The 3rd International Symposium of Forensic Drug Testing Lab Directors was held from May 14-16, 2022 in Abu Dhabi, UAE to discuss current threats and emerging trends caused by toxic adulterants in the world-wide drug supply. The Colombo Plan's Global Toxic Adulterant Project has been a world leader in testing and analysis of seized drug samples and street level drug samples since 2016 for composition and quantification of active drug, and for toxic adulterants in the drugs. The xylazine adulteration of the US drug supply reminds public health and public safety officials of the harmful and deleterious effects of adulterants. Yet, toxic adulterants detected in street drug samples across the globe have long been associated with adverse health outcomes, including anemia, bone marrow damage, cancers, cardiac arrythmias, leukopenia, renal failure, and many other conditions, including death.

The Colombo Plan's International Lab Director's Symposium allows member countries to gain visibility and collaboration into emerging drug trends, adulterant trends associated therewith, and the evolution and emergence of harmful new toxic adulterants. The Colombo Plan's gathering of International Lab Directors also provided opportunity for the scientists to preview the impending upgrade to the International Toxic Adulterant Database (ITAD) hosted by the Center for Forensic Science Research and Education (CFSRE) and resourced by the Colombo Plan.

Countries in Attendance			
Argentina	Brazil	Brunei	Columbia
Chile	Ecuador	Guatemala	Honduras
Jordan	Malaysia	Mexico	Nigeria
Paraguay	Philippines	Singapore	Sri Lanka
Thailand	Uruguay	United States	

Drugs Under Analysis Yielding Toxic Adulterants		
Cocaine	MDMA*	Captagon
Methamphetamine	Fentanyl	Ketamine*
Heroin	Cannabis	Benzodiazepines*

** Ketamine, MDMA, and Benzodiazepines were discussed as primary illicit drugs and as toxic adulterants in country*

Legacy Adulterants Reported by Countries: Caffeine, Levamisole Acetaminophen, Diphenhydramine, Benzocaine, Ephedrine, Dipyrone, Diltiazem, Levamisole, Dimethylsulfone

Primary Toxic Adulterants Reported by Region (Complete listing reported by participant countries – Appendix A&B)

South America		Central America & US	Asia		Africa/Middle East
Phenacetin	Metronidazole	Pentobarbital	Diamorphine	Ketamine	Carbamazepine
Aminopyrine	2-MeO-phenacetin	Allopseudococaine	Diazepam	Piracetam	Tramadol
Procaine	Apoatropine	Tetramisole	Chlorpheniramine	Xylazine	Morphine
Hydroxyzine	"Tusi" or "Pink" Cocaine: Dimethylterephthalate	Ketoprofen	4-Fluoro-MDMB-BUTINACA	GBL, or Gamma-Butyrolactone	Cypermethrin & analogs
Tetracaine	*N,N*-dimethylpentylone	Phenylbutazone	Methcathinone		Acetylcodeine
Irganox	Levamisole	Phenethyl 4-ANPP	FFP, BZP, TFMPP		Diazinon
MDMA		Chlorpheniramine	Methamphetamine		Acetylmorphine
Desipramine		Protonitazene	Eutylone & analogs		Griseofulvin
Imipramine		Furanylfentanyl	Etizolam & analogs		Acetyltheaboal
Clenbuterol		Quetiapine	Amphetamine & analogs		Pregabalin
Sertraline		Bisoprolol	Theophylline		Theophylline
Methadone		Ketamine	Paracetamol		Diclofenac
Ketamine		Xylazine	Chloroquine		

Predicting the Next Xylazine: Potential Toxic Adulterants Associated with Veterinary Practice

Medetomidine	Medetomidine is used in veterinary medicine to calm and immobilize animals. Medetomidine belongs to a class of drugs known as alpha 2 adrenergic agonists and bears chemical similarity to xylazine and clonidine. Medetomidine is an unscheduled drug that produces sedation, analgesic effects and pain relief in veterinary applications. As an unscheduled substance, medetomidine has begun to infiltrate the illicit drug supply. When taken by humans in high, unregulated dosages, negative cardiovascular side effects may occur, including bradycardia, hypotension, and decreased cardiac output, as well as endocrine disruption. Medetomidine has been reported in illicit drug samples in Baltimore by the Liberty High Intensity Drug Trafficking Area, and was also identified in samples from the Midwest by the Center for Forensic Science Research and Education.
Acepromazine	Acepromazine is a phenothiazine, or a first-generation antipsychotic drug that was historically allowed for use in humans to treat severe mental disorders, such as schizophrenia. Its use was abandoned in humans due to negative side effects and lack of efficacy. Acepromazine is commonly used in veterinary practice for pre-medication anesthesia, chemical restraint, or as a supplement to other sedative drugs. Acepromazine is not a scheduled drug in the US, which may increase availability and prevalence. If used as an adulterant ingested by humans, toxicity associated with CNS and respiratory depression and hypotension is possible. Like the commencement of the xylazine epidemic, human toxicity cases are rare; nevertheless, monitoring due to prevalence and availability may be warranted.
Phenylbutazone	Phenylbutazone is nonsteroidal anti-inflammatory drug for the short-term treatment of pain and fever in animals. The drug was originally used in humans; however, it is no longer used due to severe adverse health effects. Phenylbutazone is most commonly used in horses for analgesia for pain relief for infections, sprains, arthritis and injuries. The drug is used to treat dogs for chronic pain and osteoarthritis. Phenylbutazone has been identified as a toxic adulterant in illicit drug material in a review of NMS Labs data, and was most commonly found in combination with heroin, fentanyl and fentanyl derivatives. Phenylbutazone has been gaining in prevalence in the US after first detections in the eastern US. As an uncontrolled drug, the prevalence and spread of phenylbutazone warrants monitoring and targeted testing.

Expanded Global Collaborations Needed to Raise Awareness of Threats Posed by Toxic Adulterants

- Expand partnerships with global public health leaders to research, publish, speak and educate on both long-term health threats and short term misuse potential and risks of toxic adulterants
- Research customs and legal impediments to the purchase and importation of standards
- Identify instrumentation needs, resource and standard deficiencies, and capabilities of each contributing Colombo entity, and create passageways for technical information transfer and pass throughs for instrumentation
- Research scheduling laws that act as impediments to toxic adulterant sample transfer and receipt, and regularly communicate with international and national lawmakers and policy makers to effect change
- Utilize diagnostic testing to prove threat of harm when a new toxic adulterant identified
- Regularly upload adulterant data and communicate using the CFSRE-hosted International Toxic Adulterant (ITAD) Database

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Appendix A - The 2nd International Symposium of Forensic Drug Testing Lab Directors, 2019 Meeting, Singapore: Summary Matrix of Adulterants

COUNTRY	ADULTERANTS REPORTED
Argentina	In April 2019, a study of 1,259 cocaine samples was conducted. Adulterants included levamisole, phenacetin, aminopyrine, metamizole, caffeine, lidocaine, benzocaine, diphenhydramine, and procaine.
Brazil	Phenacetin, aminopyrine, levamisole, caffeine, lidocaine, and benzocaine in cocaine samples.
Brunei	Sugar and caffeine were detected in tablet samples of ecstasy and ketamine.
Chile	Levamisole, caffeine, acetaminophen, aminopyrine, lidocaine, benzocaine, and procaine.
Colombia (Ministry of Justice and Law)	The following adulterants were detected in cocaine: levamisole, caffeine, lidocaine, phenacetin, aminopyrine, diltiazem, and hydroxyzine. Main adulterants in heroin were caffeine, diltiazem, lidocaine, levamisole, and acetaminophen. Impurities from the heroin manufacturing process included 6-MAM, acetyl codeine, and papaverine.
Colombia (National Institute of Legal Medicine	Adulterants detected in cocaine from 2015 – 2018 were levamisole, phenacetin, caffeine, lidocaine, and aminopyrine. Drug samples can average about 3 to 11 adulterants.
Colombia (Office of the Attorney General of the	The following adulterants were detected in the 474 adulterated drug samples: caffeine, phenacetin, levamisole, lidocaine, aminopyrine, imipramine, and diltiazem. (0.4%). [NOTE: 29% of analyzed samples had 3 or more adulterants].
Ecuador	Adulterants for cocaine base include phenacetin and aminopyrine. Heroin contains caffeine, aminopyrine, phenacetin, and diltiazem. MDMA contains ketamine and caffeine.
Guatemala	Lidocaine, benzocaine, procaine, caffeine, levamisole, and acetaminophen.
Honduras	Levamisole, lidocaine, caffeine, piperazine, benzocaine, procaine, sufentanil, atropine, and verapamil.
Indonesia	Levamisole was detected in cocaine.
Jordan	Heroin is adulterated with impurities from the manufacturing process (6-MAM, acetyl codeine, papaverine, noscapine, etc.), caffeine, and meconates (a constituent of opium). Synthetic cannabis is cut with tramadol. Cocaine is cut with caffeine. Captagon is cut with theophylline, caffeine, acetaminophen, and diphenyl methanol.
Korea	None mentioned
Lao PDR	None mentioned
Malaysia	Major adulterants were as follows: heroin (caffeine, chloroquine, paracetamol, and dextromethorphan); meth (Dimethyl Sulfone or DMS); and Ecstasy (NPS, caffeine).
Mexico	Levamisole, benzocaine, caffeine, diphenhydramine, phenacetin, and creatine.
Nigeria	Methamphetamine (phenacetin, DMS); cocaine (levamisole, phenacetin, lidocaine, caffeine, and paracetamol), and heroin (aminopyrine, caffeine, codeine, and MDMA).
Paraguay	Adulterants detected in cocaine base included phenacetin (the main adulterant), lidocaine, caffeine, benzocaine, acetaminophen, and levamisole. Adulterants detected in Cocaine HCL included caffeine (the main adulterant), lidocaine, benzocaine, phenacetin, levamisole, and acetaminophen.
Philippines	Cutting agents/adulterants are constantly changing; the current top cutting agent for meth is IBA (Isopropyl benzylamine). Increase in NPS being used to cut MDMA. Seizures of cocaine bricks cut with levamisole.
Singapore	Some ecstasy tablets are adulterated with NPS. Other adulterants detected in such tablets include paracetamol, fentanyl, and lidocaine.
South Africa	Adulterants detected in heroin: dextromethorphan, acetaminophen, phenacetin, caffeine, and diphenhydramine. Adulterants detected in cocaine: phenacetin, levamisole, lidocaine, caffeine, acetaminophen, and benzocaine. Other drugs such as methaqualone (mandrax) are adulterated with diphenhydramine and diazepam. Methamphetamine is mostly cut with dimethylsulfone (DMS).
Sri Lanka (Government Analyst Lab)	Forty (40) cocaine samples were analyzed for impurities and adulterants. Purity ranged from 2.5 to 63%. Fourteen (14) impurities and five (5) adulterants were detected. The adulterants in descending order were: (levamisole (26), lidocaine (17), caffeine (13), acetaminophen (10), and phenacetin (8).
Sri Lanka (NDDCB Lab)	Principal adulterants analyzed by the lab in 2017 and 2018 are: heroin (acetaminophen, Benadryl, theophylline, etofylline, and tramadol); meth (Dimethyl Sulfone or DMS); cocaine (benzocaine), and MDMA (MDHOET which is very toxic and synthesized by Alexander Shulgin).
Thailand	Meth tablets primarily adulterated caffeine. DMS was the major ICE adulterant. Primary heroin adulterants/impurities were paracetamol, acetyl codeine, 6-MAM, morphine, caffeine, and dextromethorphan.
Tunisia	Benzocaine
United States	Benzocaine, DMS, levamisole, diphenhydramine, lidocaine, caffeine, phenacetin, diltiazem, aminopyrine, dipyrone, acetaminophen, quinine, gabapentin, and nicotinamide.
Uruguay	Phenacetin, diphenhydramine, aminopyrine, benzocaine, diltiazem, levamisole, lidocaine, caffeine, and clenbuterol.

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Appendix B - The 3rd International Symposium of Forensic Drug Testing Lab Directors, 2022 Meeting, Abu Dhabi, UAE: Summary Matrix of Adulterants

COUNTRY	ADULTERANTS REPORTED
Argentina	During the period of 2017-2021, principal adulterants in cocaine: levamisole, phenacetin, aminopyrine, dipyrone, caffeine, lidocaine, benzocaine, diphenhydramine, and procaine; in at least one instance, smokable cocaine (crack) was adulterated with carfentanil.
Brazil	In cocaine: 9 adulterants quantified: aminopyrine, phenacetine, levamisole, caffeine, lidocaine, benzocaine, procaine, hydroxyzine, diltiazem; "new" cocaine adulterants: tetracaine (local anesthetic) and irganox (Polymer additive).
Brunei	No adulterants found in crystal methamphetamine (MAMP- HCl); tablets normally found with sugar and caffeine.
Chile	In cocaine base: levamisole, phenacetin, caffeine, and lidocaine.
Colombia (Ministry of Justice and Law)	In cocaine: caffeine, levamisole, lidocaine, phenacetin, hydroxyzine, metronidazole, aminopyrine, 2MeO- phenacetin, apoatropine, atropine, desipramine, imipramine; 2021 testing in novel synthetic drugs: methamphetamine, MDMA, *N,N*-dimethylpentylone, phenacetin, caffeine, acetaminophen.
Colombia (National Institute of Legal Medicine & Forensic Sciences)	In cocaine: caffeine, levamisole, lidocaine, phenacetin, aminopyrine, and dimethylterephthalate, with levamisole being far more frequent in concealed cocaine samples; at least one adulterant was reported in 46 % of all cocaine samples tested; in heroin: caffeine, phenacetin and procaine.; less frequently identified adulterants were oxycodone, tramadol, and acetaminophen.
Colombia (Office of the Attorney General of the Nation)	In cocaine: caffeine, phenacetin and levamisole; Note: in some samples the content of the adulterants is higher percentage than that of cocaine.
Ecuador	In 2020, in cocaine: phenacetin and levamisole; principal adulterant in heroin and MDMA: caffeine; after 2020, adulterants began changing with some diminishing and others appearing, including ketamine and lidocaine.
Guatemala	Lidocaine, benzocaine, procaine, caffeine, levamisole, and acetaminophen, ketamine, dipyrone, chlorpheniramine, and aspirin.
Honduras	In 2021, levamisole, lidocaine, acetaminophen, pentobarbital, allopseudococaine, tetramisole, ketoprofen, bisoprolol.
Jordan	In the reporting period:6/30/21-12/31/21 In synthetic cannabinoid (ephedrine, orphenadrine, sugar, citric acid, carbamezapine, diazinon, cypermethrin, permethrin, tramadol, phytol, menthol, nicotine, as well as the appearance of rodenticide anti-coagulant drugs); in heroin (caffeine, meconine, morphine, acetylcodeine, acetylmorphine, acetyltheaboal, papaverine, noscapine, caffeine in high concentration, griseofuliven, acetaminophen, hydrocotarine, 6-monoaceytlmorphine); in cocaine (caffeine, sugar, baking soda); In Captagon tablets (lidocaine, theophylline, caffeine, acetaminophen, diphenylmethanol, diphenylamine, n-acetylamphetamine, stearic acid, phynyl-1-propanol, benzyl methyl ketone, methamphetamine, diphenhydramine, N-formylamphetamine); and in tramadol (pregabalin, paracetamol, ibuprofen, amphetamine)
Malaysia	In heroin: caffeine, chloroquine with small amounts of impurities often present, (e.g., morphine, mono-acetylmorphine (MAM) and acetylcodeine) in methamphetamine: Dimethyl Sulfone or DMS; in Yaba: caffeine; in Ecstasy: caffeine and NPS (Eutylone, 4-Fluoro-MDMB-BUTINACA, 4- FPP, BZP, TFMPP); in "designer" benzodiazepines tablets: phenazepam, etizolam, clozapine, flubromazolam, flualprazolam, and caffeine
Nigeria	In methamphetamine (fentanyl, dimethyl sulfone); in cocaine (acetaminophen, caffeine, phenacetin, levamisole, benzocaine;) in heroin (only lactose, corn starch detected in NDLEA lab); in MDMA (fentanyl, methamphetamine); in tramadol (Epsom salt and titanium oxide); in "fake" tramadol tablets (diclofenac).
Paraguay	Aminopyrine, phenacetine, imidazole, levamisole, caffeine, lidocaine, benzocaine, acetaminophen, tetracaine; "Tusi," the street name for a new psychoactive substance that appears as a bright pink cocaine-like powder contained MDMA and ketamine in one sample, and ketamine, caffeine, and phenacetin in another sample.
Peru	Phenacetin, levamisole, lidocaine, caffeine; "pink cocaine", which was not cocaine but in fact analyzed as ketamine.
Philippines (PDEA)	In methamphetamine: N-Isopropyl benzylamine (IBA) and DMS, sodium sulfate, and aluminum ammonium sulfate; in cocaine, levamisole.
Singapore	In Ice: caffeine (common). DMS (common), ammonium acetate, sildenafil, menthol; one case in 2021 revealed a combination of methamphetamine (~1%), xylazine (~60%), lidocaine (~39%); In ketamine: caffeine (common), DMS (common), lidocaine, procaine, diphenhydramine, paracetamol, benzocaine; one case in 2021 revealed combination of ketamine (~95%), xylazine (~1%), chlorpheniramine (~3%), dextromethorphan (~1%); in cocaine: levamisole/tetramisole (common), lidocaine, procaine, phenacetin; in heroin: caffeine (common), chloroquine (common), paracetamol (new), piracetam, dextromethorphan, quinine, theophylline, methamphetamine (new), 1-(2- butoxyethoxy) ethanol; Note: increasingly prevalent combinations in heroin since August 2020 such as: a) diamorphine, caffeine, chloroquine, paracetamol and b) diamorphine, caffeine, paracetamol; in Ecstasy tablets: caffeine (common), amphetamine (common), paracetamol, chloroquine, dextromethorphan, sildenafil, xylazine, lidocaine, NPS (common), diamorphine (new).
Sri Lanka (Government Analyst Department Lab)	In MDMA: MDEA, ephedrine, methyl ephedrine, 2 methyl amino-1 phenyl propanone/methcathinone, piperazine, 3,4 methylenedioxymethcathinone (methylone), N acetyl-4 methylenedioxy amphetamine, caffeine); in heroin: cffeine, acetaminophen, diazepam and starch; in cocaine (levamisole, phenacetin, caffeine, lidocaine, benzocaine) and in meth (DMS, caffeine, amphetamine).
Sri Lanka (NNL Lab)	In heroin in 2020: imidasole, asteromycin, tramadol, paromomycin, cefalexin, acetaminophen; caffeine; diazepam; lactose; glucose, sucrose) and in 2021 (acetaminophen; caffeine; phentoyin); In NBOMe in 2020- 2021 (Ketamine, 2-methoxyphenylacetone, 2-methoxy benzaldehyde, trimethoxy benzaldehyde, naphthalene, N- (2-methoxybenzyl)-2,5-dimethoxy-4-chlorophenethylamine).
Thailand	In Crystalline meth: caffeine, DMS, potassium salt, dimethylamphetamine, ketamine, nimetazepam; In Yaba (methamphetamine tablets) caffeine, ethylvanillin, theophylline, paracetamol; in heroin: acetyl codeine, 6-monoacetylmorphine, morphine, codeine, caffeine; in ketamine: diazepam, caffeine; in cocaine: caffeine, phenacetin, benzoylecgonine, tetramisole, tropacocaine, ketamine, ecgonine methyl ester, cinnamoylcocaine, methyl ecgonidine, benzocaine; in Ecstasy (MDMA): less amounts of MDMA and more amounts of caffeine, PMMA, ketamine, MDA, methamphetamine, amphetamine.
United States	2021 analyses of US street-level samples from 13 States revealed combinations of between 11 and 14 adulterants and impurities, including as many as three fentanyl analogs, seven highly toxic adulterants—such as phenacetin, and the livestock tranquilizers, levamisole, and xylazine as well as synthetic cathinones (stimulants), and a range of impurities from the drug manufacturing process.
Uruguay	In cocaine samples: phenacetin, aminopyrine, levamisole, acetaminophen dipyrone, lidocaine, tetracaine, caffeine, and clenbuterol; 76 % of cocaine samples (of 566) contained toxic adulterants; Tucibi, tuci , tusi , pantera, rosa, cocaine rosa are street names of pink powder containing: ketamine, methamphetamine, MDA, MDMA, cocaine, and caffeine, sertraline (antidepressant sold as ZOLOFT) and methadone; in October 2021, 2,148 pink tablets were seized with the active identified as MDA and bearing a distinct logo.