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Quinine & Quinidine: Toxic Adulterants Found in Illicit Street Drugs

Toxic Adulterant Alert

Substance use treatment providers, clinicians, outreach workers, and public health agencies should be aware of the following information. Quinine has been reported as an adulterant in the illicit drug supply for many decades. Quinine is added to increase total drug volume for distribution and to dilute the drug being cut. Quinine is believed to be added as an adulterant to mimic the taste of heroin due to its bitterness. Its adverse effects include cardiac arrythmias, fatigue, headache, ataxia, hepatotoxicity and nausea. In a study at the Center for Forensic Science Research and Education (CFSRE) at the Fredric Rieders Family Foundation (FRFF) supported by the Colombo Plan on the presence of toxic adulterants in heroin/fentanyl, methamphetamine and cocaine seized drug cases in the United States (n=2,151), quinine was found in 18.3% of the total exhibits (Table 1); however, positivity varied greatly between states.

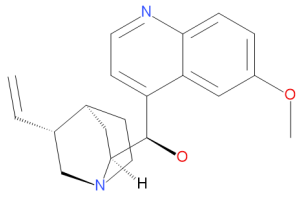
Table 1. Quinine Positivity in Seized Drug Cases in the United States

State	# of Quinine Positives	% Positivity for State	% Positivity Overall (n=2,151)
Vermont (n=244)	140	57.3	6.5
Washington, DC (n=91)	49	53.8	2.2
Kentucky (n=248)	51	20.5	2.3
Illinois (n=399)	74	18.5	3.4
Ohio (n=215)	38	17.6	1.7
New Hampshire (n=200)	19	9.5	0.8
Pennsylvania (n=106)	8	7.5	0.3
Florida (n=200)	14	7.0	0.6
Texas (n=274)	2	0.7	0.0
California (n=174)	0	0	0

Deidentified postmortem toxicology samples provided by NMS Labs were analyzed between Q1 of 2018 and Q1 of 2022 by the CFSRE and quinine was identified as an adulterant in these toxicological samples. In Q1 of 2018, 22% of samples contained this adulterant. Positivity peaked in Q3 of 2018 with 38% of samples containing quinine. In Q1 of 2022, only 14% were found to contain quinine, as other adulterants increased in positivity, such as xylazine and levamisole. Countries participating on the International Toxic Adulterant Database (ITAD) reported quinine in their drug seizures. Singapore reported quinine/quinidine in 4.35% of their heroin samples in 2019 and Indonesia reported quinine in 7.14% of their carisoprodol samples between January and May of 2020.

Background: Quinine and its naturally occurring stereoisomer quinidine are natural alkaloids found in the bark of the cinchona tree, originally from South America. Today, quinine and quinidine are individually synthesized for pharmaceutical and medical purposes. Both are effective antimalarial drugs; however, quinidine is also prescribed as a class 1a antiarrhythmic medication. Quinine and quinidine both have a similar mechanism of action as antimalarial drugs. They interfere with the malaria parasite's ability to digest hemoglobin, with quinidine being reportedly more effective in doing so. Quinine and quinidine also block sodium and potassium channels to stabilize heart rhythm, but only quinidine is prescribed for this purpose. The drugs are mainly metabolized via CYP2D6 to an inactive 3-hydroxyquinine and 3-hydroxyquinidine metabolite, respectively. Trade names for quinine include, Qualaquin® and for quinidine include Cardioquin®, Cin-Quin®, and Quinidex®. Quinine is also present in some food and beverages such as teas, Bitter Lemon, and Tonic Water. Laboratory tests may not distinguish between quinine and quinidine, and their presence may be reported non-specifically as undifferentiated quinine/quinidine.

Quinine/Quinidine



Recommendations for Clinicians

- Be aware that illicit drugs (mostly heroin or fentanyl) may contain **quinine/quinidine** which can complicate the clinical presentation.
- Be familiar with the signs and symptoms associated with **quinine/quinidine** toxicity.
- Be aware that most hospital-based clinical laboratories no longer offer **quinine/quinidine** testing.

Frequent Indicators of Toxicity

- Blurred Vision
- Blood in urine
- Hearing loss
- Thrombocytopenia
- Vomiting
- Chest pain
- Lightheadedness
- Seizures
- Arrythmia
- Blindness
- Hepatotoxicity
- Skin rashes
- Ataxia

Recommendations for MEs & Coroners

- Conduct testing for **quinine/quinidine** in suspected opioid-related fatalities.

Recommendations for Forensic and Clinical Laboratories

- Include **quinine/quinidine** in the routine scope of testing.
- Develop sensitive confirmatory procedures for common adulterating agents, including **quinine/quinidine**.
- Consider laboratory analysis of seized drug samples taken from suspected drug overdose investigations.
- Share data on adulterants in drug seizures in your jurisdiction with local health departments, medical examiners and coroners.

Health Impacts:

Quinine has been identified as an adulterant in the illicit opioid supply and may be administered intravenously when these drugs are injected. Acute quinine poisoning can lead to cinchonism, which includes symptoms such as hearing loss, tinnitus, dizziness, flushing, blurred vision and headache as noted with its clinical use. Consumption of larger doses of quinine may result in more severe symptoms including nausea, vomiting, and visual disturbances. In cases of severe overdose, quinine can result in cardiac and platelet disorders, including arrythmia, chest pain and thrombocytopenia. If not diagnosed and treated in a timely manner, it can lead to long term vision damage. Toxic doses range from 3-4 grams in adults with 1 gram potentially resulting in fatalities in children. Plasma quinine concentrations associated with visual impairment were above 10 mg/mL and levels higher than 16 mg/L were associated with cardiac toxicity and blindness.

Health providers should maintain airways in patients with suspected quinine/quinidine toxicity. Clinicians should avoid antiarrhythmic drugs (types 1a and 1c) as they can complicate the effects. Electrocardiogram (ECG) vital signs should be monitored at least up to 6 hours after suspected quinine/quinidine poisoning.

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