-ban-on-legal-highs-england-wales-begin-26-may

³⁶ UNODC, “May 2016 — United Kingdom: The Psychoactive Substances Act came into force,” UNODC, undated, www.unodc.org/LSS/announcement/Details/499f1da4-a158-48a2-a995-d752a6ffe79e

³⁷ Community Anti-Drug Coalitions of America (CADCA), “Synthetic Drug,” CADCA, 2018, www.cadca.org/synthetic-drugs

³⁸ Warren, Katherine E., Shirli Tay, and Leana S. Wen, “The Role of Public Health in Combatting Synthetic Cannabinoid Use in Adolescents,” *Journal of Adolescent Health*, 60 (2017): 483-486.

³⁹ Wong, op. cit.; Bates, Clive, and Andy Rowell, “Tobacco Explained...The truth about the tobacco industry...in its own words,” *WHO Tobacco Control Papers*, University of California, San Francisco, 1999, cloudfront.escholarship.org/dist/prd/content/qt9fp6566b/qt9fp6566b.pdf?t=krnrga

International cooperation

Designer drugs abuse will not stop unless the countries where they are manufactured act to curb their availability. While easier said than done, there are signs that this is happening. For example, at the request of the US government, China has banned the domestic production and sale of a list of synthetic drugs including flakka.⁴⁰ Collaboration among countries (at times, through international organisations like the United Nations) presents greater opportunities for accomplishing more than what a single country can achieve. When necessary, it allows like-minded countries and stakeholders to share information as well as pool resources and expertise on key aspects of the designer drug problem, such as what a specific drug type and its mode of trafficking are.

CONCLUSION

This policy report looked at synthetic cannabinoids and synthetic cathinones, two novel designer drugs that have a major impact on public health and security today. Addiction to these potent man-made substances is chronic, difficult to treat, and associated with high rates of morbidity and mortality. Their trafficking is often linked to other criminal activities. To curb their proliferation, this report identified five countermeasures. While there may be others, these practical solutions could be the first step towards protecting Singapore society from the deleterious effects of novel designer drugs.

⁴⁰ Ganim, Sara, "China's fentanyl ban a 'game-changer' for opioid epidemic, DEA officials say," *CNN*, February 15, 2017, edition.cnn.com/2017/02/16/health/fentanyl-china-ban-opioids/index.html

ABOUT THE AUTHORS

Nandhakumar Gunasekaran is Senior Analyst in the Science and Technology Studies Programme (STSP), S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University, Singapore.

Tan Teck-Boon is Research Fellow and STSP Coordinator.

ABOUT THE SCIENCE AND TECHNOLOGY STUDIES PROGRAMME

The Science and Technology Studies Programme (STSP) in the Office of the Executive Deputy Chairman, RSIS, focuses on how emerging science and technology trends impact homefront security and the larger public policy arena. Supported by the Office of the Chief Science and Technology Officer (OCSTO) in the Singapore Ministry of Home Affairs (MHA), the STSP produces upstream insights into global and regional developments in the science and technology field. It also carries out strategic engagements with global thought leaders, practitioners and academics, including through the holding of public lectures and seminars, to share knowledge and best practices on a broad spectrum of issues in the science and technology domain.

ABOUT THE S. RAJARATNAM SCHOOL OF INTERNATIONAL STUDIES

The **S. Rajaratnam School of International Studies (RSIS)** is a think tank and professional graduate school of international affairs at the Nanyang Technological University, Singapore. An autonomous school, RSIS' mission is to be a leading research and graduate teaching institution in strategic and international affairs in the Asia Pacific. With the core functions of research, graduate education and networking, it produces cutting-edge research on Asia Pacific Security, Multilateralism and Regionalism, Conflict Studies, Non-traditional Security, Cybersecurity, Maritime Security and Terrorism Studies.

For more details, please visit "<http://www.rsis.edu.sg>" www.rsis.edu.sg. Follow us at "<http://www.facebook.com/RSIS.NTU>" www.facebook.com/RSIS.NTU or connect with us at www.linkedin.com/school/rsis-ntu.

Notes



RSiS

S. RAJARATNAM
SCHOOL OF
INTERNATIONAL
STUDIES

Nanyang Technological University, Singapore

Nanyang Technological University

Block S4, Level B4, 50 Nanyang Avenue, Singapore 639798

Tel: +65 6790 6982 | Fax: +65 6794 0617 | www.rsis.edu.sg