Compound Summary for CID 3007

Amphetamine

Cite this Record

STRUCTURE VENDORS DRUG INFO PHARMACOLOGY LITERATURE PATENTS BIOACTIVITIES

PubChem CID:	3007
Chemical Names:	AMPHETAMINE; Amfetamine; Dl-Amphetamine; 1-phenylpropan-2-amine; Desoxynorephedrine; Adderall More...
Molecular Formula:	$C_9H_{13}N$
Molecular Weight:	135.21 g/mol
InChI Key:	KWTSXDURSIMDCE-UHFFFAOYSA-N
Safety Summary:	Laboratory Chemical Safety Summary (LCSS)
Drug Information:	Drug Indication Therapeutic Uses Clinical Trials FDA Orange Book

Amphetamine is a powerful central nervous system stimulant and sympathomimetic. Amphetamine has multiple mechanisms of action including blocking uptake of adrenergics and dopamine, stimulation of release of monamines, and inhibiting monoamine oxidase. Amphetamine is also a drug of abuse and a psychotomimetic. The l- and the d,l-forms are included here. The l-form has less central nervous system activity but stronger cardiovascular effects. The d-form is DEXTROAMPHETAMINE.

from MeSH

Source: MeSH
Record Name: Amphetamine
URL: https://www.ncbi.nlm.nih.gov/mesh/68000661

Amphetamine is a synthetic substance related to natural sympathomimetic amines. Amphetamine appears to exert its central nervous system (CNS) and peripheral effects indirectly by inducing the release of biogenic amines from their storage sites in nerve terminals. This agent is a commonly abused psychostimulant drug, which may be snorted, taken orally, smoked, or injected. Amphetamine induces psychologic dependence which is manifested by elevated mood, increased wakefulness, concentration, physical performance and a feeling of well-being. With sustained use, the effects of tachycardia and enhanced alertness diminish while psychotoxic effects such as hallucinations and delusions may occur. (NCI04)

Pharmacology from NCIt

Source: NCIt
Record Name: Amphetamine
URL: https://ncit.nci.nih.gov/ncitbrowser/ConceptReport.jsp?dictionary=NCI_Thesaurus&ns=NCI_Thesaurus&code=C62006
Description: NCI Thesaurus (NCIt) provides reference terminology for many systems. It covers vocabulary for clinical care, translational and basic research, and public information and administrative activities.

The amphetamines are indirect acting sympathomimetic amines and powerful central nervous system stimulants which are used in the therapy of attention deficit disorder, hyperactivity and narcolepsy. Amphetamines also have a potential for abuse and illicit forms of amphetamines constitute some of the most dangerous, but widely used drugs of abuse. High doses of amphetamines can be associated with liver injury and distinctive forms of clinically apparent liver injury which has been most commonly associated with methylenedioxymetamphetamine (MDMA: "ecstasy").

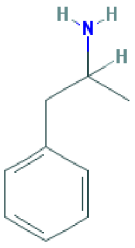
LiverTox Summary from LiverTox

Source: LiverTox
Record Name: Amphetamines
URL: https://livertox.nlm.nih.gov/Amphetamines.htm
Description: LIVERTOX provides up-to-date, accurate, and easily accessed information on the diagnosis, cause, frequency, patterns, and management of liver injury attributable to prescription and nonprescription medications, herbals and dietary supplements. Read more.

Contents

1 2D Structure

Search Download Get Image



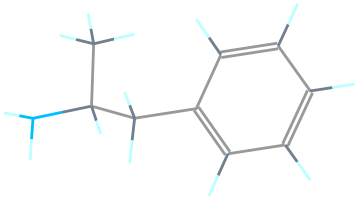
Magnify

from PubChem

Source: PubChem
URL: https://pubchem.ncbi.nlm.nih.gov
Description: Data deposited in or computed by PubChem

2 3D Conformer

Search Download Get Image



Magnify

Show Hydrogens Show Atoms Animate

from PubChem

Source: PubChem
URL: https://pubchem.ncbi.nlm.nih.gov
Description: Data deposited in or computed by PubChem

3 Names and Identifiers

3.1 Computed Descriptors

3.1.1 IUPAC Name

1-phenylpropan-2-amine

from PubChem

Source: PubChem
URL: https://pubchem.ncbi.nlm.nih.gov
Description: Data deposited in or computed by PubChem

3.1.2 InChI

InChI=1S/C9H13N/c1-8(10)7-9-5-3-2-4-6-9/h2-6,8H,7,10H2,1H3

from PubChem

3.1.3 InChI Key

KWTSXDURSIMDCE-UHFFFAOYSA-N

from PubChem

3.1.4 Canonical SMILES

CC(CC1=CC=CC=C1)N

from PubChem

3.2 Molecular Formula

$C_9H_{13}N$

from PubChem

3.3 Other Identifiers

3.3.1 CAS

300-62-9

from CAMEO Chemicals, ChemIDplus, DrugBank, EPA DSStox, European Chemicals Agency (ECHA), Human Metabolome Database (HMDB)

51-64-9

from DTP/NCI

60-15-1

from DTP/NCI, European Chemicals Agency (ECHA)

3.3.2 EC Number

200-458-3

from European Chemicals Agency (ECHA)

206-096-2

from European Chemicals Agency (ECHA)

3.3.3 NSC Number

73713

from DTP/NCI

27159

from DTP/NCI

3.3.4 UN Number

2811

from CAMEO Chemicals

3.3.5 Wikipedia

Title	amphetamine
Description	central nervous system stimulant

from Wikipedia

3.4 Synonyms

3.4.1 MeSH Entry Terms

1. Amfetamine
2. Amphetamine
3. Amphetamine Sulfate
4. Amphetamine Sulfate (2:1)
5. Centramina
6. Desoxynorephedrin
7. Fenamine
8. l Amphetamine
9. l-Amphetamine
10. levo Amphetamine
11. levo-Amphetamine
12. Levoamphetamine
13. Mydrial
14. Phenamine
15. Phenopromin
16. Sulfate, Amphetamine
17. Thyramine

from MeSH

3.4.2 Depositor-Supplied Synonyms

1. AMPHETAMINE
2. Amfetamine
3. dl-Amphetamine
4. 1-phenylpropan-2-amine
5. Desoxynorephedrine
6. Adderall
7. 1-Phenyl-2-aminopropane
8. alpha-Methylphenethylamine
9. Fenopromin
10. Phenedrine
11. Elastonon
12. Mydrial
13. 1-Methyl-2-phenylethylamine
14. 300-62-9
15. beta-Aminopropylbenzene
16. Norephedrane
17. 1-Phenyl-2-propylamine
18. Actedron
19. Allodene
20. Anorexide
21. Anorexine
22. Benzebar
23. Benzolone
24. Isoamyne
25. Mecodrin
26. Novydrine
27. Oktedrin
28. Ortedrine
29. Percomon
30. Profamina
31. Simpatina
32. Adipan
33. Isomyn
34. Finam
35. Protioamphetamine
36. alpha-Methylbenzeneethaneamine
37. 3-Phenyl-2-propylamine
38. Psychedrine
39. amfetaminum
40. Fenylo-izopropylaminyl
41. (Phenylisopropyl)amine
42. dl-alpha-Methylphenethylamine
43. 1-Phenyl-2-propanamine
44. 2-Amino-1-phenylpropane
45. racemic-Desoxynor-ephedrine
46. (+-)-Benzedrine
47. Benzeneethanamine, .alpha.-meth
48. Amfetamina [Italian]
49. Anfetamina [Spanish]
50. Sympatedrine

from PubChem

Source: PubChem
URL: https://pubchem.ncbi.nlm.nih.gov
Description: Data deposited in or computed by PubChem

4 Chemical and Physical Properties

4.1 Computed Properties

Property Name	Property Value
Molecular Weight	135.21 g/mol
Hydrogen Bond Donor Count	1
Hydrogen Bond Acceptor Count	1
Rotatable Bond Count	2
Complexity	84.7
CACTVS Substructure Key Fingerprint	AAADccByAAAAAAAAAAAAAAAAAAAAAAAAAAAwAAAAAAAAAAABAAAAHAAQAAAADCjBGAQyAIBAAACAAiBCAAACAAAgAAAIiIAAAIgIICKAkRGAIAAgkAAIiAcQgIAOAAAAAAAAAAAAAAAAAAAAAAAAAAAAA==
Topological Polar Surface Area	26 A^2
Monoisotopic Mass	135.105 g/mol
Exact Mass	135.105 g/mol
XLogP3	1.8
Compound Is Canonicalized	true
Formal Charge	0
Heavy Atom Count	10
Defined Atom Stereocenter Count	0
Undefined Atom Stereocenter Count	1
Defined Bond Stereocenter Count	0
Undefined Bond Stereocenter Count	0
Isotope Atom Count	0
Covalently-Bonded Unit Count	1

from PubChem

4.2 Experimental Properties

4.2.1 Physical Description

Colored liquid with an amine odor. Used as a pharmaceutical, a central nervous system stimulant. (EPA, 1998)

from CAMEO Chemicals

Solid

from Human Metabolome Database (HMDB)

4.2.2 Color

Mobile liquid

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 99

from HSDB

Colorless, volatile liquid

Lewis, R.J. Sr.; Hawley's Condensed Chemical Dictionary 15th Edition. John Wiley & Sons, Inc. New York, NY 2007., p. 75

from HSDB

4.2.3 Odor

Amine odor

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 99

from HSDB

Characteristic strong odor

Lewis, R.J. Sr.; Hawley's Condensed Chemical Dictionary 15th Edition. John Wiley & Sons, Inc. New York, NY 2007., p. 75

from HSDB

4.2.4 Taste

Acrid, burning taste

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 99

from HSDB

Slightly burning taste

Lewis, R.J. Sr.; Hawley's Condensed Chemical Dictionary 15th Edition. John Wiley & Sons, Inc. New York, NY 2007., p. 75

from HSDB

4.2.5 Boiling Point

392 to 397° F at 760 mm Hg (EPA, 1998)

from CAMEO Chemicals

200-203 deg C at 760 mm Hg

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 99

from HSDB

4.2.6 Melting Point

Volatizes slowly at room temperature

from DrugBank

25 °C

from Human Metabolome Database (HMDB)

4.2.7 Flash Point

80° F (EPA, 1998)

from CAMEO Chemicals

</= 100 deg C

Pohanish, R.P. (ed). Sittig's Handbook of Toxic and Hazardous Chemical Carcinogens 6th Edition Volume 1: A-K,Volume 2: L-Z. William Andrew, Waltham, MA 2012, p. 213

from HSDB

4.2.8 Solubility

Water Solubility

Slightly

from DrugBank

In water, 2.8X10+4 mg/L at 25 deg C (est)

US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Nov, 2012. Available from, as of Oct 23, 2015: http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm

from HSDB

Sparingly soluble in water (1:50)

McEvoy, G.K. (ed.). American Hospital Formulary Service-Drug Information 19 98. Bethesda, MD: American Society of Health-System Pharmacists, Inc. 1998 (Plus Supplements)., p. 1905

from HSDB

Slightly soluble in water

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 99

from HSDB

Readily sol in acids

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 99

from HSDB

Slightly soluble inethyl ether; soluble in ethanol and chloroform

Haynes, W.M. (ed.). CRC Handbook of Chemistry and Physics. 95th Edition. CRC Press LLC, Boca Raton: FL 2014-2015, p. 3-456

from HSDB

1.74e+00 g/L

from Human Metabolome Database (HMDB)

4.2.9 Density

0.913 at 77° F (EPA, 1998)

from CAMEO Chemicals

0.936 g/cu cm at 25 deg C

Haynes, W.M. (ed.). CRC Handbook of Chemistry and Physics. 95th Edition. CRC Press LLC, Boca Raton: FL 2014-2015, p. 3-456

from HSDB

4.2.10 Vapor Density

4.65 (EPA, 1998) (Relative to Air)

from CAMEO Chemicals

4.2.11 Vapor Pressure

0.24 Torr /mm Hg/ at 20 deg C

Lawrence AH et al; Can J Chem 62: 1886-88 (1984)

from HSDB

4.2.12 LogP

1.76

HANSCH,C ET AL. (1995)

from DrugBank

log Kow = 1.76

Hansch, C., Leo, A., D. Hoekman. Exploring QSAR - Hydrophobic, Electronic, and Steric Constants. Washington, DC: American Chemical Society., 1995., p. 61

from HSDB

1.8

from Human Metabolome Database (HMDB)

4.2.13 Stability

Stable under recommended storage conditions.

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

4.2.14 Decomposition

When heated to decomposition it emits toxic fumes of nitroxides.

Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 245

from HSDB

4.2.15 pH

Aqueous solutions are alkaline to litmus

American Conference of Governmental Industrial Hygienists. Documentation of the TLVs and BEIs with Other World Wide Occupational Exposure Values. 7th Ed. CD-ROM Cincinnati, OH 45240-1634 2013., p. 99

from HSDB

4.2.16 pKa

10.1 (at 20 °C)

PERRIN,DD (1965)

from DrugBank

4.2.17 Dissociation Constants

pKa = 10.13

Perrin DD; Dissociation constants of organic bases in aqueous solution. IUPAC Chem Data Ser, Buttersworth, London (1965)

from HSDB

4.2.18 Kovats Retention Index

Standard non-polar	1125, 1123, 1100, 1100, 1100, 1105, 1105, 1105, 1108, 1110, 1110, 1110, 1110, 1110, 1112, 1112, 1115, 1117, 1120, 1118, 1118, 1111, 1120, 1119, 1122, 1115, 1105, 1117, 1130, 1150, 1110, 1123, 1125, 1126, 1118, 1123, 1116.1, 1099.9, 1131.5, 1131.5, 1120, 1145, 1123, 1118, 1118
Semi-standard non-polar	1136.2, 1132, 1132, 1129, 1135, 1100.2, 1124.6, 1126.5, 1110, 1099.8
Standard polar	1581, 1581, 1587

from NIST

4.3 Spectral Properties

Index of refraction: 1.518 at 26 deg C/D

Haynes, W.M. (ed.). CRC Handbook of Chemistry and Physics. 95th Edition. CRC Press LLC, Boca Raton: FL 2014-2015, p. 3-456

from HSDB

Intense mass spectral peaks: 44 m/z, 65 m/z, 91 m/z, 120 m/z, 135 m/z

Pfleger, K., H. Maurer and A. Weber. Mass Spectral and GC Data of Drugs, Poisons and their Metabolites. Parts I and II. Mass Spectra Indexes. Weinheim, Federal Republic of Germany. 1985., p. 174

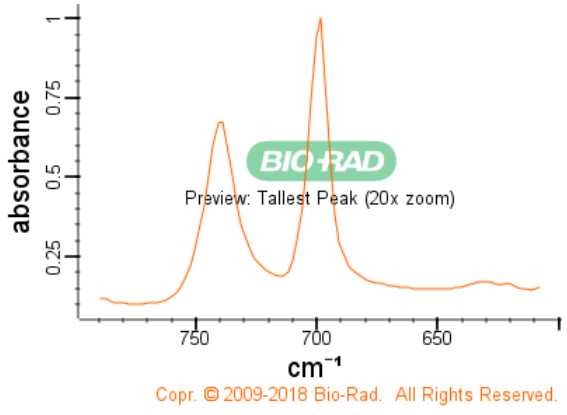
from HSDB

MASS: 42276 (NIST/EPA/MSDC Mass Spectral Database, 1990 version); 305 (National Bureau of Standards)

Haynes, W.M. (ed.). CRC Handbook of Chemistry and Physics. 95th Edition. CRC Press LLC, Boca Raton: FL 2014-2015, p. V1: 933

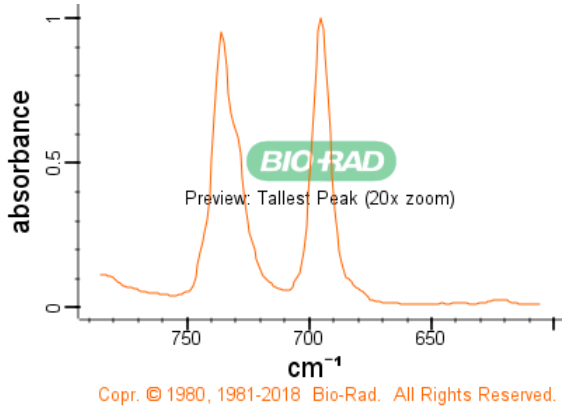
from HSDB

4.3.1 Infrared Spectra

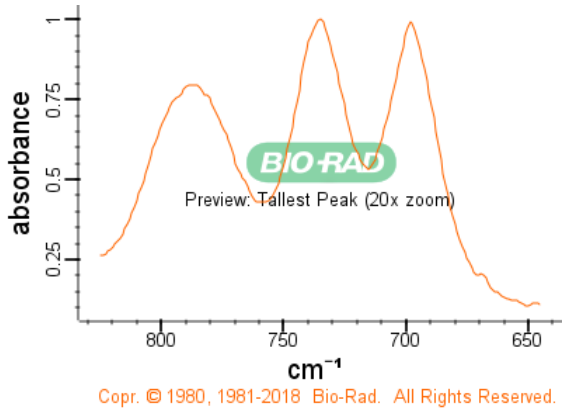
Infrared Spectra: 1 of 3 (ATR-IR Spectra)	
Instrument Name	Bio-Rad FTS
Technique	ATR-Film (MeCl2) (DuraSamplIR II)
Source of Spectrum	Forensic Spectral Research
Source of Sample	Lipomed AG
Catalog Number	AMP-95-HC-50
Lot Number	95.1B13.2
Copyright	Copyright © 2009-2018 Bio-Rad Laboratories, Inc. All Rights Reserved.
Thumbnail	

from SpectraBase

Infrared Spectra: 2 of 3 (FTIR Spectra)	
Technique	CAPILLARY CELL: NEAT
Source of Sample	Aldrich Chemical Company, Inc., Milwaukee, Wisconsin

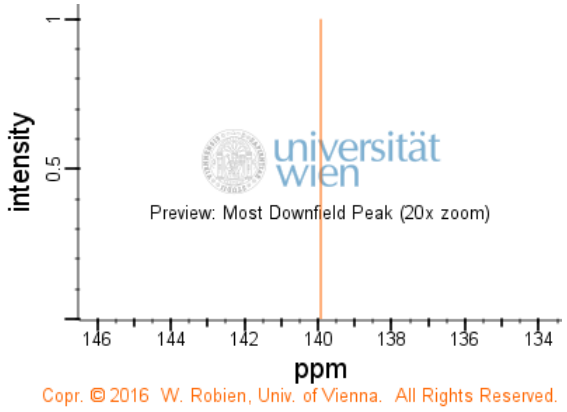
Infrared Spectra: 2 of 3 (FTIR Spectra)	
Copyright	Copyright © 1980, 1981-2018 Bio-Rad Laboratories, Inc. All Rights Reserved.
Thumbnail	

from SpectraBase

Infrared Spectra: 3 of 3 (Vapor Phase IR Spectra)	
Instrument Name	DIGILAB FTS-14
Technique	Vapor Phase
Copyright	Copyright © 1980, 1981-2018 Bio-Rad Laboratories, Inc. All Rights Reserved.
Thumbnail	

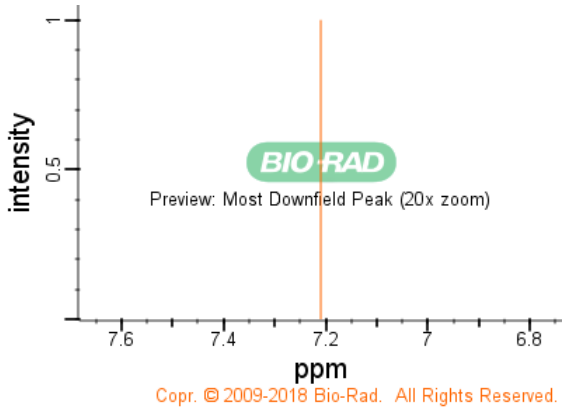
from SpectraBase

4.3.2 1D NMR Spectra

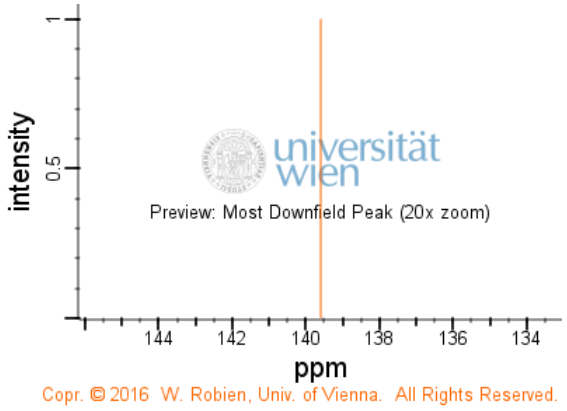
1D NMR Spectra: 1 of 3 (13C NMR Spectra)	
Copyright	Copyright © 2016 W. Robien, Inst. of Org. Chem., Univ. of Vienna. All Rights Reserved.
Thumbnail	

from SpectraBase

1D NMR Spectra: 2 of 3 (1H NMR Spectra)	
Instrument Name	Varian A-60

1D NMR Spectra: 2 of 3 (1H NMR Spectra)	
Source of Sample	Aldrich Chemical Company, Inc., Milwaukee, Wisconsin
Copyright	Copyright © 2009-2018 Bio-Rad Laboratories, Inc. All Rights Reserved.
Thumbnail	

from SpectraBase

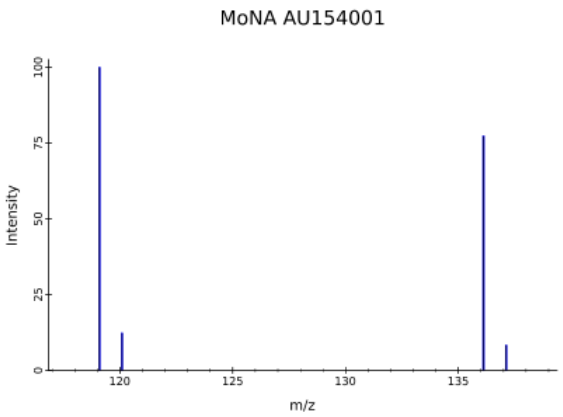
1D NMR Spectra: 3 of 3 (13C NMR Spectra)	
Copyright	Copyright © 2016 W. Robien, Inst. of Org. Chem., Univ. of Vienna. All Rights Reserved.
Thumbnail	

from SpectraBase

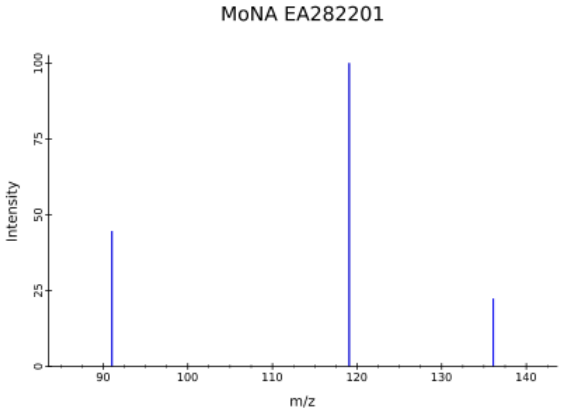
4.3.3 Mass Spectrometry

4.3.3.1 General MS

General MS: 1 of 11 (MS)	
MoNA ID	AU154001
MS Category	Experimental
MS Type	Chromatography identified as LC-MS
MS Level	MS2
Precursor Type	[M+H]+
precursor m/z	136.1121
Instrument	Bruker maXis Impact
Instrument Type	LC-ESI-QTOF
Ionization	ESI
Ionization Mode	positive
Collision Energy	10 eV
Retention Time	4.385 min
Splash	splash10-014r-0900000000-8c26eef755113726e527

General MS: 1 of 11 (MS)	
Thumbnail	
Submitter	Nikolaos Thomaidis, University of Athens

from MassBank of North America (MoNA)

General MS: 2 of 11 (MS)	
MoNA ID	EA282201
MS Category	Experimental
MS Type	Chromatography identified as LC-MS
MS Level	MS2
Precursor Type	[M+H]+
precursor m/z	136.1121
Instrument	LTQ Orbitrap XL Thermo Scientific
Instrument Type	LC-ESI-ITFT
Ionization	ESI
Ionization Mode	positive
Collision Energy	35 % (nominal)
Retention Time	3.5 min
Splash	splash10-014i-3900000000-5ec7b13e93ed8e0dc0b5
Thumbnail	
Submitter	Emma Schymanski, Eawag: Swiss Federal Institute of Aquatic Science and Technology

from MassBank of North America (MoNA)

General MS: 3 of 11 (MS)	
Total MS spectra from MoNA	17
Update to PubChem	2018-09-13

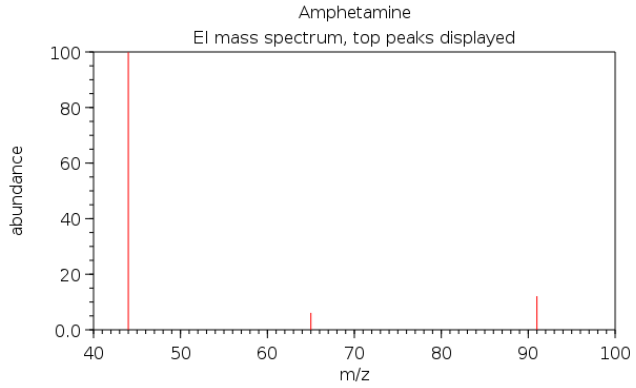
from MassBank of North America (MoNA)

View All 11 General MS

4.3.3.2 GC-MS

GC-MS Spectrum 6545 - GC-MS Ei Predicted by CFMID-EI, energy0

from Human Metabolome Database (HMDB)

1 of 8	
NIST Number	335467
Library	Main library
Total Peaks	50
m/z Top Peak	44
m/z 2nd Highest	91
m/z 3rd Highest	65
Thumbnail	

from NIST

4.3.3.3 MS-MS

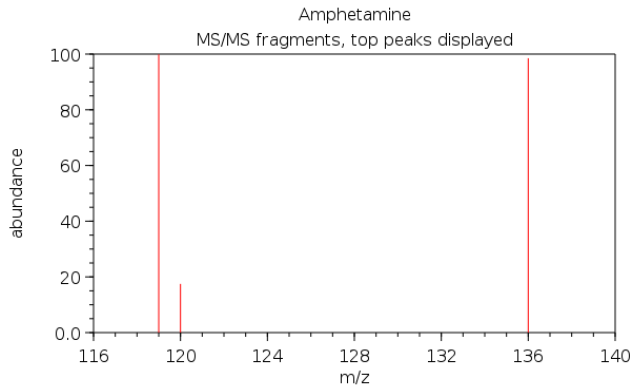
1. MS-MS Spectrum 248217 - 10V Positive Predicted by CFM-ID
2. MS-MS Spectrum 248218 - 20V Positive Predicted by CFM-ID
3. MS-MS Spectrum 248219 - 40V Positive Predicted by CFM-ID
4. MS-MS Spectrum 268158 - 10V Negative Predicted by CFM-ID
5. MS-MS Spectrum 268159 - 20V Negative Predicted by CFM-ID
6. MS-MS Spectrum 268160 - 40V Negative Predicted by CFM-ID
7. MS-MS Spectrum 441082 - LC-ESI-QTOF positive instrument=Bruker maXis Impact
8. MS-MS Spectrum 441083 - LC-ESI-QTOF positive instrument=Bruker maXis Impact
9. MS-MS Spectrum 443028 - LC-ESI-ITFT positive instrument=LTQ Orbitrap XL Thermo Scientific
10. MS-MS Spectrum 443029 - LC-ESI-ITFT positive instrument=LTQ Orbitrap XL Thermo Scientific
11. MS-MS Spectrum 443030 - LC-ESI-ITFT positive instrument=LTQ Orbit
12. MS-MS Spectrum 443031 - LC-ESI-ITFT positive instrument=LTQ Orbit
13. MS-MS Spectrum 443032 - LC-ESI-ITFT positive instrument=LTQ Orbit
14. MS-MS Spectrum 443033 - LC-ESI-ITFT positive instrument=LTQ Orbit
15. MS-MS Spectrum 443034 - LC-ESI-ITFT positive instrument=LTQ Orbit
16. MS-MS Spectrum 443035 - LC-ESI-ITFT positive instrument=LTQ Orbit
17. MS-MS Spectrum 443036 - LC-ESI-ITFT positive instrument=LTQ Orbit
18. MS-MS Spectrum 443037 - LC-ESI-ITFT positive instrument=LTQ Orbit
19. MS-MS Spectrum 443038 - LC-ESI-ITFT positive instrument=LTQ Orbit
20. MS-MS Spectrum 443039 - LC-ESI-ITFT positive instrument=LTQ Orbit

from Human Metabolome Database (HMDB)

MS-MS: 1 of 1 (MS-MS Fields)	
NIST Number	1000724
Instrument Type	IT/ion trap
Collision Energy	0
Spectrum Type	MS2
Precursor Type	[M+H]+
Precursor m/z	136.1121
Total Peaks	5
m/z Top Peak	119
m/z 2nd Highest	136
m/z 3rd Highest	120

MS-MS: 1 of 1 (MS-MS Fields)

Thumbnail



from NIST

4.3.3.4 EI-MS

EI-MS Spectrum 706 -

from Human Metabolome Database (HMDB)

5 Related Records

Download

Chemical Information	Ingenuity Pathways Analysis
Chemical Information	Side effects of amphetamine - SIDER Side Effect Resource

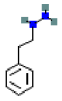
from NCBI

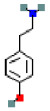
5.1 Related Compounds with Annotation

Download

Literature (236) 3D Structure (49) Bioactivities (808) Patents (11216)


Histamine


Phenelzine


Tyramine


Dextroamphetamine


Methamphetamine


Tranylcypromin

from PubChem

5.2 Related Compounds

Same Connectivity	43 records
Same Stereo	32 records
Same Isotope	3 records
Same Parent, Connectivity	102 records
Same Parent, Stereo	73 records
Same Parent, Isotope	54 records
Same Parent, Exact	36 records
Mixtures, Components, and Neutralized Forms	234 records
Similar Compounds	6131 records
Similar Conformers	37575 records

from PubChem

5.3 Substances

5.3.1 Related Substances

All	595 records
Same	106 records
Mixture	489 records

from PubChem

5.3.2 Substances by Category

Download

- Chemical Vendors (18)
- Curation Efforts (22)
- Governmental Organizations (27)

- Journal Publishers (5)
- NIH Initiatives (1)
- Research and Development (43)
- Subscription Services (8)
- Legacy Depositors (9)

from PubChem

5.4 Entrez Crosslinks

PubMed	749 records
Taxonomy	6 records
OMIM	53 records
Gene	181 records

from PubChem

6 Chemical Vendors

Refine/Analyze Download

Vendor/Supplier	Purchasable Chemical	PubChem SID
Nanjing Kaimubo	KB-219221	172868614
	KB-50276	172913538
Finetech Industry Limited	FT-0631912	164815706
	FT-0694835	164847715
AN PharmaTech	AN-23365	223667161
Aurora Fine Chemicals LLC	A01.300.744	292417064
	K02.105.366	289681695
Sigma-Aldrich	610240_SIAL	329759353
	A-007_CERILLIAN	329770569
	A-011_CERILLIAN	329770575
LGC Standards	LGCAMP0741.05-01	340514727
Mcule	MCULE-4193952437	253419589
Chembase.cn	125849	162220194
3B Scientific (Wuhan) Corp	3B3-084875	375127012
AHH Chemical co.,ltd	MT-50602	252348671
Chemieliva Pharmaceutical Co., Ltd	PBCM1264851	349746707
Alfa Chemistry	300-62-9	347753163
AKos Consulting & Solutions	AKOS022196414	215795817

from PubChem

7 Drug and Medication Information

7.1 Drug Indication

For treatment of Attention Deficit Disorder with Hyperactivity (ADDH), narcolepsy, and exogenous obesity as a short term (a few weeks) adjunct in a regimen of weight reduction based on caloric restriction for patients refractory to alternative therapy.

from DrugBank

FDA Label

from DrugBank

7.2 LiverTox Summary

The amphetamines are indirect acting sympathomimetic amines and powerful central nervous system stimulants which are used in the therapy of attention deficit disorder, hyperactivity and narcolepsy. Amphetamines also have a potential for abuse and illicit forms of amphetamines constitute some of the most dangerous, but widely used drugs of abuse. High doses of amphetamines can be associated with liver injury and distinctive forms of clinically apparent liver injury which has been most commonly associated with methylenedioxymetamphetamine (MDMA: "ecstasy").

from LiverTox

7.3 Drug Classes

Central Nervous System Stimulants

from LiverTox

7.4 FDA Medication Guides

Dyanavel XR (amphetamine) [5/2017 version]

from FDA Medication Guides

Adzenys ER (amphetamine) [9/2017 version]

from FDA Medication Guides

7.5 FDA Orange Book

7.5.1 Prescription Drug Products

Prescription Drug Products: 1 of 4 (RX Drug Ingredient)	
Drug Ingredient	AMPHETAMINE ASPARTATE; AMPHETAMINE SULFATE; DEXTROAMPHETAMINE SACCHARATE; DEXTROAMPHETAMINE SULFATE
Proprietary Name	DEXTROAMP SACCHARATE, AMP ASPARTATE, DEXTROAMP SULFATE AND AMP SULFATE
Applicant	1. ACTAVIS ELIZABETH (Application Number: A077302) 2. ACTAVIS ELIZABETH (Application Number: A206340) 3. ALVOGEN MALTA (Application Number: A207388) 4. AUROLIFE PHARMA LLC (Application Number: A202424) 5. BARR (Application Number: A040422) 6. EPIC PHARMA LLC (Application Number: A040444) 7. IMPAX LABS (Application Number: A076852) 8. MYLAN PHARMS INC (Application Number: A206721) 9. NESHER PHARMS (Application Number: A207340) 10. SANDOZ (Application Number: A040439) 11. SPECGX LLC (Application Number: A040440) 12. SUN PHARM INDUSTRIES (Application Number: A040480) 13. SUNRISE PHARM INC (Application Number: A209799) 14. TEVA (Application Number: A077488)

from FDA Orange Book

Prescription Drug Products: 2 of 4 (RX Drug Ingredient)	
Drug Ingredient	AMPHETAMINE
Proprietary Name	ADZENYS ER
Applicant	NEOS THERAPS INC (Application Number: N204325. Patents: 8709491, 9017731, 9265737)

from FDA Orange Book

Prescription Drug Products: 3 of 4 (RX Drug Ingredient)

Prescription Drug Products: 3 of 4 (RX Drug Ingredient)	
Drug Ingredient	AMPHETAMINE
Proprietary Name	ADZENYS XR-ODT
Applicant	NEOS THERAPS (Application Number: N204326. Patents: 8709491, 8840924, 9017731, 9265737)

from FDA Orange Book

View All 4 Prescription Drug Products

7.5.2 Discontinued Drug Products

Discontinued Drug Products: 1 of 5 (DISCN Drug Ingredient)	
Drug Ingredient	AMPHETAMINE RESIN COMPLEX; DEXTROAMPHETAMINE RESIN COMPLEX
Proprietary Name	BIPHETAMINE 12.5
Applicant	UCB INC (Application Number: N010093)

from FDA Orange Book

Discontinued Drug Products: 2 of 5 (DISCN Drug Ingredient)	
Drug Ingredient	AMPHETAMINE RESIN COMPLEX; DEXTROAMPHETAMINE RESIN COMPLEX
Proprietary Name	BIPHETAMINE 7.5
Applicant	UCB INC (Application Number: N010093)

from FDA Orange Book

Discontinued Drug Products: 3 of 5 (DISCN Drug Ingredient)	
Drug Ingredient	AMPHETAMINE ASPARTATE; AMPHETAMINE SULFATE; DEXTROAMPHETAMINE SACCHARATE; DEXTROAMPHETAMINE SULFATE
Proprietary Name	DEXTROAMP SACCHARATE, AMP ASPARTATE, DEXTROAMP SULFATE AND AMP SULFATE
Applicant	1. ACTAVIS ELIZABETH (Application Number: A040456) 2. TEVA PHARMS (Application Number: A040472)

from FDA Orange Book

View All 5 Discontinued Drug Products

7.6 Drug Labels for Ingredients

Drug Labels for Ingredients: 1 of 1 (Label Title)	
Label Information	Total 76 labels
Drug Ingredient	AMPHETAMINE
NDC Code(s)	0054-0389-25, 0115-1328-01, 0115-1329-01, 0115-1330-01, 0115-1331-01, 0115-1332-01, 0115-1333-01, 0115-1486-01, 0115-1487-01, 0115-1488-01 ... total 425.
Packagers	ACETRIS HEALTH, LLC; Actavis Pharma, Inc.; Akorn, Inc.; Alvogen Inc.; Amedra Pharmaceuticals LLC; American Health Packaging; Arbor Pharmaceuticals; Arbor Pharmaceuticals, Inc.; Aurolife Pharma, LLC; Avadel Generics, LLC ... total 50.

from DailyMed

7.7 Drugs at PubMed Health

Drugs at PubMed Health: 1 of 1 (PubMed Health Drug Name)	
Drug Name	Amphetamine (By mouth)
Description	Treats attention deficit hyperactivity disorder (ADHD) and narcolepsy. Also helps with weight loss in obese patients.
Drug Classes	Amphetamine (class), Appetite Suppressant, Centrally Acting, CNS Stimulant, Central Nervous System Agent

from PubMed Health

7.8 Clinical Trials

Download

1 to 5 of 15 View More

Record ID	Title	Status	Phase
NCT00151996	Safety and Tolerability of SPD503 and Psychostimulants in Children and Adolescents Aged 6-17 With Attention-Deficit/Hyperactivity Disorder (ADHD)	Completed	2
NCT00468143	A Within-Subject Cross-Over Comparison Between Immediate Release and Extended Release Adderall	Completed	4
NCT00557011	NRP104, Adderall XR or Placebo in Children Aged 6-12 Years With ADHD	Completed	2
NCT00733993	Caffeine and Cocaine	Completed	2
NCT00746733	Vyvanse and Adderall XR Given Alone and in Combination With Prilosec OTC	Completed	1

from ClinicalTrials.gov

7.9 Therapeutic Uses

Adrenergic Agents; Adrenergic Uptake Inhibitors; Central Nervous System Stimulants; Dopamine Agents; Dopamine Uptake Inhibitors; Sympathomimetics

National Library of Medicine's Medical Subject Headings. Amphetamine. Online file (MeSH, 2015). Available from, as of November 23, 2015: https://www.nlm.nih.gov/mesh/2015/mesh_browser/MBrowser.html

from HSDB

/CLINICAL TRIALS/ ClinicalTrials.gov is a registry and results database of publicly and privately supported clinical studies of human participants conducted around the world. The Web site is maintained by the National Library of Medicine (NLM) and the National Institutes of Health (NIH). Each ClinicalTrials.gov record presents summary information about a study protocol and includes the following: Disease or condition; Intervention (for example, the medical product, behavior, or procedure being studied); Title, description, and design of the study; Requirements for participation (eligibility criteria); Locations where the study is being conducted; Contact information for the study locations; and Links to relevant information on other health Web sites, such as NLM's MedlinePlus for patient health information and PubMed for citations and abstracts for scholarly articles in the field of medicine. Amphetamine is included in the database.

NIH/NLM; ClinicalTrials.Gov. Available from, as of September 30, 2015: https://clinicaltrials.gov/search/intervention=Amphetamine

from HSDB

Evekeo (amphetamine sulfate tablets, USP) is indicated for: 1. Narcolepsy 2. Attention Deficit Disorder with Hyperactivity as an integral part of a total treatment program which typically includes other remedial measures (psychological, educational, social) for a stabilizing effect in children with behavioral syndrome characterized by the following group of developmentally inappropriate symptoms: moderate to severe distractibility, short attention span, hyperactivity, emotional lability , and impulsivity. The diagnosis of the syndrome should not be made with finality when these symptoms are only of comparatively recent origin. Nonlocalizing (soft) neurological signs, learning disability, and abnormal EEG may or may not be present, and a diagnosis of central nervous system dysfunction may or not be warranted. 3. Exogenous Obesity as a short term (a few weeks) adjunct in a regimen of weight reduction based on caloric restriction for patients refractory to alternative therapy, e.g., repeated diets, group programs, and other drugs. /Included in US product label/

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Vet: to alleviate anesthetic overdosage, particularly with barbiturates. To incr ... response to external stimuli such as depressive states & milk fever in cows. May have value in selected cases of encephalomyelitis (horses) & epileptic (cattle) or hyperkinetic syndromes.

Rossoff, I.S. Handbook of Veterinary Drugs. New York: Springer Publishing Company, 1974., p. 17

from HSDB

7.10 Drug Warning

/BOXED WARNING/ Amphetamines have a high potential for abuse. Administration of amphetamines for prolonged periods of time may lead to drug dependence and must be avoided. Particular attention should be paid to the possibility of subjects obtaining amphetamines for non-therapeutic use or distribution to others, and the drugs should be prescribed or dispensed sparingly. Misuse of amphetamine may cause sudden death and serious cardiovascular adverse events.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Amphetamines are distributed into milk in concentrations 3-7 times maternal blood concentrations. A decision should be made whether to discontinue nursing or the drug.

American Society of Health-System Pharmacists 2015; Drug Information 2015. Bethesda, MD. 2015, p. 2530

from HSDB

Amphetamines should be used during pregnancy only if the potential benefits justify the possible risks to the fetus. During pregnancy it is questionable whether potential benefits from amphetamines outweigh potential risks. Infants born to women dependent on amphetamines have an increased risk of prematurity, low birthweight, and withdrawal symptoms (e.g., dysphoria, lassitude, agitation).

American Society of Health-System Pharmacists 2015; Drug Information 2015. Bethesda, MD. 2015, p. 2529

from HSDB

Adverse effects of amphetamines may include nervousness, insomnia, irritability, talkativeness, changes in libido, dizziness, headaches, increased motor activity, chilliness, pallor or flushing, blurred vision, mydriasis, and hyperexcitability. Exacerbation of motor or phonic tics, Tourette's syndrome, dyskinesia, seizures, euphoria, dysphoria, emotional lability, and impotence have been reported in patients receiving amphetamines. Psychotic episodes have occurred rarely in patients receiving amphetamines at recommended dosages.

American Society of Health-System Pharmacists 2015; Drug Information 2015. Bethesda, MD. 2015, p. 2528

▸ *from HSDB*

CONTRAINDICATIONS: Advanced arteriosclerosis, symptomatic cardiovascular disease, moderate to severe hypertension, hyperthyroidism, known hypersensitivity or idiosyncrasy to the sympathomimetic amines.; Agitated states.; Patients with a history of drug abuse.; During or within 14 days following the administration of monoamine oxidase inhibitors (hypertensive crises may result).

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

▸ *from HSDB*

Pregnancy Category C. Evekeo should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

▸ *from HSDB*

Sudden death has been reported in association with CNS stimulant treatment at usual doses in children and adolescents with structural cardiac abnormalities or other serious heart problems. Although some serious heart problems alone carry an increased risk of sudden death, stimulant products generally should not be used in children or adolescents with known serious structural cardiac abnormalities, cardiomyopathy, serious heart rhythm abnormalities, or other serious cardiac problems that may place them at increased vulnerability to the sympathomimetic effects of a stimulant drug.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

▸ *from HSDB*

Sudden deaths, stroke, and myocardial infarction have been reported in adults taking stimulant drugs at usual doses for ADHD. Although the role of stimulants in these adult cases is also unknown, adults have a greater likelihood than children of having serious structural cardiac abnormalities, cardiomyopathy, serious heart rhythm abnormalities, coronary artery disease, or other serious cardiac problems. Adults with such abnormalities should also generally not be treated with stimulant drugs.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

▸ *from HSDB*

Amphetamines are excreted in human milk. Mothers taking amphetamines should be advised to refrain from nursing.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

▸ *from HSDB*

Infants born to mothers dependent on amphetamines have an increased risk of premature delivery and low birth weight. Also, these infants may experience symptoms of withdrawal as demonstrated by dysphoria, including agitation, and significant lassitude.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

▸ *from HSDB*

Stimulant medications cause a modest increase in average blood pressure (about 2 to 4 mmHg) and average heart rate (about 3 to 6 bpm), and individuals may have larger increases. While the mean changes alone would not be expected to have short-term consequences, all patients should be monitored for larger changes in heart rate and blood pressure. Caution is indicated in treating patients whose underlying medical conditions might be compromised by increases in blood pressure or heart rate, e.g., those with pre-existing hypertension, heart failure, recent myocardial infarction, or ventricular arrhythmia.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

▸ *from HSDB*

Children, adolescents, or adults who are being considered for treatment with stimulant medications should have a careful history (including assessment for a family history of sudden death or ventricular arrhythmia) and physical exam to assess for the presence of cardiac disease, and should receive further cardiac evaluation if findings suggest such disease (e.g., electrocardiogram and echocardiogram). Patients who develop symptoms such as exertional chest pain, unexplained syncope, or other symptoms suggestive of cardiac disease during stimulant treatment should undergo a prompt cardiac evaluation.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

▸ *from HSDB*

Administration of stimulants may exacerbate symptoms of behavior disturbance and thought disorder in patients with a pre-existing psychotic disorder.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

▸ *from HSDB*

Particular care should be taken in using stimulants to treat ADHD in patients with comorbid bipolar disorder because of concern for possible induction of a mixed/manic episode in such patients. Prior to initiating treatment with a stimulant, patients with comorbid depressive symptoms should be adequately screened to determine if they are at risk for bipolar disorder; such screening should include a detailed psychiatric history, including a family history of suicide, bipolar disorder, and depression.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

▸ *from HSDB*

Treatment emergent psychotic or manic symptoms, e.g., hallucinations, delusional thinking, or mania in children and adolescents without a prior history of psychotic illness or mania can be caused by stimulants at usual doses. If such symptoms occur, consideration should be given to a possible causal role of the stimulant, and discontinuation of treatment may be appropriate. In a pooled analysis of multiple short-term, placebo-controlled studies, such symptoms occurred in about 0.1% (4 patients with events out of 3482 exposed to methylphenidate or amphetamine for several weeks at usual doses) of stimulant-treated patients compared to 0 in placebo-treated patients.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Aggressive behavior or hostility is often observed in children and adolescents with ADHD, and has been reported in clinical trials and the postmarketing experience of some medications indicated for the treatment of ADHD. Although there is no systematic evidence that stimulants cause aggressive behavior or hostility, patients beginning treatment for ADHD should be monitored for the appearance of or worsening of aggressive behavior or hostility.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Careful follow-up of weight and height in children ages 7 to 10 years who were randomized to either methylphenidate or non-medication treatment groups over 14 months, as well as in naturalistic subgroups of newly methylphenidate-treated and non-medication treated children over 36 months (to the ages of 10 to 13 years), suggests that consistently medicated children (i.e., treatment for 7 days per week throughout the year) have a temporary slowing in growth rate (on average, a total of about 2 cm less growth in height and 2.7 kg less growth in weight over 3 years), without evidence of growth rebound during this period of development. Published data are inadequate to determine whether chronic use of amphetamines may cause a similar suppression of growth, however, it is anticipated that they likely have this effect as well. Therefore, growth should be monitored during treatment with stimulants, and patients who are not growing or gaining height or weight as expected may need to have their treatment interrupted.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

There is some clinical evidence that stimulants may lower the convulsive threshold in patients with prior history of seizures, in patients with prior EEG abnormalities in absence of seizures, and, very rarely, in patients without a history of seizures and no prior EEG evidence of seizures. In the presence of seizures, the drug should be discontinued.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Stimulants, including Evekeo, used to treat ADHD are associated with peripheral vasculopathy, including Raynaud's phenomenon. Signs and symptoms are usually intermittent and mild; however, very rare sequelae include digital ulceration and/or soft tissue breakdown. Effects of peripheral vasculopathy, including Raynaud's phenomenon, were observed in post-marketing reports at different times and at therapeutic doses in all age groups throughout the course of treatment. Signs and symptoms generally improve after reduction in dose or discontinuation of drug. Careful observation for digital changes is necessary during treatment with ADHD stimulants. Further clinical evaluation (e.g., rheumatology referral) may be appropriate for certain patients.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Difficulties with accommodation and blurring of vision have been reported with stimulant treatment.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

In cases of propoxyphene overdosage, amphetamine CNS stimulation is potentiated and fatal convulsions can occur.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

7.11 Drug Idiosyncracies

Toxic manifestations /of amphetamine/ occasionally occur as an idiosyncrasy after as little as 2 mg, but are rare with doses of less than 15 mg.

Hardman, J.G., L.E. Limbird, P.B. Molinoff, R.W. Ruddon, A.G. Goodman (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 9th ed. New York, NY: McGraw-Hill, 1996., p. 220

from HSDB

7.12 Minimum/Potential Fatal Human Dose

In adults, 120 mg of amphetamine has caused death, but in one patient 200 mg produced only mild signs of peripheral sympathomimetic activity. Death usually is preceded by seizures and coma and usually results from cardiovascular collapse or from seizures.

American Society of Health-System Pharmacists 2015; Drug Information 2015. Bethesda, MD. 2015, p. 2530

from HSDB

The acute lethal dose in adults has been reported at 20-25 mg/kg, and in children, 5 mg/kg. Death from as little as 1.5 mg/kg in an adult has also been noted.

Gossel, T.A., J.D. Bricker. Principles of Clinical Toxicology. 3rd ed. New York, NY: Raven Press, Ltd., 1994., p. 348

from HSDB

Toxic amphetamine blood concentration: 50 ug/dL; Lethal amphetamine blood concentration: 200 ug/dL /From table/

Gossel, T.A., J.D. Bricker. Principles of Clinical Toxicology. 3rd ed. New York, NY: Raven Press, Ltd., 1994., p. 420

from HSDB

7.13 Drug Tolerance

Tolerance develops to some of the central effects of amphetamines, and the chronic user often incr the dose to continue to obtain the desired effect. Some users are able to take several hundred milligrams per day over prolonged periods. By supressing appetite, high doses of amphetamine may foster ketosis; and, since amphetamine is excreted

much more rapidly in acidic urine, some of the apparent tolerance may be due to more rapid elimination of the drug. At the same time there is increased sensitivity to other effects on the CNS. ... Cross tolerance between the amphetamine-like sympathomimetic agents has been observed clinically, & cross tolerance between the anorectic effect of cocaine & amphetamine has been demonstrated in rats.

Gilman, A.G., L.S.Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 7th ed. New York: Macmillan Publishing Co., Inc., 1985., p. 553

from HSDB

Tolerance does not develop to certain of the toxic effects of amphetamine on the CNS, & a toxic psychosis may occur after periods of weeks to months of continued use. Those who develop such a psychosis may have a lowered threshold during subsequent episodes if they resume use of amphetamine.

Gilman, A.G., L.S.Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 7th ed. New York: Macmillan Publishing Co., Inc., 1985., p. 553

from HSDB

Psychological dependence often occurs when amphetamine or dextroamphetamine is used chronically. ... Tolerance almost invariably develops to the anorexigenic effect of amphetamines, & is often seen also in the need for increasing doses to maintain improvement of mood in psychiatric patients. Tolerance is striking in individuals who are dependent on the drug, and a daily intake of 1.7 g without apparent ill effects has been reported. Development of tolerance is not invariable, and cases of narcolepsy have been treated for years without requiring an incr in the initially effective dose.

Hardman, J.G., L.E. Limbird, P.B. Molinoff, R.W. Ruddon, A.G. Goodman (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 9th ed. New York, NY: McGraw-Hill, 1996., p. 220

from HSDB

With time, tolerance develops to the euphorigenic effects of amphetamine; higher & more frequent doses are used, & toxic symptoms & signs then appear. These include bruxism, touching, & picking of the face & extremities, suspiciousness, & a feeling of being watched.

Gilman, A.G., L.S.Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 7th ed. New York: Macmillan Publishing Co., Inc., 1985., p. 552

from HSDB

A detailed examination of the effects of single (0.1 ml/g of body wt) and repeated equiactive doses (1.25, 2.5 and 5.0 mg/kg, sc of d-amphetamine and 2.50, 5.0 and 10.0 mg/kg, sc of l-amphetamine) of d- and l-amphetamine on food consumption by adult male Sprague Dawley rats was undertaken with emphasis on aspects of tolerance development. Wt loss and pattern of daily food intake differed depending upon the isomer, dose, and degree of tolerance. Two types of tolerance were seen with both isomers, an initial tolerance with a decr in efficacy between days 1 and 2, and a later gradual decr in efficacy over 12 days of repeated dosage. Rats tolerant to the anorectic effects of d-amphetamine were only minimally affected when challenged with an equiactive anorectic dose of l-amphetamine, while rats tolerant to the anorectic effects of l-amphetamine showed a significantly depressed food intake and modified eating pattern when challenged with an equiactive dose of d-amphetamine.
Abstract: PubMed

Nichols MB, Maickel RP; Pharmacol Biochem Behav 33 (1): 181-8 (1989)

from HSDB

8 Pharmacology and Biochemistry

8.1 Pharmacology

Amphetamine is a synthetic substance related to natural sympathomimetic amines. Amphetamine appears to exert its central nervous system (CNS) and peripheral effects indirectly by inducing the release of biogenic amines from their storage sites in nerve terminals. This agent is a commonly abused psychostimulant drug, which may be snorted, taken orally, smoked, or injected. Amphetamine induces psychologic dependence which is manifested by elevated mood, increased wakefulness, concentration, physical performance and a feeling of well-being. With sustained use, the effects of tachycardia and enhanced alertness diminish while psychotoxic effects such as hallucinations and delusions may occur. (NCI04)

from NCIt

8.2 MeSH Pharmacological Classification

Adrenergic Agents

Drugs that act on adrenergic receptors or affect the life cycle of adrenergic transmitters. Included here are adrenergic agonists and antagonists and agents that affect the synthesis, storage, uptake, metabolism, or release of adrenergic transmitters.
See a list of PubChem compounds matching this category.

from MeSH

Dopamine Uptake Inhibitors

Drugs that block the transport of DOPAMINE into axon terminals or into storage vesicles within terminals. Most of the ADRENERGIC UPTAKE INHIBITORS also inhibit dopamine uptake.
See a list of PubChem compounds matching this category.

from MeSH

Sympathomimetics

Drugs that mimic the effects of stimulating postganglionic adrenergic sympathetic nerves. Included here are drugs that directly stimulate adrenergic receptors and drugs that act indirectly by provoking the release of adrenergic transmitters.
See a list of PubChem compounds matching this category.

from MeSH

Central Nervous System Stimulants

A loosely defined group of drugs that tend to increase behavioral alertness, agitation, or excitation. They work by a variety of mechanisms, but usually not by direct excitation of neurons. The many drugs that have such actions as side effects to their main therapeutic use are not included here.
See a list of PubChem compounds matching this category.

from MeSH

Adrenergic Uptake Inhibitors

Drugs that block the transport of adrenergic transmitters into axon terminals or into storage vesicles within terminals. The tricyclic antidepressants (ANTIDEPRESSIVE AGENTS, TRICYCLIC) and amphetamines are among the therapeutically important drugs that may act via inhibition of adrenergic transport. Many of these drugs also block transport of serotonin.
See a list of PubChem compounds matching this category.

from MeSH

Dopamine Agents

Any drugs that are used for their effects on dopamine receptors, on the life cycle of dopamine, or on the survival of dopaminergic neurons.
See a list of PubChem compounds matching this category.

from MeSH

8.3 ATC Code

N - Nervous system
N06 - Psychoanaleptics
N06B - Psychostimulants, agents used for adhd and nootropics
N06BA - Centrally acting sympathomimetics
N06BA01 - Amfetamine

from WHO ATC

8.4 Absorption, Distribution and Excretion

Absorption

Amphetamine forms easily absorbed molecules that are highly lipid soluble. D-amphetamine mean peak plasma concentrations of 44.9 ng/mL occurred at a median time of 5.0 hours after dosing, and L-amphetamine mean peak plasma concentrations of 14.5 ng/mL occurred at a median time of 5.25 hours after dosing.

from DrugBank

Route of Elimination

With normal urine pHs, approximately half of an administered dose of amphetamine is recoverable in urine as derivatives of alpha-hydroxy-amphetamine and approximately another 30-40% of the dose is recoverable in urine as amphetamine itself. Since amphetamine has a pKa of 9 .9, urinary recovery of amphetamine is highly dependent on pH and urine flow rates. Alkaline urine pHs result in less ionization and reduced renal elimination, and acidic pHs and high flow rates result in increased renal elimination with clearances greater than glomerular filtration rates, indicating the involvement of active secretion.

from DrugBank

Children: Children eliminated amphetamine faster than adults.

Drug Facts and Comparisons 2015. Clinical Drug Information, LLC St. Louis, MO 2015, p. 1302

from HSDB

/MILK/ Amphetamines are excreted in human milk.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Amphetamines are readily absorbed from the GI tract and effects persist for 4-24 hours. Amphetamines are distributed into most body tissues with high concentrations occurring in the brain and CSF. Amphetamine appears in the urine within about 3 hours following oral administration. Urinary excretion of the amphetamines is pH-dependent and excretion is enhanced in acidic urine. Following oral administration of racemic amphetamine to humans, approximately equal amounts of both isomers were excreted during the first 12 hours; after the first 12 hours, a continually decreasing proportion of the d-isomer was excreted.

American Society of Health-System Pharmacists 2015; Drug Information 2015. Bethesda, MD. 2015, p. 2531

from HSDB

Amphetamine has been measured in human sweat at a median range of 15.5 (low dose 6.5-40.5) and 53.8 (high dose 34.0-83.4) ng per patch(1).

(1) Daughton CG, Ruhoy IS; Environ Toxicol Chem 28(12): 2495-521 (2009)

from HSDB

/MILK/ Amphetamines are distributed into milk in concentrations 3-7 times maternal blood concentrations.

American Society of Health-System Pharmacists 2015; Drug Information 2015. Bethesda, MD. 2015, p. 2530

from HSDB

There was considerable species difference in biotransformation, but not in the excretion of (14)C, after admin of (14)C-amphetamine ... Much of the (14)C was excreted in the 24 hr urine after ip admin of amphetamine to dogs & guinea pigs, & oral admin to other species. Three days after a dose of (+ or -)-amphetamine, human subjects had excreted 91% of the (14)C in the urine, rats 86%, rabbits 86%, & dogs 78%. The last 3 species excreted 5%, 7%, & 0% of the dose respectively in 3 day feces. Since excretion of (14)C over broad time intervals did not differ significantly within each species whether (+ or -)-amphetamine or its optical isomers was given, the above data can be compared with results obtained when an optical isomer was given to monkeys, mice, & guinea pigs. Thus, after a dose of (+)-amphetamine, (also known as dexamphetamine ...), guinea pigs excreted 88% of the (14)C in the 2 day urine, mice excreted 87% in the 3-day urine, & a monkey excreted 80% in the 3 day urine. Another monkey excreted less than 58%. Of interest was that man, monkey, dog, & mouse excreted about 30% of the (14)C as unchanged amphetamine in 24 hr, whereas guinea pig excreted 22%, rat excreted 13%, & rabbit only excreted 4%. These results confirmed an earlier study of the excretion of (14)C & of unchanged amphetamine in rats given (+ or -)-amphetamine at 4 different dose levels orally & at 1 level sc. ... These earlier studies showed that rates of excretion of (14)C were similar after oral or ip dosing, thus indicating comparable & rapid absorption of amphetamine in these animals by two routes.

The Chemical Society. Foreign Compound Metabolism in Mammals. Volume 1: A Review of the Literature Published Between 1960 and 1969. London: The Chemical Society, 1970., p. 65

from HSDB

The excretion of a drug into saliva depends on the ability of the drug to pass through the epithelial cells of the salivary glands into the saliva. The concentration of a drug in saliva could be higher, such as amphetamine, or lower, such as methaqualone, than that in plasma.

DHHS/NIDA; Research Monograph Series 73: Urine Testing for Drugs of Abuse p.70 (1986) DHHS Pub No. (ADM)87-1481

from HSDB

8.5 Metabolism/Metabolites

Metabolism

Amphetamine is reported to be oxidized at the 4 position of the benzene ring to form 4-hydroxyamphetamine, or on the side chain α or β carbons to form alpha-hydroxy-amphetamine or norephedrine, respectively. Norephedrine and 4-hydroxy-amphetamine are both active and each is subsequently oxidized to form 4-hydroxy-norephedrine. Alpha-hydroxy-amphetamine undergoes deamination to form phenylacetone, which ultimately forms benzoic acid and its glucuronide and the glycine conjugate hippuric acid. Although the enzymes involved in amphetamine metabolism have not been clearly defined, CYP2D6 is known to be involved with formation of 4-hydroxy-amphetamine. Since CYP2D6 is genetically polymorphic, population variations in amphetamine metabolism are a possibility.

from DrugBank

Amphetamine is metabolized in the liver by aromatic hyroxylation, N-dealkylation, and deamination. Although the enzymes involved in amphetamine metabolism have not been clearly defined, cytochrome P450 (CYP-450) 2D6 is known to be involved with formation of 4-hydroxy-amphetamine. Because CYP2D6 is genetically polymorphic, population variations in amphetamine metabolism are a posibility.

Drug Facts and Comparisons 2015. Clinical Drug Information, LLC St. Louis, MO 2015, p. 1302

from HSDB

Metabolism that results in aromatic hydroxylation, aliphatic hydroxylation, and n-dealkylation of amphetamines can give rise to active metabolites such as the potent hallucinogen p-hydroxyamphetamine. Other metabolic pathways, including deamination and subsequent side chain oxidation, produce inactive amphetamine derivatives.

Haddad, L.M. (Ed). Clinical Management of Poisoning and Drug Overdose 3rd Edition. Saunders, Philadelphia, PA. 1998., p. 563

from HSDB

8.6 Biological Half-Life

The half life for adults in the fasted state was found to be 11.25 hr.

from DrugBank

Biological half-life is between 10-13 hr in adults and 9-11 hr in children.

Drug Facts and Comparisons 2015. Clinical Drug Information, LLC St. Louis, MO 2015, p. 1302

from HSDB

8.7 Mechanism of Action

Amphetamines stimulate the release of norepinephrine from central adrenergic receptors. At higher dosages, they cause release of dopamine from the mesocorticolimbic system and the nigrostriatal dopamine systems. Amphetamine may also act as a direct agonist on central 5-HT receptors and may inhibit monoamine oxidase (MAO). In the periphery, amphetamines are believed to cause the release of noradrenaline by acting on the adrenergic nerve terminals and alpha- and beta-receptors. Modulation of serotonergic pathways may contribute to the calming affect. The drug interacts with VMAT enzymes to enhance release of DA and 5-HT from vesicles. It may also directly cause the reversal of DAT and SERT.

from DrugBank

Inactivation of sympathomimetic noncatecholamines largely depends on breakdown by monoamine oxidase and since substitution of an alkyl group for hydrogen on the a-carbon atom blocks enzymatic inactivation of the amino group, the duration of action of noncatecholamines (but not of catecholamines, which are inactivated largely by a different mechanism) is prolonged by a-substitution. The absence of a hydroxyl group on the aromatic ring of amphetamine reduces inactivation of the drug in the GI tract and the amphetamines are active following oral administration.

American Society of Health-System Pharmacists 2015; Drug Information 2015. Bethesda, MD. 2015, p. 2531

from HSDB

8.8 Human Metabolite Information

8.8.1 Metabolite Description

Description

Amphetamine is a chiral compound. The racemic mixture can be divided into its optical antipodes: levo- and dextro-amphetamine. Amphetamine is the parent compound of its own structural class, comprising a broad range of psychoactive derivatives, e. g. , MDMA (Ecstasy) and the N-methylated form, methamphetamine. Amphetamine is a homologue of phenethylamine.

from Human Metabolome Database (HMDB)

8.8.2 Tissue Locations

1. Kidney
2. Liver

from Human Metabolome Database (HMDB)

8.8.3 Cellular Locations

CytoplasmExtracellularMembrane

from Human Metabolome Database (HMDB)

9 Use and Manufacturing

9.1 Methods of Manufacturing

Amphetamine is prepared by treating phenylacetone with formic acid and ammonia under the Leuckart-Wallach conditions.

Houlihan WJ; Anti-Obesity Drugs. Ullmann's Encyclopedia of Industrial Chemistry 7th ed. (1999-2015). NY, NY: John Wiley & Sons. Online Posting Date: June 15, 2000

from HSDB

Preparation: Goggin, USA patent 2507468 (1950 to Clarke & Clarke) /Amphetamine phosphate/

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 99

from HSDB

Preparation: ... F. P. Nabenhauer, USA patent 1921424 (1933 to SK & F).

O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. Cambridge, UK: Royal Society of Chemistry, 2013., p. 99

from HSDB

Phenylacetone + hydroxylamine sulphate (oxime formation/hydrogenation)

Ashford, R.D. Ashford's Dictionary of Industrial Chemicals. London, England: Wavelength Publications Ltd., 1994., p. 84

from HSDB

9.2 Impurities

Di(1-phenylisopropyl)formamide is a by-product in the Leuckart synthesis of N-formylamphetamine, which is a reaction precursor to illegally produced dl-amphetamine. Side reactions and incomplete conversions lead to a variety of impurities and intermediate products, including benzyl methyl ketone, dibenzyl ketone, formamide, formic acid, methylamine, N,N-dimethylamphetamine, N-formylamphetamine, di(1-fenylisopropyl)amine, benzylamine, and several pyrimidine, pyridine, and pyridone compounds. Analysis of street samples suggests that amphetamines may be present in as little as 60% of purported samples. These illicit drugs contain varying amt of phencyclidine, LSD, STP, cocaine, atropine, mescaline, strychnine, and adulterants (eg, cornstarch, maltose, lactose, magnesium silicate, quinine, fibrous material).

Ellenhorn, M.J. and D.G. Barceloux. Medical Toxicology - Diagnosis and Treatment of Human Poisoning. New York, NY: Elsevier Science Publishing Co., Inc. 1988., p. 627

from HSDB

9.3 Formulations/Preparations

Oral: amphetamine sulfate tablets, 5 mg, 10 mg, Evekeo. /Amphetamine sulfate/

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

... Heroin-amphetamine ("poor man's speedball") combinations.

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 342

from HSDB

Route of Administration	Dosage Form	Strength	Brand or Generic Name (Manufacturer)
Oral	Capsules, extended-release	5 mg total amphetamine (as 1.25 mg, with Amphetamine Asparate 1.25 mg, Dextroamphetamine Saccharate 1.25 mg, and Dextroamphetamine Sulfate 1.25 mg)	Adderall XR, C-II (Shire)
Oral	Capsules, extended-release	10 mg total amphetamine (as 2.5 mg, with Amphetamine Aspartate 2.5 mg, Dextroamphetamine Saccharate 2.5 mg, and Dextroamphetamine Sulfate 2.5 mg)	Adderall XR, C-II (Shire)
Oral	Capsules, extended-release	15 mg total amphetamine (as 3.75 mg, with Amphetamine Aspartate 3.75 mg, Dextroamphetamine Saccharate 3.75 mg, and Dextroamphetamine Sulfate 3.75 mg)	Adderall XR, C-II (Shire)
Oral	Capsules, extended-release	20 mg total amphetamine (as 5 mg, with Amphetamine Aspartate 5 mg, Dextroamphetamine Saccharate 5 mg, and Dextroamphetamine Sulfate 5 mg)	Adderall XR, C-II (Shire)
Oral	Capsules, extended-release	25 mg total amphetamine (as 6.25 mg, with Amphetamine Aspartate 6.25 mg, Dextroamphetamine Saccharate 6.25 mg, and Dextroamphetamine Sulfate 6.25 mg)	Adderall XR, C-II (Shire)
Oral	Capsules, extended-release	30 mg total amphetamine (as 7.5 mg, with Amphetamine Aspartate 7.5 mg, Dextroamphetamine Saccharate 7.5 mg, and Dextroamphetamine Sulfate 7.5 mg)	Adderall XR, C-II (Shire)

Oral	Tablets	5 mg total amphetamine (as 1.25 mg, with Amphetamine Aspartate 1.25 mg, Dextroamphetamine Saccharate 1.25 mg, and Dextroamphetamine Sulfate 1.25 mg)	Adderall, C-II; double-scored (Shire)
Oral	Tablets	5 mg total amphetamine (as 1.25 mg, with Amphetamine Aspartate 1.25 mg, Dextroamphetamine Saccharate 1.25 mg, and Dextroamphetamine Sulfate 1.25 mg)	Dextroamphetamine Saccharate, Amphetamine Aspartate, Dextroamphetamine Sulfate, and Amphetamine Sulfate Tablets, C-II; double-scored (Available from one or more manufacturer, distributor, and/or repackager by generic (nonproprietary) name)
Oral	Tablets	7.5 mg total amphetamine (as 1.875 mg, with Amphetamine Aspartate 1.875 mg, Dextroamphetamine Saccharate 1.875 mg, and Dextroamphetamine Sulfate 1.875 mg)	Adderall, C-II; double-scored (Shire)
Oral	Tablets	7.5 mg total amphetamine (as 1.875 mg, with Amphetamine Aspartate 1.875 mg, Dextroamphetamine Saccharate 1.875 mg, and Dextroamphetamine Sulfate 1.875 mg)	Dextroamphetamine Saccharate, Amphetamine Aspartate, Dextroamphetamine Sulfate, and Amphetamine Sulfate Tablets, C-II; double-scored (Available from one or more manufacturer, distributor, and/or repackager by generic (nonproprietary) name)
Oral	Tablets	10 mg total amphetamine (as 2.5 mg, with Amphetamine Aspartate 2.5 mg, Dextroamphetamine Saccharate 2.5 mg, and Dextroamphetamine Sulfate 2.5 mg)	Adderall, C-II; double-scored (Shire)
Oral	Tablets	10 mg total amphetamine (as 2.5 mg, with Amphetamine Aspartate 2.5 mg, Dextroamphetamine Saccharate 2.5 mg, and Dextroamphetamine Sulfate 2.5 mg)	Dextroamphetamine Saccharate, Amphetamine Aspartate, Dextroamphetamine Sulfate, and Amphetamine Sulfate Tablets, C-II; double-scored (Available from one or more manufacturer, distributor, and/or repackager by generic (nonproprietary) name)
Oral	Tablets	12.5 mg total amphetamine (as 3.125 mg, with Amphetamine Aspartate 3.125 mg, Dextroamphetamine Saccharate 3.125 mg, and Dextroamphetamine Sulfate 3.125 mg)	Adderall, C-II; double-scored (Shire)
Oral	Tablets	12.5 mg total amphetamine (as 3.125 mg, with Amphetamine Aspartate 3.125 mg, Dextroamphetamine Saccharate 3.125 mg, and Dextroamphetamine Sulfate 3.125 mg)	Dextroamphetamine Saccharate, Amphetamine Aspartate, Dextroamphetamine Sulfate, and Amphetamine Sulfate Tablets, C-II; double-scored (Available from one or more manufacturer, distributor, and/or repackager by generic (nonproprietary) name)
Oral	Tablets	15 mg total amphetamine (as 3.75 mg, with Amphetamine Aspartate 3.75 mg, Dextroamphetamine Saccharate 3.75 mg, and Dextroamphetamine Sulfate 3.75 mg)	Adderall, C-II; double-scored (Shire)
Oral	Tablets	15 mg total amphetamine (as 3.75 mg, with Amphetamine Aspartate 3.75 mg, Dextroamphetamine Saccharate 3.75 mg, and Dextroamphetamine Sulfate 3.75 mg)	Dextroamphetamine Saccharate, Amphetamine Aspartate, Dextroamphetamine Sulfate, and Amphetamine Sulfate Tablets, C-II; double-scored (Available from one or more manufacturer, distributor, and/or repackager by generic (nonproprietary) name)
Oral	Tablets	20 mg total amphetamine (as 5 mg, with Amphetamine Aspartate 5 mg, Dextroamphetamine Saccharate 5 mg, and Dextroamphetamine Sulfate 5 mg)	Adderall, C-II; double-scored (Shire)
Oral	Tablets	20 mg total amphetamine (as 5 mg, with Amphetamine Aspartate 5 mg, Dextroamphetamine Saccharate 5 mg, and Dextroamphetamine Sulfate 5 mg)	Dextroamphetamine Saccharate, Amphetamine Aspartate, Dextroamphetamine Sulfate, and Amphetamine Sulfate Tablets, C-II; double-scored (Available from one or more manufacturer, distributor, and/or repackager by generic (nonproprietary) name)
Oral	Tablets	30 mg total amphetamine (as 7.5 mg, with Amphetamine Aspartate 7.5 mg, Dextroamphetamine Saccharate 7.5 mg, and Dextroamphetamine Sulfate 7.5 mg)	Adderall, C-II; double-scored (Shire)
Oral	Tablets	30 mg total amphetamine (as 7.5 mg, with Amphetamine Aspartate 7.5 mg, Dextroamphetamine Saccharate 7.5 mg, and Dextroamphetamine Sulfate 7.5 mg)	Dextroamphetamine Saccharate, Amphetamine Aspartate, Dextroamphetamine Sulfate, and Amphetamine Sulfate Tablets, C-II; double-scored (Available from one or more manufacturer, distributor, and/or repackager by generic (nonproprietary) name)

American Society of Health-System Pharmacists 2015; Drug Information 2015. Bethesda, MD. 2015, p. 2532

▸ *from HSDB*

Common street names: Bennies, Black Beauties, Crank, Ice, Speed, and Uppers.

USDOJ/DEA; Drugs of Abuse - A DEA Resource Guide p.46 (2015 edition). Available from, as of April 20, 2016: http://www.dea.gov/pr/multimedia-library/publications/drug_of_abuse.pdf#page=41

▸ *from HSDB*

9.4 Sampling Procedures

Drug testing is an important clinical tool that is available to physicians who are assessing the effectiveness of drug treatment as well as patient compliance to the administered program. While urine has traditionally been the matrix of choice for drug monitoring, oral fluid, a filtrate of the blood, has shown great promise as an alternative matrix for such applications. Oral fluid collection can be accomplished without the need for highly trained medical staff through the use of a simple, noninvasive oral fluid collection device, which obtains an adequate sample in only a few minutes. There has been a significant amount of research performed on the use of oral fluid for forensic toxicology application; however, more studies assessing the use of oral fluid drug testing are required to validate its ability to achieve clinical drug monitoring goals. Testing for various

drugs in oral fluid may yield a different result when compared to the same drugs in urine, requiring an assessment of the utility of oral fluid for such practices. The purpose of this study was to examine the application of oral fluid drug testing in patients undergoing buprenorphine treatment for opioid dependence. A retrospective analysis of drug testing results obtained from 6,928 patients (4,560 unobserved urine collections and 2,368 observed oral fluid collections) monitored for heroin metabolite, amphetamine, benzodiazepines, buprenorphine, tetrahydrocannabinol, cocaine, codeine, hydrocodone, hydromorphone, methadone, morphine, oxycodone, and oxymorphone was completed. Results of this statistical exercise indicated that patients undergoing observed oral fluid collection tested positive more frequently than those unobserved urine collections for several illicit drugs and prescription medications targeted. Oral fluid was shown to detect illicit drug use as well as noncompliance in this patient population under the studied conditions more often than the urine specimens.
Abstract: PubMed

Kunkel F et al; J Opioid Manag 11 (5): 435-42 (2015)

from HSDB

10 Identification

10.1 Analytic Laboratory Methods

AOAC Method 954.14. Amphetamine drugs. Stereochemical composition.

Association of Official Analytical Chemists. Official Methods of Analysis. 15th ed. and Supplements. Washington, DC: Association of Analytical Chemists, 1990, p. 520

from HSDB

AOAC Method 972.47. Amphetamine in drugs. Gas chromatographic method. /d-Amphetamine sulfate; dl-amphetamine sulfate/

Association of Official Analytical Chemists. Official Methods of Analysis. 15th ed. and Supplements. Washington, DC: Association of Analytical Chemists, 1990, p. 520

from HSDB

AOAC Method 974.39. Amphetamine in presence of antihistamines and barbituates and other drugs.

Association of Official Analytical Chemists. Official Methods of Analysis. 15th ed. and Supplements. Washington, DC: Association of Analytical Chemists, 1990, p. 521

from HSDB

AOAC Method 960.55. Sympathomimetic drugs. Microchemical tests. /dl-Amphetamine/

Association of Official Analytical Chemists. Official Methods of Analysis. 15th ed. and Supplements. Washington, DC: Association of Analytical Chemists, 1990, p. 536

from HSDB

AOAC Method 988.28. Enantionmers of amphetamine in bulk drugs, syrups, and capsules. Liquid chromatographic method. /d-Amphetamine sulfate; dl-amphetamine sulfate/

Association of Official Analytical Chemists. Official Methods of Analysis. 15th ed. and Supplements. Washington, DC: Association of Analytical Chemists, 1990, p. 622

from HSDB

Use of electron capture negative ion chem ionization mass spectrometry in analyzing amphetamine, amphetamine hydrochloride, dopamine hydrochloride, & tetrahydrocannabinol is discussed. Data are provided which define the lowest level of sample detection achieved & furnish experimental details on the operation of a negative ion chemical ionization quadrupole mass spectrometer. Detection at the attomole (10-18) level by conventional gc/MS selected ion monitoring methodology is reported.

HUNT DF, CROW FW; ANAL CHEM 50 (11): 1781-4 (1978)

from HSDB

A GLC procedure was developed to determine amphetamine salts in tablets & capsules. Amphetamine was extracted from the solid matrix with dilute hydrochloric acid & reacted with cyclohexanone in a strongly basic aqueous methanolic solution. The schiff base reaction product was extracted with hexane for GLC determination. Reaction time & optimum conditions were studied. Phenethylamine was used as an internal std. Results compared favorably with those obtained by using USP methods.
Abstract: PubMed

CLARK CC; J ASSOC OFF ANAL CHEM 58 (11): 1174-7 (1975)

from HSDB

A method of acetylating amphetamines quickly to permit rapid analysis by gas chromatography/mass spectrometry is presented. Amphetamine, methamphetamine, methylenedioxyamphetamine, & mescaline were acetylated with trifluoracetic anhydride in the presence of mercuric trifluoracetate as a catalyst. The reagent can acetylate the amine directly in the form of free base or salt. Slightly varying procedures were used, depending on whether the drugs were in solid form or were obtained in organic fluids such as urine. Samples were analyzed on a gas chromatography/mass spectrometry with an electron impact source. Advantages of this method of analysis are: rapidity, no previous cleanup to remove adulterants, & detection at the picomole level.
Abstract: PubMed

WU A; CLIN TOXICOL 8 (2): 225-32 (1975)

from HSDB

Amphetamines & related arylalkylamines were converted in high yields to the corresponding 4-nitrobenzamides to enhance their UV detectability. The derivatives are chemically stable & can be rapidly prepared & purified by extraction. These amides were separated by reverse phase high pressure liquid chromatography using an isocratic solvent system. The derivatives exhibited excellent gas chromatographic properties on 3% ov-17 liquid phase. The amides are much less volatile than the parent amines requiring column temperatures in excess of 240 deg C for elution. The derivatives were thermally stable at these temperatures.
Abstract: PubMed

CLARK CR ET AL; ANAL CHEM 49 (6): 912-5 (1977)

from HSDB

A comparison of fluorometric procedures for assay of amphetamine is presented.

MEHTA AC, SCHULMAN SG; J PHARM SCI 63 (7): 1150-1 (1975)

from HSDB

The concentrations of 17 drugs of abuse, including cocaine, several amphetamines, opioid drugs, and 2 metabolites-benzoylecgonine, a metabolite of cocaine, and 2-ethylidene-1,5-dimethyl-3,3-diphenylpyrolidine, a metabolite of methadone-were investigated in an urban watershed that is heavily impacted by discharges of municipal wastewater. The artificial sweetener sucralose was also monitored as a persistent tracer of contamination from municipal wastewater. Monitoring was conducted in a municipal wastewater treatment plant (WWTP) and at sites upstream and downstream of the WWTP discharge, as well as in a drinking water treatment plant (DWTP) located 19 km downstream of the WWTP discharge that withdraws raw water from the river. Drug concentrations were monitored with polar organic chemical integrative samplers deployed for 2 wk in the river and in the WWTP and DWTP. Several of the investigated compounds exhibited a decrease in concentration with distance downstream from the wastewater discharge into the river, but there was little attenuation of sucralose, cocaine, benzoylecgonine, morphine, acetylmorphine, acetylcodeine, and oxycodone. Heroin and methadone were not detected at any sample locations. Amphetamine, methamphetamine, 3,4-methylenedioxy-methamphetamine, and 2-ethylidene-1,5-dimethyl-3,3-diphenylpyrolidine were not detected in the samples collected at the drinking water intake. Many of the drugs of abuse were not removed effectively in the DWTP, including cocaine, benzoylecgonine, methylenedioxyamphetamine, ephedrine, and several prescription opioids, most probably because the DWTP was operating at or above its rated treatment capacity. These data indicate that there can be transport of drugs of abuse from wastewater sources into drinking water in urban watersheds.[Rodayan A et al; Environ Toxicol Chem. 2015 Jul 18. doi: 10.1002/etc.3085.
Abstract: PubMed

Epub ahead of print]

from HSDB

BACKGROUND: Wastewater analysis is a new approach developed to estimate drug (of abuse) consumption in large communities, such as cities or even whole countries. AIMS: This paper presents data on the loads of amphetamine and methamphetamine measured in ten wastewater treatment plants in different parts of a German federal state. It provides an estimation of the intensity of the consumption and a comparison to other regions in Germany and Europe. METHODS: Consumption of amphetamine and methamphetamine was estimated by analysis of drug residues in composite 24 hr samples of wastewater after mechanical treatment over one week by liquid chromatography-high resolution tandem mass spectrometry. Samples were collected from the inlet of ten wastewater treatment plants (WWTP) in the federal state of Saarland, representing bigger cities (>200,000 inhabitants), medium sized cities (>50,000 inhabitants), small cities (>25,000 inhabitants), and villages (<25,000 inhabitants). In each WWTP, samples were taken daily for seven consecutive days in July 2014. RESULTS: We observed differences of amphetamine versus methamphetamine loads (expressed as mg/day/1000 inhabitants): Amphetamine loads were much higher in all tested WWTPs indicating a low prevalence of methamphetamine abuse in the federal state of Saarland at the tested period. These findings are in line with previous reports about the distribution of amphetamine and methamphetamine in Germany and Europe. CONCLUSIONS: The approach confirms that wastewater analysis can provide valuable data about the abuse pattern of drugs of abuse in cities and larger areas. It can be useful for planning interventions aimed at specific areas and substances.

Meyer MR et al; Drug Alcohol Depend 156: 311-4 (2015)

from HSDB

A method was developed for the analysis of amphetamines and cocaine (Coc) in wastewater samples using liquid chromatography coupled with tandem mass spectrometry (LC-MS-MS). Seven stimulant-type drugs and metabolites were analyzed. These drugs included amphetamine (Amp), methamphetamine (Meth), methylenedioxyamphetamine (MDA), methylenedioxymethamphetamine (MDMA), methylenedioxyethylamphetamine (MDEA), Coc and benzoylecgonine (BE, the major metabolite of Coc). These drugs were chosen because of their widespread use. Wastewater samples were collected at both the Oxford Waste Water Treatment Plant in Oxford, Mississippi (MS) and the University Wastewater Treatment Plant in University, MS. Samples were collected on weekends in which the Ole Miss Rebel football team held home games (Vaught-Hemingway Stadium, University, MS 38677). The collected samples were analyzed using a validated method and found to contain Amp, Meth, MDMA, Coc and BE. The concentrations of Amp and BE significantly rose in the university wastewater during football games.[Gul W et al; J Anal Toxicol. 2015 Nov 4. pii: bkv124.
Abstract: PubMed

Epub ahead of print]

from HSDB

There is currently a gap in on-site drug of abuse monitoring. Current detection methods involve invasive sampling of blood and urine specimens, or collection of oral fluid, followed by qualitative screening tests using immunochromatographic cartridges. While remote laboratories then may provide confirmation and quantitative assessment of a presumptive positive, this instrumentation is expensive and decoupled from the initial sampling making the current drug-screening program inefficient and costly. The authors applied a noninvasive oral fluid sampling approach integrated with the in-development chip-based Programmable bio-nano-chip (p-BNC) platform for the detection of drugs of abuse. METHOD: The p-BNC assay methodology was applied for the detection of tetrahydrocannabinol, morphine, amphetamine, methamphetamine, cocaine, methadone and benzodiazepines, initially using spiked buffered samples and, ultimately, using oral fluid specimen collected from consented volunteers. RESULTS: Rapid (~10min), sensitive detection (~ng/mL) and quantitation of 12 drugs of abuse was demonstrated on the p-BNC platform. Furthermore, the system provided visibility to time-course of select drug and metabolite profiles in oral fluids; for the drug cocaine, three regions of slope were observed that, when combined with concentration measurements from this and prior impairment studies, information about cocaine-induced impairment may be revealed. CONCLUSIONS: This chip-based p-BNC detection modality has significant potential to be used in the future by law enforcement officers for roadside drug testing and to serve a variety of other settings, including outpatient and inpatient drug rehabilitation centers, emergency rooms, prisons, schools, and in the workplace.[Christodoulides N et al; Drug Alcohol Depend 153: 306-13 (2015)] Full text: PMC4509839
Abstract: PubMed

from HSDB

10.2 Clinical Laboratory Methods

An alternate to type C procedure (immunoassay) is avail for the direct analysis of a biological specimen (urine). Immunoassay of drugs is based on classical immunochemical procedures & utilizes an antigen-antibody reaction as an analytical tool. The reagents for the enzyme multiplied immunoassay technique (emit) used for the analysis of amphetamine in urine is avail commercially. The sensitivity of the EMIT for the analysis of amphetamine is 1.0 ug/mL. The reagents for the radioimmunoassay (ria) procedure used for the analysis of amphetamine are avail commercially. The sensitivity of RIA for amphetamine is 0.1 ug/mL.

Sunshine, Irving (ed.) Methodology for Analytical Toxicology. Cleveland: CRC Press, Inc., 1975., p. 22

from HSDB

A method of acetylating amphetamines quickly to permit rapid analysis by gas chromatography/mass spectrometry is presented. Amphetamine, methamphetamine, methylenedioxyamphetamine, & mescaline were acetylated with trifluoracetic anhydride in the presence of mercuric trifluoracetate as a catalyst. The reagent can acetylate the amine directly in the form of free base or salt. Slightly varying procedures were used, depending on whether the drugs were in solid form or were obtained in organic fluids such as urine. Samples were analyzed on a gas chromatography/mass spectrometry with an electron impact source. Advantages of this method of analysis are: rapidity, no previous cleanup to remove adulterants, & detection at the picomole level.
Abstract: PubMed

WU A; CLIN TOXICOL 8 (2): 225-32 (1975)

from HSDB

When using capillary gas chromatography with nitrogen-specific detection for rapid screening of drugs, to overcome problems associated with the use of retention indices based on homologous series determined with nitrogen-specific detectors, a retention indices reference system was developed based on molecular masses and retention times of nitrogen-containing compounds. The standards chosen are readily available in highly purified form and can be detected by the unmodified nitrogen-specific detector. By using temperature programming, a linear relationship can be obtained between the molecular masses of standards and their retention times. Used in conjunction with microcomputer data handling, this screening system is rugged and reliable, operating 22 hr/day. Using the present method the retention time in min for amphetamine standard was 3.340 on a DB-1 column, and 1.295 on a DB-17 column with retention indices of 1350 (initial temperature 120 deg C for 1 min, incr by 8 deg C/min and held for 22 min).
Abstract: PubMed

Manca D et al; Clin Chem 35 (4): 601-7 (1989)

from HSDB

A multi-column system has been developed for automated analysis of basic drugs in urine. Two polymeric precolumns, containing PRP-1 and Aminex A-28, were used to isolate the drugs. A short reversed phase column, coupled to a 150 x 4.6 mm I.D. silica column, produced the analytical separation. Sample preparation consisted of dilution and centrifugation. The entire procedure required less than 30 min. Urine from healthy laboratory employees was spiked with amphetamine. Levels of 0.2 mg/l produced peaks that could be matched against stored spectra with a computerized library search program. The retention value k' for amphetamine on a 10 x 3.2 mm I.D. Aminex A-28 column was 0.1 at a phase ratio of from 0.1 to 0.7. The retention value k' for amphetamine was 2.5 for the fully automated four column system, for isocratic analysis on the reversed phase and silica columns only, and for isocratic analysis on the silica column only. 2.5 ug amphetamine added to 500 ul urine had a retention time of 10.43 + or - 0.012 min for

10 consecutive injections. When concn from 0.3 to 10 mg/l were analyzed, the slope of the regression line was 4.5X10-5 for amphetamine.
Abstract: PubMed

Binder SR et al; J Chromatogr 473 (2): 325-41 (1989)

from HSDB

The use of a gas chromatography system equipped with dual flame ionization & nitrogen selective rubidium bead detectors in the identification of drugs is presented. With the method, drugs are chromatographed along with a caffeine std on a 3% ov-17 column programmed from 100 to 250 deg C at 4 deg/min. In addn to characterizing the drug in terms of retention time relative to caffeine, the drug can also be characterized by the ratio of the nitrogen/flame ionization detector response of the drug to the response of the caffeine std. The response index & relative retention time of 71 nitrogen containing drugs commonly encountered in forensic & toxicology applications are presented. The drugs analyzed incl amphetamine.
Abstract: PubMed

BAKER JK; ANAL CHEM 49 (6): 906-8 (1977)

from HSDB

Thin layer chromatography- as basic drugs, amphetamines are extracted from alkaline urine by an organic solvent. This solvent may be evaporated to dryness & the residue thin-layer chromatographed. ... Amphetamine is present (procedure a). Amphetamine, amphetamine sulfate, amphetamine hydrochloride, & methamphetamine are determined by this procedure. ... Amphetamine can be detected in urine samples up to 24 hr after admin of a 10.0 mg therapeutic dose. The ninhydrin-phenylacetaldehyde spray test is used in this procedure and is sensitive to as little as 0.3 ug of amphetamine.

Sunshine, Irving (ed.) Methodology for Analytical Toxicology. Cleveland: CRC Press, Inc., 1975., p. 22

from HSDB

Gas chromatography. As basic drugs, amphetamines are extracted from alkaline urine by an organic solvent. ... Back-extraction of the organic solvent extract into an acid, the addn of base to make the acid extract basic once again, & reextraction with a small vol of organic solvent sufficiently cleans the specimen for gas-chromatographic analysis. Free amphetamine drugs are separated by a 10% apiezon-10% potassium hydroxide column. Further confirmation is obtained by reacting the amphetamine drugs with trichloroacetyl chloride to obtaiN amphetamine n-trichloroamide derivatives which are separated by a 3% ov-17 column. Amphetamine, amphetamine sulfate, methamphetamine hydrochloride, & methamphetamine in blood or urine are determined by this procedure. The method is sensitive to 0.1 ug/mL of ... methamphetamine. The quantitation is accurate to + or - 7%. Greater sensitivity may be obtained if an electron-capture detector is used instead of a flame ionization detector. This method of amphetamine analysis shows a coefficient of variation of 6.5% over the range of 0.025 to 5.0 ug/mL. Recoveries over the range 0.1 to 5.0 ug/mL are 60 to 65%. Below 0.1 ug/mL they gradually decrease to a value of 40 to 45% at o.025% ug/mL. Sensitivity is limited by the decreasing recovery & the presence of solvent impurities. If a sample is known to contain amphetamine, it can usually be quantitated in concn as low as 0.005 to 0.010 ug/mL. If the analysis must identify as well as quantitate amphetamine, then 0.015 to 0.020 ug/mL is a reasonable limit of sensitivity.

Sunshine, Irving (ed.) Methodology for Analytical Toxicology. Cleveland: CRC Press, Inc., 1975., p. 22

from HSDB

BACKGROUND: Conventional methods for analysis of drugs of abuse require multiple assays which can be both expensive and time-consuming. This work describes a novel, rapid, simple and sensitive method for the quantification of 14 illicit drugs and their metabolites in whole blood. Results/methodology: This method employed a rapid liquid-liquid sample extraction of whole blood followed by UPLC-MS/MS analysis. Calibration curves were validated for analysis of appropriate concentrations. Inter- and intra-assay variations were <14.8%. Deviation of accuracy was <14.9% from target concentration for each quality control level. CONCLUSION: This work described the development and the full validation of a precise, sensitive and accurate assay. After validation, this new assay was successfully applied to routine toxicological analysis.

Feliu C et al; Bioanalysis 7 (20): 2685-700 (2015)

from HSDB

Nails (fingernails and toenails) are made of keratin. As the nail grows, substances incorporate into the keratin fibers where they can be detected 3-6 months after use. Samples are collected by clipping of 2-3 mm of nail from all fingers (100 mg). We present drug testing results from 10,349 nail samples collected from high-risk cases during a 3-year period of time. Samples were analyzed by validated analytical methods. The initial testing was performed mostly using enzyme-linked immunosorbent assay, but by liquid chromatography-tandem mass spectrometry (LC-MS-MS) as well. Presumptive positive samples were subjected to confirmatory testing with sample preparation procedures including washing, pulverizing, digestion and extraction optimized for each drug class. The total of 7,799 samples was analyzed for amphetamines. The concentrations ranged from 40 to 572,865 pg/mg (median, 100-3,687) for all amphetamine analytes. Amphetamine and methamphetamine were present in 14% of the samples, 22 samples were positive for 3,4-methylenedioxymethamphetamine (0.3%), 7 for methylenedioxyamphetamine (0.09%) and 4 for 3,4-methylenedioxy-N-ethylamphetamine (0.05%). Cocaine and related analytes were found in 5% samples (7,787 total), and the concentration range was 20-265,063 pg/mg (median 84-1,768). Opioids overall ranged from 40 to 118,229 pg/mg (median 123-830). The most prevalent opioid was oxycodone (15.1%) and hydrocodone (11.4%) compared with 1.0-3.6% for the others, including morphine, codeine, hydromorphone, methadone, 2-ethylidene-1,5-dimethyl-3,3-diphenylpyrrolidine and oxymorphone. Carboxy-?-9-tetrahydrocannabinol positivity rate was 18.1% (0.04-262 pg/mg, median 6.41). Out of 3,039 samples, 756 were positive (24.9%) for ethyl glucuronide (20-3,754 pg/mg, median 88). Other drugs found in nails included barbiturates, benzodiazepines, ketamine, meperidine, tramadol, zolpidem, propoxyphene, naltrexone and buprenorphine. Nail analyses have become a reliable way of determining the long-term use and abuse of drugs. Extraction techniques are simple and produce accurate and precise results. Sensitive analytical instrumentation, mainly LC-MS-MS, allows for detection of femtogram (10(-15) g) quantities of substances in nails. Samples were from a high-risk population, therefore the extraordinary positivity rate was observed.
Abstract: PubMed

Shu I et al; J Anal Toxicol 39 (8): 624-8 (2015)

from HSDB

Some amphetamine (AMP) and ecstacy (MDMA) urine immunoassay (IA) kits are prone to false-positive results due to poor specificity of the antibody. We employed two techniques, high-resolution mass spectrometry (HRMS) and an in silico structure search, to identify compounds likely to cause false-positive results. Hundred false-positive IA specimens for AMP and/or MDMA were analyzed by an Agilent 6230 time-of-flight (TOF) mass spectrometer. Separately, SciFinder (Chemical Abstracts) was used as an in silico structure search to generate a library of compounds that are known to cross-react with AMP/MDMA IAs. Chemical formulas and exact masses of 145 structures were then compared against masses identified by TOF. Compounds known to have cross-reactivity with the IAs were identified in the structure-based search. The chemical formulas and exact masses of 145 structures (of 20 chemical formulas) were compared against masses identified by TOF. Urine analysis by HRMS correlates accurate mass with chemical formulae, but provides little information regarding compound structure. Structural data of targeted antigens can be utilized to correlate HRMS-derived chemical formulas with structural analogs.[Marin SJ et al; J Anal Toxicol. 2015 Sep 4. pii: bkv101. [Epub ahead of print]] Full text: PMC4731401
Abstract: PubMed

from HSDB

To assess whether analysis of oral fluid can be used to identify individual drivers with drug concentrations in blood above 25ng/mL for amphetamine and methamphetamine, 10ng/mL for cocaine and 1.0ng/mL for tetrahydrocannabinol (THC), which are the cut-off concentrations used in the European DRUID Project, by calculating the diagnostic accuracies when using the analytical cut-off concentrations in oral fluid as well as for the optimal cut-off concentrations. METHODS: Paired samples of whole blood and oral fluid collected with the Statsure SalivaSampler were obtained from 4080 drivers in four European countries and analysed for amphetamine, methamphetamine, cocaine and THC using GC-MS or LC-MS. The vast majority (89%) were random drivers not suspected of drug-impaired driving. Receiver-Operating Characteristic analysis was used to evaluate the analytical results. RESULTS: The prevalence of drug findings above the cut-off concentrations in blood was 1.3% for amphetamine, 1.0% for methamphetamine,

0.6% for cocaine and 1.3% for THC. The cut-off concentrations in oral fluid that gave the highest diagnostic accuracy were for amphetamine 130ng/mL (accuracy 99.8%), methamphetamine 280ng/mL (accuracy 99.9%), cocaine 570ng/mL (accuracy 99.6%), and THC 38ng/mL (accuracy 98.3%). The proportion of false positives were 0.2%, 0.1%, 0.1% and 0.9%; and the proportion of false negatives were 0.1%, 0.0%, 0.3% and 0.8%, respectively, when using those cut-offs. The positive predictive values were 87.9%, 92.9%, 84.6% and 35.7% for amphetamine, methamphetamine, cocaine and THC, respectively. CONCLUSIONS: Analysis of concentrations of illicit drugs in oral fluid could not be used to accurately identify drivers with drugs concentrations above the selected cut-offs in blood in a cohort of drivers with low prevalence of drugs.
Abstract: PubMed

Gjerde H et al; Forensic Sci Int 256: 42-5 (2015)

from HSDB

Freely dissolved concentrations are considered to be the most relevant concentration in pharmacology and toxicology, as they represent the active concentration available for interaction with its surroundings. Here, a solid-phase microextraction (SPME) coating that combines octadecyl and propylsulfonic acid groups as strong cation exchange sites, known as C18/SCX or "mixed-mode" SPME, is used to measure freely dissolved concentrations of amitriptyline, amphetamine, diazepam and tramadol to different binding matrices, including bovine serum albumin (BSA), human serum albumin (HSA), human plasma and human whole blood. A potential confounding factor in binding studies is that proteins may sorb to the fiber coating leading to incorrect measurement of protein sorption or changes in uptake kinetics to the fiber coating. Sorption of bovine serum albumin (BSA) was observed and quantified using a Lowry assay. BSA binds to the C18/SCX fiber in small amounts, but large changes in uptake kinetics were not observed. All experiments were performed at equilibrium. In addition, however, the effect of depletion and non-equilibrium extraction on the estimation of protein binding affinities was also studied. Binding affinities to BSA and human serum albumin (HSA) were calculated as log KBSA or log KHSA. These values were very similar to reported literature values. Sampling at either equilibrium or non-equilibrium resulted in similar binding affinities. Furthermore, SPME fibers were used to measure freely dissolved concentrations in undiluted human plasma and whole blood. Analysis of SPME extracts could be performed using HPLC-UV or HPLC with fluorescence detection without prior clean-up of the samples. Measured bound fractions in plasma using this SPME approach were comparable to literature reference values. Bound fractions in whole blood were always higher than in plasma, due to red blood cell partitioning. This work shows the potential of SPME as sampling tool for freely dissolved concentrations, especially for highly protein-bound compounds. Conventional SPME coatings such as polyacrylate (PA) or polydimethylsiloxane (PDMS) might be lacking sensitivity when sampling the small neutral fraction of highly protein-bound positively charged compounds, but the C18/SCX fiber is able to sorb the charged species of organic cations, thereby improving sensitivity for these types of compounds.
Abstract: PubMed

Peltenburg H et al; J Pharm Biomed Anal 115: 534-42 (2015)

from HSDB

In forensic toxicology, body fluids are important materials not only as alternatives to blood but also for investigation of postmortem drug redistributions and pharmaco-/toxicokinetic analysis; however, there are limited data on postmortem drug distributions in cerebrospinal fluid (CSF). The present study reviewed toxicological data of autopsy cases (n=103), in which drugs were detected in CSF using gas chromatography/mass spectrometry (GC/MS), to investigate drug concentrations in CSF, compared with blood and pericardial fluid (PCF) concentrations. Oral/injected amphetamines (n=23) showed similar CSF and blood/PCF concentrations with partly lower CSF concentrations (about x0.5-1.1). CSF concentrations of the venous anesthetic midazolam (n=7) were lower with poor correlations. Oral caffeine (n=15), acetaminophen (n=7), chlorpheniramine (n=6), dihydrocodeine (n=6), and phenobarbital (n=21) showed equivalent to lower CSF concentrations (about x0.2-1.2), compared with blood and PCF concentrations; however, CSF phenobarbital concentrations were high in a fatal intoxication case. CSF concentrations of phenothiazine derivatives (n=29) were markedly lower (about x0.1) than blood/PCF concentrations. The distribution of the local anesthetic lidocaine used in critical medical care (n=49) markedly varied by case. These findings suggest that CSF is useful in routine forensic toxicology as an alternative to blood as well as for investigating pharmaco-/toxicokinetics and postmortem redistributions.
Abstract: PubMed

Tominaga M et al; Forensic Sci Int 254: 118-25 (2015)

from HSDB

The present study aimed to verify the prevalence of psychoactive drug use (amphetamines, methamphetamines, cannabinoids, cocaine, opioids and benzodiazepines) among military police officers in the state of Goias. Data were obtained from urine samples voluntarily provided by the officers participating in the study, who were informed of the study methods and signed a free and informed consent form. The samples were subject to screening analysis by immunochromatography (Multi-DrugOneStep Test), with positive tests confirmed by gas chromatography- mass spectrometry (GC-MS) and data analyzed by descriptive statistics. The results indicated the presence of the following drugs: amphetamines (0.33%), cannabinoids (0.67%) and benzodiazepines (1.34%); 97.66% showed negative results. The positive cases were distributed as follows: benzodiazepines (57.1%); cannabinoids (28.6%) and amphetamines (14.3%). In conclusion, the detection of psychoactive substances in voluntary sampling of military police officers indicates the need to implement drug testing among active military officers and preventive public policies aimed at eliminating the abusive consumption of psychotropic drugs.
Abstract: PubMed

Costa SH et al; Cien Saude Colet 20 (6): 1843-9 (2015)

from HSDB

10.3 NIOSH Analytical Methods

METHAMPHETAMINE and Illicit Drugs, Precursors, and Adulterants on Wipes by Liquid-Liquid Extraction 9106 Now available in NMAM 5th edition

from NIOSH Manual of Analytical Methods

METHAMPHETAMINE and Illicit Drugs, Precursors, and Adulterants on Wipes by Solid Phase Extraction 9109 Now available in NMAM 5th edition

from NIOSH Manual of Analytical Methods

11 Safety and Hazards

11.1 Hazards Identification

11.1.1 GHS Classification

Signal: Danger
GHS Hazard Statements
Aggregated GHS information provided by 23 companies from 1 notifications to the ECHA C&L Inventory. Each notification may be associated with multiple companies.

H226 (100%): Flammable liquid and vapor [Warning Flammable liquids]
H300 (100%): Fatal if swallowed [Danger Acute toxicity, oral]

Information may vary between notifications depending on impurities, additives, and other factors. The percentage value in parenthesis indicates the notified classification ratio from companies that provide hazard codes. Only hazard codes with percentage values above 10% are shown.

Precautionary Statement Codes
P210, P233, P240, P241, P242, P243, P264, P270, P280, P301+P310, P303+P361+P353, P321, P330, P370+P378, P403+P235, P405, and P501
(The corresponding statement to each P-code can be found here.)

from European Chemicals Agency (ECHA)

11.1.2 Health Hazard

It is classified as extremely hazardous. Probable lethal dose in humans is 5-50 mg/kg or 7 drops to 1 teaspoon for a 70 kg (150 lb.) person. Habit forming drug which affects the central nervous system. Excessive use may lead to tolerance and physical dependence. Death is possible. (EPA, 1998)

from CAMEO Chemicals

11.1.3 Fire Hazard

Dangerous when exposed to heat or flames. Upon decomposition, nitrogen oxides are emitted. Can react with oxidizing materials. (EPA, 1998)

from CAMEO Chemicals

11.2 Safety and Hazard Properties

11.2.1 LEL

It is flammable. (EPA, 1998)

from CAMEO Chemicals

11.2.2 UEL

It is flammable. (EPA, 1998)

from CAMEO Chemicals

11.2.3 NFPA Fire Rating

1

from CAMEO Chemicals

11.2.4 NFPA Health Rating

3

from CAMEO Chemicals

11.3 First Aid Measures

11.3.1 First Aid

Signs and Symptoms of Amphetamine Exposure: Signs and symptoms of acute amphetamine exposure include the following: headache, flushing or pallor, dry mouth, metallic taste, loss of appetite, abdominal cramps, nausea, vomiting, diarrhea, difficulty urinating, chills or fever, restlessness, dizziness, tremors, and hyperactive reflexes. Mood and behavioral changes may include irritability, apprehensiveness, talkativeness, and confusion. Convulsions and coma may also occur. Cardiovascular signs include hypertension (high blood pressure) and tachycardia (rapid heart beat). Cardiovascular collapse may occur in cases of extreme intoxication. Emergency Life-Support Procedures: Acute exposure to amphetamine may require decontamination and life support for the victims. Emergency personnel should wear protective clothing appropriate to the type and degree of contamination. Air-purifying or supplied-air respiratory equipment should also be worn, as necessary. Rescue vehicles should carry supplies such as plastic sheeting and disposable plastic bags to assist in preventing spread of contamination. Inhalation Exposure: 1. Move victims to fresh air. Emergency personnel should avoid self-exposure to amphetamine. 2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support. 3. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures. 4. Transport to a health care facility. Dermal/Eye Exposure: 1. Remove victims from exposure. Emergency personnel should avoid self-exposure to amphetamine. 2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support. 3. Remove and isolate contaminated clothing as soon as possible. 4. If eye exposure has occurred, eyes must be flushed with lukewarm water for at least 15 minutes. 5. Wash exposed skin areas thoroughly with water. 6. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures. 7. Transport to a health care facility. Ingestion Exposure: 1. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support. 2. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures. 3. Vomiting may be induced with syrup of Ipecac. If elapsed time since ingestion of amphetamine is unknown or suspected to be greater than 30 minutes, do not induce vomiting and proceed to Step 4. Ipecac should not be administered to children under 6 months of age. Warning: Ingestion of amphetamine may result in sudden onset of seizures or loss of consciousness. Syrup of Ipecac should be administered only if victims are alert, have an active gag reflex, and show no signs of impending seizure or coma. If ANY uncertainty exists, proceed to Step 4. The following dosages of Ipecac are recommended: children up to 1 year old, 10 mL (1/3 oz); children 1 to 12 years old, 15 mL (1/2 oz); adults, 30 mL (1 oz). Ambulate (walk) the victims and give large quantities of water. If vomiting has not occurred after 15 minutes, Ipecac may be readministered. Continue to ambulate and give water to the victims. If vomiting has not occurred within 15 minutes after second administration of Ipecac, administer activated charcoal. 4. Activated charcoal may be administered if victims are conscious and alert. Use 15 to 30 g (1/2 to 1 oz) for children, 50 to 100 g (1-3/4 to 3-1/2 oz) for adults, with 125 to 250 mL (1/2 to 1 cup) of water. 5. Promote excretion by administering a saline cathartic or sorbitol to conscious and alert victims. Children require 15 to 30 g (1/2 to 1 oz) of cathartic; 50 to 100 g (1-3/4 to 3-1/2 oz) is recommended for adults. 6. Transport to a health care facility. (EPA, 1998)

from CAMEO Chemicals

11.4 Fire Fighting Measures

Advice for firefighters: Wear self-contained breathing apparatus for firefighting if necessary.

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

Suitable extinguishing media: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

11.4.1 Fire Fighting

Extinguish with carbon dioxide or dry chemical. (EPA, 1998)

from CAMEO Chemicals

11.5 Accidental Release Measures

11.5.1 Isolation and Evacuation

Excerpt from ERG Guide 154 [Substances - Toxic and/or Corrosive (Non-Combustible)]: As an immediate precautionary measure, isolate spill or leak area in all directions for at least 50 meters (150 feet) for liquids and at least 25 meters (75 feet) for solids. SPILL: Increase, in the downwind direction, as necessary, the isolation distance shown above. FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2016)

from CAMEO Chemicals

11.5.2 Cleanup Methods

ACCIDENTAL RELEASE MEASURES. Personal precautions, protective equipment and emergency procedures: Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.; Environmental precautions: Prevent further leakage or spillage if safe to do so. Do not let product enter drains.; Methods and materials for containment and cleaning up: Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations.

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

11.5.3 Disposal Methods

SRP: Expired or waste pharmaceuticals shall carefully take into consideration applicable DEA, EPA, and FDA regulations. It is not appropriate to dispose by flushing the pharmaceutical down the toilet or discarding to trash. If possible return the pharmaceutical to the manufacturer for proper disposal being careful to properly label and securely

package the material. Alternatively, the waste pharmaceutical shall be labeled, securely packaged and transported by a state licensed medical waste contractor to dispose by burial in a licensed hazardous or toxic waste landfill or incinerator.

from HSDB

Dissolve or mix material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. All federal, state, and local environmental regulations must be observed.

Pohanish, R.P. (ed). Sittig's Handbook of Toxic and Hazardous Chemical Carcinogens 6th Edition Volume 1: A-K,Volume 2: L-Z. William Andrew, Waltham, MA 2012, p. 214

from HSDB

11.5.4 Other Preventative Measures

Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

Precautions for safe handling: Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

11.6 Handling and Storage

11.6.1 Nonfire Spill Response

(Non-Specific -- Drugs, n.o.s.) Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Shut off ignition sources; no flares, smoking or flames in hazard area. Keep combustibles (wood, paper, oil, etc.) away from spilled material. Do not touch spilled material. Small spills: absorb with sand or other noncombustible absorbent material and place into containers for later disposal. Large spills: dike far ahead of spill for later disposal. (EPA, 1998)

from CAMEO Chemicals

11.6.2 Storage Conditions

Conditions for safe storage, including any incompatibilities: Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Recommended storage temperature -20 deg C

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

11.7 Exposure Control and Personal Protection

11.7.1 Protective Equipment and Clothing

For emergency situations, wear a positive pressure, pressure-demand, full facepiece self-contained breathing apparatus (SCBA) or pressure- demand supplied air respirator with escape SCBA and a fully-encapsulating, chemical resistant suit. (EPA, 1998)

from CAMEO Chemicals

Respiratory protection: Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

Body Protection: Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

Skin protection: Handle with gloves.

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

Eye/face protection: Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

11.8 Stability and Reactivity

11.8.1 Air and Water Reactions

No rapid reaction with air. No rapid reaction with water.

from CAMEO Chemicals

11.8.2 Reactive Group

Amines, Phosphines, and Pyridines

from CAMEO Chemicals

11.8.3 Reactivity Profile

Amines, such as AMPHETAMINE, are chemical bases. They neutralize acids to form salts plus water. These acid-base reactions are exothermic. The amount of heat that is evolved per mole of amine in a neutralization is largely independent of the strength of the amine as a base. Amines may be incompatible with isocyanates, halogenated organics, peroxides, phenols (acidic), epoxides, anhydrides, and acid halides. Flammable gaseous hydrogen is generated by amines in combination with strong reducing agents, such as hydrides.

from CAMEO Chemicals

11.8.4 Reactivities and Incompatibilities

Incompatible materials: Acids, Oxidizing agents, Alkali metals, Strong oxidizing agents, Strong acids, Acid chlorides, Acid anhydrides, Reducing agents, Strong reducing agents, Phosphorus halides

Sigma-Aldrich; Material Safety Data Sheet for (+/-)-Amphetamine solution, Product Number: A-007, Version 5.4 (Revision Date 05/05/2015). Available from, as of November 23, 2015: http://www.sigmaaldrich.com/safety-center.html

from HSDB

11.9 Transport Information

11.9.1 DOT Label

Poison

from CAMEO Chemicals

11.10 Regulatory Information

11.10.1 CERCLA Reportable Quantities

Releases of CERCLA hazardous substances are subject to the release reporting requirement of CERCLA section 103, codified at 40 CFR part 302, in addition to the requirements of 40 CFR part 355. Amphetamine is an extremely hazardous substance (EHS) subject to reporting requirements when stored in amounts in excess of its threshold planning quantity (TPQ) of 1,000 lbs.

40 CFR 355 (USEPA); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of November 24, 2015: http://www.ecfr.gov

from HSDB

11.10.2 FDA Requirements

The Approved Drug Products with Therapeutic Equivalence Evaluations identifies currently marketed prescription drug products, including amphetamine sulfate, approved on the basis of safety and effectiveness by FDA under sections 505 of the Federal Food, Drug, and Cosmetic Act. /Amphetamine sulfate/

DHHS/FDA; Electronic Orange Book-Approved Drug Products with Therapeutic Equivalence Evaluations. Available from, as of September 30, 2015: http://www.fda.gov/cder/ob/

from HSDB

The Approved Drug Products with Therapeutic Equivalence Evaluations identifies currently marketed prescription drug products, including amphetamine aspartate, approved on the basis of safety and effectiveness by FDA under sections 505 of the Federal Food, Drug, and Cosmetic Act. /Amphetamine aspartate/

DHHS/FDA; Electronic Orange Book-Approved Drug Products with Therapeutic Equivalence Evaluations. Available from, as of September 30, 2015: http://www.fda.gov/cder/ob/

from HSDB

Schedule II shall consist of the drugs and other substances, by whatever official name, common or usual name, chemical name, or brand name designated, listed in this section. Each drug or substance has been assigned the DEA Controlled Substances Code Number set forth opposite it. ... (d) Stimulants. Unless specifically excepted or unless listed in another schedule, any material, compound, mixture, or preparation which contains any quantity of the following substances having a stimulant effect on the central nervous

system: Amphetamine, its salts, optical isomers, and salts of its optical isomers (DEA Code Number: 1100) is included on this list. /Amphetamine, its salts, optical isomers, and salts of its optical isomers/

21 CFR 1308.12(d) (USFDA); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of October 7, 2015: http://www.ecfr.gov

from HSDB

12 Toxicity

12.1 Toxicological Information

12.1.1 Heptatoxicity

In clinical trials, amphetamine has not been associated with serum aminotransferase elevations during therapy, but monitoring of serum enzymes during large scale, long term trials of therapy have not been reported.

from LiverTox

12.1.2 Interactions

Amphetamines inhibit the hypotensive effect of veratrum alkaloids.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

In cases of propoxyphene overdosage, amphetamine CNS stimulation is potentiated and fatal convulsions can occur.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Amphetamines may delay intestinal absorption of phenytoin; co-administration of phenytoin may produce a synergistic anticonvulsant action.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Amphetamines may delay intestinal absorption of Phenobarbital. Co-administration of phenobarbital may produce a synergistic anticonvulsant action.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Amphetamines enhance the adrenergic effect of norepinephrine.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Urinary excretion of amphetamines is increased, and efficacy is reduced by acidifying agents used in methenamine therapy.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Amphetamines potentiate the analgesic effect of meperidine.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

The antiobesity and stimulatory effects of amphetamines may be inhibited by lithium carbonate.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Haloperidol blocks dopamine and norepinephrine reuptake, thus inhibiting the central stimulant affects of amphetamines.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Amphetamines may delay intestinal absorption of ethosuximide.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Chlorpromazine blocks dopamine and norepinephrine reuptake, thus inhibiting the central stimulant effects of amphetamine, and can be used to treat amphetamine poisoning.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Amphetamines may antagonize the hypotensive effects of antihypertensives.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Amphetamines may counteract the sedative effect of antihistamines.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

MAOI antidepressants, as well as a metabolite of furazolidone, slow amphetamine metabolism. This slowing potentiates amphetamines, increasing their effect on the release of norepinephrine and other monoamines from adrenergic nerve endings; this can cause headaches and other signs of hypertensive crisis. A variety of neurological toxic effects and malignant hyperpyrexia can occur, sometimes with fatal results.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Amphetamines may enhance the activity of tricyclic or sympathomimetic agents; d-amphetamine with desipramine or protriptyline and possibly other tricyclics cause striking and sustained increases in the concentration of d-amphetamine in the brain; cardiovascular effects can be potentiated.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Gastrointestinal alkalinizing agents (sodium bicarbonate, etc.) increase absorption of amphetamines. Urinary alkalinizing agents (acetazolamide, some thiazides) increase the concentration of the non-ionized species of the amphetamine molecule, thereby decreasing urinary excretion. Both groups of agents increase blood levels and therefore potentiate the action of amphetamines.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Adrenergic blockers are inhibited by amphetamines.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Gastrointestinal acidifying agents (guanethidine, reserpine, glutamic acid HCl, ascorbic acid, fruit juices, etc.) lower absorption of amphetamines. Urinary acidifying agents (ammonium chloride, sodium acid phosphate, etc.) increase concentration of the ionized species of the amphetamine molecule, thereby increasing urinary excretion. Both groups of agents lower blood levels and efficacy of amphetamines.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

The effects of D-Trp11-neurotensin (0-8 ug/rat, iv, ventricle) and alpha-flupenthixol (0-1 mg/kg ip) on hyperactivity induced by d-amphetamine (1.5 mg/kg, ip) was studied in male Wistar rats. The usual total counts index of activity suggested that alpha-flupenthixol and D-Trp11-neurotensin blocked the incr activity. In contrast, conditional count data suggested that only alpha-flupenthixol was effective. Both measures indicated that amphetamine, administered separately, enhanced activity.

Sahgal A et al; Neuropharmacol 28 (3): 283-9 (1989)

from HSDB

In animals ibogaine enhances amphetamine ... induced increases in brain dopamine levels.

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 935

from HSDB

BACKGROUND: Methamphetamine addiction is a significant public health problem for which no Food and Drug Administration-approved pharmacotherapies exist. Preclinical drug vs. food choice procedures have been predictive of clinical medication efficacy in the treatment of opioid and cocaine addiction. Whether preclinical choice procedures are predictive of candidate medication effects for other abused drugs, such as methamphetamine, remains unclear. The present study aim was to determine continuous 7-day treatment effects with the monoamine releaser d-amphetamine and the monoamine uptake inhibitor methylphenidate on methamphetamine vs. food choice. In addition, 7-day cocaine treatment effects were also examined. METHODS: Behavior was maintained under a concurrent schedule of food delivery (1-g pellets, fixed-ratio 100 schedule) and methamphetamine injections (0-0.32mg/kg/injection, fixed-ratio 10 schedule) in male rhesus monkeys (n=4). Methamphetamine choice dose-effect functions were determined daily before and during 7-day periods of continuous intravenous treatment with d-amphetamine (0.01-0.1mg/kg/hr), methylphenidate (0.032-0.32mg/kg/hr), or cocaine (0.1-0.32mg/kg/hr). RESULTS: During saline treatment, increasing methamphetamine doses resulted in a corresponding increase in methamphetamine vs. food choice. Continuous 7-day treatments with d-amphetamine, methylphenidate or cocaine did not significantly attenuate methamphetamine vs. food choice up to doses that decreased rates of operant responding. However, 0.1mg/kg/hr d-amphetamine did eliminate methamphetamine choice in two monkeys. CONCLUSIONS: The present subchronic treatment results support the utility of preclinical methamphetamine choice to evaluate candidate medications for methamphetamine addiction. Furthermore, these results confirm and extend previous results demonstrating differential pharmacological mechanisms between cocaine choice and methamphetamine choice.[Schwienteck KL, Banks ML; Drug Alcohol Depend 155: 16-23 (2015)] Full text: PMC4582002
Abstract: PubMed

from HSDB

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopment disorder occurring during childhood. However, ADHD persists into adulthood in 45.7% of cases. The global prevalence of adult ADHD is estimated to 5.3%, with no difference between Europe and North America. ADHD is often comorbid with substance use disorder (SUD), with Odds Ratio ranges from 1.5 to 7.9, depending on the substance and the dependence level. Conversely, the prevalence of ADHD among patients with SUD is 10.8%, versus 3.8% for patients without SUD. Methylphenidate (MPH) alleviates ADHD symptoms and, as such, is currently considered as a first choice medication. MPH blocks the dopamine and norepinephrine transporters leading to an increase in extracellular dopamine. It should be noted that its subjective effects are highly dependent on the pharmacokinetic and especially on the rate of input, which highlights the importance of choosing a sustained-release formulation. Meanwhile, prescribing MPH to patients with comorbid SUD has always been challenging for clinicians. The aim of this review is to address the benefits and pitfalls of using MPH in adults with ADHD comorbid SUD, depending on each of the following types of SUD: amphetamine, cocaine, nicotine, alcohol, cannabis and opiates. Overall, due to the prevalence of ADHD in SUD and to the benefits of MPH observed in this population, and considering the mild or low side effects observed, the response to MPH treatment should be evaluated individually in adults with comorbid ADHD and

SUD. The choice of the formulation should favor sustained- release MPH over immediate release MPH. Cardiovascular parameters also have to be monitored during long-term use.
Abstract: PubMed

Simon N et al; Curr Pharm Des 21 (23): 3359-66 (2015)

from HSDB

Amphetamine (AMPH) is an addictive psychostimulant drug whose use has been related to neurotoxicity. Experimentally, AMPH increases anxiety-like symptoms, showing addictive properties. In the last decades, the growing consumption of processed foods has provided an excess of saturated and trans fats in detriment of essential fatty acids, which may modify the lipid profile of brain membranes, thus modifying its permeability and dopaminergic neurotransmission. Here, we assessed the influence of brain incorporation of different fatty acids (FA) on AMPH self-administration. Three groups of young male rats were orally supplemented from weaning with a mixture of soybean oil (SO, rich in n-6 FA) and fish oil (FO, rich in n-3 FA), hydrogenated vegetable fat (HVF, rich in trans fatty acids-TFA), or water (control group). These animals were born from dams that were supplemented with the same fat from pregnancy to lactation. Anxiety-like symptoms and locomotor index were assessed in elevated plus maze and open-field (OF), respectively, while brain molecular expressions of dopaminergic receptors, dopamine transporter (DAT), and BDNF were determined in the cortex and hippocampus. HVF increased the frequency of AMPH self-administration and was associated with reinforcement and withdrawal signs as observed by increased anxiety-like symptoms. Contrarily, SO/FO decreased these parameters. Increased BDNF protein together with decreased DAT expression was observed in the hippocampus of HVF group. Based on these findings, our study points to a harmful influence of trans fats on drug addiction and craving symptoms, whose mechanism may be related to changes in the dopaminergic neurotransmission.
Abstract: PubMed

Kuhn FT et al; Neurotox Res 28 (4): 319-31 (2015)

from HSDB

Amphetamine ... in large doses systemically can dilate the pupils and cause slight blurring of near vision. Applied to the eye, amphetamine dilates the pupil and retracts the upper lid, but these actions are prevented by previous depletion of catecholamines such as is brought about by local guanethidine.

Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 96

from HSDB

12.1.3 Toxicity Summary

Toxicity

LD_{50}=180 mg/kg(subcutaneous injection in rat). The most common presenting symptoms seen are agitation, hallucinations, suicidal behaviour, and chest pain.

from DrugBank

IDENTIFICATION AND USE: Amphetamine is a colorless liquid with characteristic amine odor (similar to geranium leaves) and an acrid taste. It is used for the following indications: Psychostimulant: Accepted indications: Narcolepsy; Hyperkinetic states in children (as an adjunct to psychological, educational and social measures). The drug is misused for performance enhancement. Abuse either orally or by injection is extremely common. HUMAN EXPOSURE AND TOXICITY: Main risks include: acute central nervous system (CNS) stimulation, cardiotoxicity causing tachycardia, arrhythmias, hypertension and cardiovascular collapse. High risk of dependency and abuse. Cardiovascular effects include: palpitation, chest pain, tachycardia, arrhythmias and hypertension; cardiovascular collapse can occur in severe poisoning, as well as, myocardial ischemia, infarction and ventricular dysfunction. CNS effects include: stimulation of CNS, tremor, restlessness, agitation, insomnia, increased motor activity, headache, convulsions, coma and hyperreflexia. Stroke and cerebral vasculitis have been observed. Gastrointestinal effects include: vomiting, diarrhea and cramps. Acute transient ischemic colitis has occurred with chronic methamphetamine abuse. Genitourinary effects: increased bladder sphincter tone may cause dysuria, hesitancy and acute urinary retention. Renal failure can occur secondary to dehydration or rhabdomyolysis. Renal ischemia may be noted. Transient hyperthyroxinemia may be noted. Increased metabolic and muscular activity may result in hyperventilation and hyperthermia. Weight loss is common with chronic use. Hypo- and hyperkalemia have been reported. Dehydration is common. Fasciculations and rigidity may be noted. Rhabdomyolysis is an important consequence of severe amphetamine poisoning. Agitation, confusion, mood elevation, increased wakefulness, talkativeness, irritability and panic attacks are typical. Chronic abuse can cause delusions and paranoia. A withdrawal syndrome occurs after abrupt cessation following chronic use. Amphetamine appears to exert most or all of its effect in the CNS by causing release of biogenic amines, especially norepinephrine and dopamine, from storage sites in nerve terminals. It may also slow down catecholamine metabolism by inhibiting monoamine oxidase. Children appear to be more susceptible than adults and are less likely to have developed tolerance. The use of amphetamine for medical indications does not pose a significant risk to the fetus for congenital anomalies. Amphetamines generally do not appear to be human teratogens. Mild withdrawal symptoms may be observed in the newborn, but the few studies of infant follow-up have not shown long-term sequelae. Illicit maternal use or abuse of amphetamine presents a significant risk to the fetus and newborn, including intrauterine growth retardation, premature delivery and the potential for increased maternal, fetal and neonatal morbidity. However, cerebral injuries occurring in newborns exposed in utero appear to be directly related to the vasoconstrictive properties of amphetamines. 65 children whose mothers were addicted to amphetamine during pregnancy, at least during the first trimester, were studied. Intelligence, psychological function, growth, and physical health were all within the normal range at eight years, but those children exposed throughout pregnancy tended to be more aggressive. ANIMAL STUDIES: Testing for toxicity to the retina has been negative; 10 mg/kg given daily to dogs for three months caused occasional slight ophthalmoscopic appearance of blanching of the fundus, but no histologic change in the retina. The behavioral effects of d-amphetamine administration were studied in 17 adult cats. The doses of amphetamine administered were 0.1, 0.5, 1.0 and 5.0 mg/kg sc. Amphetamine administration induced a dose-dependent hypomotility, which was marked with the higher doses. In addition, rhythmic, bilateral slow movements of the head as a mode of stereotype, indifference to the environment and dose-dependent incr in respiratory rate were observed in amphetamine-treated cats. Amphetamine damages cerebral arteries in experimental animal models. ECOTOXICITY STUDIES: In the freshwater bivalve Dreissena polymorpha the bell-shaped trend of antioxidants showed at the highest tested amphetamine concentration (5000 ng/L) suggested an overproduction of reactive oxygen species, leading to oxidative damage, as confirmed by the significant increase of protein carbonylation and DNA fragmentation.

from HSDB

12.1.4 Antidote and Emergency Treatment

Emergency and supportive measures. 1. Maintain an open airway and assist ventilation if necessary. 2. Treat agitation, seizures, coma, and hyperthermia if they occur. 3. Continuously monitor the temperature, other vital signs, and the ECG for a minimum of 6 hours. /Amphetamines/

OLSON, K.R. (Ed). Poisoning and Drug Overdose, Sixth Edition. McGraw-Hill, New York, NY 2012, p. 79

from HSDB

Specific drugs and antidotes. There is no specific antidote. 1. Agitation. Benzodiazepines are usually satisfactory, although antipsychotic agents may be added as needed. 2. Hypertension is best treated with sedation and, if this is not effective, a parenteral vasodilator such as phentolamine or nitroprusside. 3. Treat tachyarrhythmias with propranolol or esmolol. NOTE: Paradoxical hypertension can occur owing to unopposed alpha-adrenergic effects when beta2-mediated vasodilation is blocked; be prepared to give a vasodilator if needed. 4. Treat arterial vasospasm ... . /Amphetamines/

OLSON, K.R. (Ed). Poisoning and Drug Overdose, Sixth Edition. McGraw-Hill, New York, NY 2012, p. 79

from HSDB

Decontamination. Administer activated charcoal orally if conditions are appropriate. Gastric lavage is not necessary after small to moderate ingestions if activated charcoal can be given promptly. Consider whole-bowl irrigation and repeated doses of charcoal after ingestion of drug-filled packets (body stuffers). /Amphetamines/

OLSON, K.R. (Ed). Poisoning and Drug Overdose, Sixth Edition. McGraw-Hill, New York, NY 2012, p. 79

from HSDB

Enhanced elimination. Dialysis and hemoperfusion are not effective. repeat-dose charcoal has not been studied. Renal elimination of dextroamphetamine may be enhanced by acidification of the urine, but this is not recommended because of the risk for aggravating the nephrotoxicity of myoglobinuria. /Amphetamines/

OLSON, K.R. (Ed). Poisoning and Drug Overdose, Sixth Edition. McGraw-Hill, New York, NY 2012, p. 79

from HSDB

/SRP:/ Immediate first aid: Ensure that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a demand valve resuscitator, bag-valve-mask device, or pocket mask, as trained. Perform CPR if necessary. Immediately flush contaminated eyes with gently flowing water. Do not induce vomiting. If vomiting occurs, lean patient forward or place on the left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Keep patient quiet and maintain normal body temperature. Obtain medical attention. /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 160

from HSDB

/SRP:/ Basic treatment: Establish a patent airway (oropharyngeal or nasopharyngeal airway, if needed). Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if needed. Administer oxygen by nonrebreather mask at 10 to 15 L/min. Monitor for pulmonary edema and treat if necessary ... . Monitor for shock and treat if necessary ... . Anticipate seizures and treat if necessary ... . For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with 0.9% saline (NS) during transport ... . Do not use emetics. For ingestion, rinse mouth and administer 5 mL/kg up to 200 mL of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool ... . Cover skin burns with dry sterile dressings after decontamination ... . /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 160

from HSDB

/SRP:/ Advanced treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious, has severe pulmonary edema, or is in severe respiratory distress. Positive-pressure ventilation techniques with a bag valve mask device may be beneficial. Consider drug therapy for pulmonary edema ... . Consider administering a beta agonist such as albuterol for severe bronchospasm ... . Monitor cardiac rhythm and treat arrhythmias as necessary ... . Start IV administration of D5W TKO /SRP: "To keep open", minimal flow rate/. Use 0.9% saline (NS) or lactated Ringer's (LR) if signs of hypovolemia are present. For hypotension with signs of hypovolemia, administer fluid cautiously. Watch for signs of fluid overload ... . Treat seizures with diazepam or lorazepam ... . Use proparacaine hydrochloride to assist eye irrigation ... . /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 160-1

from HSDB

12.1.5 Human Toxicity Excerpts

/SIGNS AND SYMPTOMS/ Overdose of an amphetamine may be manifested initially by cardiovascular symptoms including flushing or pallor, palpitation, tachypnea, tremor, labile pulse rate and blood pressure (hypertension or hypotension), cardiac arrhythmias (e.g., extrasystoles), heart block, circulatory collapse, and chest pain.

American Society of Health-System Pharmacists 2015; Drug Information 2015. Bethesda, MD. 2015, p. 2530

from HSDB

/SIGNS AND SYMPTOMS/ Adverse effects of amphetamines may include nervousness, insomnia, irritability, talkativeness, changes in libido, dizziness, headaches, increased motor activity, chilliness, pallor or flushing, blurred vision, mydriasis, and hyperexcitability. Exacerbation of motor or phonic tics, Tourette's syndrome, dyskinesia, seizures, euphoria, dysphoria, emotional lability, and impotence have been reported in patients receiving amphetamines. Psychotic episodes have occurred rarely in patients receiving amphetamines at recommended dosages.

American Society of Health-System Pharmacists 2015; Drug Information 2015. Bethesda, MD. 2015, p. 2528

from HSDB

/SIGNS AND SYMPTOMS/ The acute toxic effects of amphetamine are usually extensions of its therapeutic actions and, as a rule, result from overdosage. The central effects commonly include restlessness, dizziness, tremor, hyperactive reflexes, talkativeness, tenseness, irritability, weakness, insomnia, fever, and sometimes euphoria. Confusion, assaultiveness, changes in libido, anxiety, delirium, paranoid hallucinations, panic states, and suicidal or homicidal tendencies occur, esp in mentally ill pt. However, these psychotic effects can be elicited in any individual if sufficient quantities of amphetamine are ingested for a prolonged period. Fatigue and depression usually follow central stimulation. Cardiovascular effects are common and include headache, chilliness, pallor or flushing, palpitation, cardiac arrhythmias, anginal pain, hypertension or hypotension, and circulatory collapse. Excessive sweating occurs. Symptoms referable to the GI system include dry mouth, metallic taste, anorexia, nausea, vomiting, diarrhea, and abdominal cramps. Fatal poisoning usually terminates in convulsions and coma, and cerebral hemorrhages are the main pathological findings.

Ellenhorn, M.J., S. Schonwald, G. Ordog, J. Wasserberger. Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning. 2nd ed. Baltimore, MD: Williams and Wilkins, 1997., p. 220

from HSDB

/SIGNS AND SYMPTOMS/ Amphetamine given orally raises both systolic & diastolic blood pressures. Heart rate is often reflexly slowed; with large doses, cardiac arrhythmias may occur. Cardiac output is not enhanced by therapeutic doses, & cerebral blood flow does not change much. The l-isomer is slightly more potent than the d-isomer in its cardiovascular actions. In general, smooth muscles respond to amphetamine as they do to other sympathomimetic amines. ... Pain & difficulty in micturition occasionally occur. The GI effects of amphetamine are unpredictable. If enteric activity is pronounced, amphetamine may cause relaxation & delay the movement of intestinal contents; if the gut is already relaxed, the opposite effect may occur. The response of the human uterus varies, but usually there is an increase in tone.

Hardman, J.G., L.E. Limbird, P.B. Molinoff, R.W. Ruddon, A.G. Goodman (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 9th ed. New York, NY: McGraw-Hill, 1996., p. 219

from HSDB

/SIGNS AND SYMPTOMS/ Because tolerance develops to the hyperthermic and cardiovascular effects of amphetamine, acute intoxication is more likely to occur in the neophyte. The syndrome includes dizziness, tremor, irritability, confusion, hallucinations, chest pain, palpitation, hypertension, sweating, and cardiac arrhythmias. There may be hyperpyrexia and convulsions. Death is usually preceded by hyperpyrexia, convulsions, and shock.

Gilman, A.G., L.S.Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 7th ed. New York: Macmillan Publishing Co., Inc., 1985., p. 554

from HSDB

/SIGNS AND SYMPTOMS/ Perivascular infiltration of amphetamines can produce local necrosis, cellulitis, granulomas, & abscess formation. Intra-arterial injection causes intense vasospasm with distal cyanosis, ecchymosis, petechiae, edema, paresthesias, pain, weakness, necrosis, & decreased capillary filling. Immediate intense vasospasm is obvious after intra-arterial injections.

Ellenhorn, M.J. and D.G. Barceloux. Medical Toxicology - Diagnosis and Treatment of Human Poisoning. New York, NY: Elsevier Science Publishing Co., Inc. 1988., p. 635

from HSDB

/SIGNS AND SYMPTOMS/ Chronic intoxication with amphetamine causes symptoms similar to those of acute overdosage, but abnormal mental conditions are more common. Weight loss may be marked. A psychotic reaction with vivid hallucinations and paranoid delusions, often mistaken for schizophrenia, is the most common serious effect. Recovery usually is rapid after withdrawal of the drug, but occasionally the condition becomes chronic. In these persons, amphetamine may act as a precipitating factor hastening the onset of an incipient schizophrenia.

Hardman, J.G., L.E. Limbird, P.B. Molinoff, R.W. Ruddon, A.G. Goodman (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 9th ed. New York, NY: McGraw-Hill, 1996., p. 220

from HSDB

/SIGNS AND SYMPTOMS/ Chronic use of high doses of amphetamines has been reported to produce microvascular damage, neuronal chromatolysis (primarily in brain areas rich in adrenergic neurons), and profound and long lasting (or permanent) depletion of dopamine in the caudate nucleus.

Gilman, A.G., L.S.Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 7th ed. New York: Macmillan Publishing Co., Inc., 1985., p. 554

from HSDB

/SIGNS AND SYMPTOMS/ The psychic effects depend on the dose & the mental state & personality of the individual. The main results of an oral dose of 10-30 mg include wakefulness, alertness, & a decreased sense of fatigue; elevation of mood with increased initiative, self-confidence, & ability to concentrate; often, elation & euphoria; and increase in motor & speech activities. Performance of simple mental tasks is improved, but, although more work may be accomplished, the number of errors may increase. Physical performance - in athletes, for example - is improved, & the drug is often abused for this purpose. These effects are not invariable, & may be reversed by overdosage or repeated usage. Prolonged use or large doses are nearly always followed by depression & fatigue. Many individuals given amphetamine experience headache, palpitation, dizziness, vasomotor disturbances, agitation, confusion, dysphoria, apprehension, delirium, or fatigue.

Hardman, J.G., L.E. Limbird, P.B. Molinoff, R.W. Ruddon, A.G. Goodman (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 9th ed. New York, NY: McGraw-Hill, 1996., p. 219

from HSDB

/SIGNS AND SYMPTOMS/ The fully developed toxic syndrome from amphetamine is characterized by vivid visual, auditory, and sometimes tactile hallucinations; picking and excoriation of the skin and delusions of parasitosis are not uncommon. There is also paranoid ideation, loosening of assoc, and changes in affect occurring in assoc with clear sensorium. In chronic users, there may be a striking paucity of sympathomimetic effects, and the blood pressure is not unduly elevated. It is often extremely difficult to differentiate this syndrome from a schizophrenic reaction. The syndrome may be seen as early as 36 to 48 hr after the ingestion of a single large dose of amphetamine; in apparently sensitive individuals, psychosis may be produced by 55 to 75 mg of dextroamphetamine. With high enough doses, psychosis can probably be induced in anyone. Unless the individual continues to use the drug, the psychosis usually clears within a week, the hallucinations being the first symptoms to disappear.

Gilman, A.G., L.S.Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 7th ed. New York: Macmillan Publishing Co., Inc., 1985., p. 553

from HSDB

/SIGNS AND SYMPTOMS/ Amphetamine ... in large doses systemically can dilate the pupils and cause slight blurring of near vision. Applied to the eye, amphetamine dilates the pupil and retracts the upper lid, but these actions are prevented by previous depletion of catecholamines such as is brought about by local guanethidine.

Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 96

from HSDB

/SIGNS AND SYMPTOMS/ Renal failure assoc with amphetamine use is usually the result of rhabdomyolysis, but it has also been found in patients without evidence of muscle damage or other apparent predisposing factors.

Knoben, J.E. and P.O. Anderson (eds.) Handbook of Clinical Drug Data. 6th ed. Bethesda, MD: Drug Intelligence Publications, Inc. 1988., p. 90

from HSDB

/SIGNS AND SYMPTOMS/ Abrupt discontinuation of amphetamines produces neither seizures nor life threatening symptoms, even in those patients who habitually consume large quantities. The abstinence syndrome assoc with chronic use of amphetamine ... is characterized by apathy, depression, lethargy, anxiety, & sleep disturbances. Myalgias, abdominal pain, voracious appetite, & a profound depression with suicidal tendencies may complicate the immediate postwithdrawal period & peak in 2-3 days. Symptoms persisting 6-7 days indicate an underlying disease process.

Ellenhorn, M.J. and D.G. Barceloux. Medical Toxicology - Diagnosis and Treatment of Human Poisoning. New York, NY: Elsevier Science Publishing Co., Inc. 1988., p. 636

from HSDB

/SIGNS AND SYMPTOMS/ During the early phases of iv use, 3 to 4 doses of 20 to 40 mg of amphetamine are usually considered sufficient /by abusers to produce euphoric effects/. In addition to the marked euphoria, the user experiences a sense of markedly enhanced physical strength & mental capacity, & feels little need for either sleep or food. Difficult to substantiate by objective means is the claim made by many users that orgasm in both male & female is delayed, permitting extended periods of sexual activity finally culminating in orgasms reported to be more intense & pleasurable. The sensation of "flash" or "rush" that immediately follows iv admin, while qualitatively distinct from the opioid "rush", is nevertheless described as being intensely pleasurable & somewhat akin to sexual orgasm.

Gilman, A.G., L.S.Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 7th ed. New York: Macmillan Publishing Co., Inc., 1985., p. 551

from HSDB

/SIGNS AND SYMPTOMS/ Anorexia is a common finding /in chronic toxicity from abuse/. Occasionally it may be so pronounced that the amphetamine abuser experiences considerable difficulty in swallowing. Chronic abusers are reported to force themselves to eat small amt of highly nutritious food & take vitamin supplements to compensate for decr in appetite. ... Constant grinding of teeth is also a common finding ...

Casarett, L.J., and J. Doull. Toxicology: The Basic Science of Poisons. New York: MacMillan Publishing Co., 1975., p. 630

from HSDB

/SIGNS AND SYMPTOMS/ Bleeding within the cranial vault is a rare but well-reported complication of amphetamine use. About 20 cases, which are about evenly divided between iv & oral exposures, have been reported in the American literature. Ages range from 16-60, & most patients are habitual & often multidrug abusers. However, intracranial hemorrhages have been reported after the ingestion of as few as 2-4 tablets of amphetamine or structurally related anorectic drugs ...

Ellenhorn, M.J. and D.G. Barceloux. Medical Toxicology - Diagnosis and Treatment of Human Poisoning. New York, NY: Elsevier Science Publishing Co., Inc. 1988., p. 634

from HSDB

/SIGNS AND SYMPTOMS/ The etiology of intracerebral & subarachnoid hemorrhages associated with amphetamine use appears multifactorial. Inflammation & necrosis of small cerebral arteries (ie, vasculitis) secondary to particulate foreign bodies or bacterial endocarditis can develop after iv drug use. Subsequently, the hypertension seen in amphetamine use may lead to vessel rupture & hemorrhage. However, vasculitis has occurred in the setting of oral acute dextroamphetamine overdose, amphetamine withdrawal, & therapeutic use as an anorectic drug. The presence of vasculitis after exposure by different routes suggests an immunopathological abnormality. Direct toxic damage to vessels seems unlikely because of the dilution that occurs before the drug reaches the cerebral circulation.

Ellenhorn, M.J. and D.G. Barceloux. Medical Toxicology - Diagnosis and Treatment of Human Poisoning. New York, NY: Elsevier Science Publishing Co., Inc. 1988., p. 633

from HSDB

/SIGNS AND SYMPTOMS/ Repetitive behavior may occur /from the use of amphetamines/ (e.g. repeatedly cleans dishes or continually grooms hair). Amphetamines also will extenuate hostile, aggressive, and antisocial behavior. Progression to paranoia, panic states, violence, and even suicide may occur.

Young, L.Y., M.A. Koda-Kimble (eds.). Applied Therapeutics. The Clinical Use of Drugs. 6th ed. Vancouver, WA., Applied Therapeutics, Inc. 1995., p. 84-3

from HSDB

/SIGNS AND SYMPTOMS/ Amphetamines used in large doses over a long period of time may lead to substantial weight loss, liver disease, hypertensive disorders, kidney damage, stroke, heart attack, nonhealing ulcers, and sores in the skin.

Young, L.Y., M.A. Koda-Kimble (eds.). Applied Therapeutics. The Clinical Use of Drugs. 6th ed. Vancouver, WA., Applied Therapeutics, Inc. 1995., p. 84-3

from HSDB

/SIGNS AND SYMPTOMS/ The use of amphetamine for medical indications does not pose a significant risk to the fetus for congenital anomalies. Amphetamines generally do not appear to be human teratogens. Mild withdrawal symptoms may be observed in the newborn, but the few studies of infant follow-up have not shown long-term sequelae. Illicit maternal use or abuse of amphetamine presents a significant risk to the fetus and newborn, including intrauterine growth retardation, premature delivery and the potential for increased maternal, fetal and neonatal morbidity. However, cerebral injuries occurring in newborns exposed in utero appear to be directly related to the vasoconstrictive properties of amphetamines. 65 children whose mothers were addicted to amphetamine during pregnancy, at least during the first trimester, were studied. Intelligence, psychological function, growth, and physical health were all within the normal range at eight years, but those children exposed throughout pregnancy tended to be more aggressive.

International Programme on Chemical Safety; Poisons Information Monograph: Amphetamine (PIM 934) (1998) Available from, as of May 16, 2008: http://www.inchem.org/pages/pims.html

from HSDB

/CASE REPORTS/ In an acute poisoning in a child ... external stimuli precipitated increased hyperactivity.

Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984., p. III-27

from HSDB

/CASE REPORTS/ Although comparable clinical data are lacking, hyperpyrexia has been noted as a frequent & prominent sign in acute human intoxication. During a grueling bicycle race a cyclist collapsed with symptoms closely resembling heat exhaustion, &, despite vigorous treatment, he died /after/ cardiovascular collapse; it was learned subsequently that he had consumed 105 mg of amphetamine during the race.

Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984., p. III-27

from HSDB

/EPIDEMIOLOGY STUDIES/ Data on the effect of prenatal amphetamines, both prescribed and abused, are conflicting; however no consistent pattern of abnormalities has emerged. A large prospective evaluation of amphetamines prescribed during pregnancy found no incr in severe congenital malformations, but did report three cases of oral clefts. Another prospective study evaluating infants of amphetamine addicted women failed to demonstrate an incr in birth defects, but did note an incr in premature births, respiratory distress and jitteriness. The use of other drugs and alcohol may have confounded these findings.

Knoben, J.E. and P.O. Anderson (eds.) Handbook of Clinical Drug Data. 6th ed. Bethesda, MD: Drug Intelligence Publications, Inc. 1988., p. 203

from HSDB

/EPIDEMIOLOGY STUDIES/ Epidemiological studies of the association between drug use and involvement in road traffic crashes (RTCs) published from January 1998 to February 2015 have been reviewed. Cohort andpopulation studies compared RTC involvement among drug users and non-drug users, case-control studies compared drug use among RTC-involved and non-RTC-involved drivers, and responsibility studies and case-crossover studies were performed for RTC-involved drivers. Difficulties associated with the types of studies are discussed with a special focus on case-control studies. Statistically significant associations between drug use and RTC involvement were found for benzodiazepines and z-hypnotics in 25 out of 28 studies, for cannabis in 23 out of 36 studies, for opioids in 17 out of 25 studies, for amphetamines in 8 out of 10 studies, for cocaine in 5 out of 9 studies, and for antidepressants in 9 out of 13 studies. It was a general trend among studies that did not report significant associations between the use of these drugs and increased RTC risk that they often had either poor statistical power or poor study design compared to studies that found an association. Simultaneous use of two or more psychoactive drugs was associated with higher RTC risk. Studies on the combination of alcohol and drugs have not been reviewed in this article even though this combination is known to be associated with the highest RTC risk.
Abstract: PubMed

Gjerde H et al; Forensic Sci Rev 27 (2): 89-113 (2015)

from HSDB

/SURVEILLANCE/ Fatal poisonings among drug addicts in Denmark in 2012 were examined. Cause of death, abuse pattern and geographic differences are discussed and data are compared with previous studies. METHODS: All fatal poisonings examined at the three institutes of forensic medicine in Denmark in 2012 were included in the study. RESULTS: A total of 188 fatal intoxications were recorded. The median age increased from 37.5 in 2007 to 41.5 in 2012. The majority were men (77%). Methadone (59%) was the main intoxicant. The decrease in the frequency of heroin/morphine deaths since 1997 (71%) continued, declining to 44% in 2002, 33% in 2007 and finally to 27% in 2012. Few deaths from central stimulants (amphetamine and cocaine) occurred. Multiple drug use was common and consisted mainly of opioids, cocaine, amphetamine, cannabis, benzodiazepines and alcohol. Heroin/morphine use was most frequent on Funen and in South Jutland. Cocaine was most frequently detected in East Denmark, while amphetamine was more frequent in West Denmark. CONCLUSIONS: The number of fatal poisonings among drug addicts has stabilized around 200. The increase in methadone deaths continued and, as in 2007, methadone was the main intoxicant. The increase in methadone deaths seems to be associated with use of methadone in substitution treatment. Nevertheless, methadone treatment also seems to save lives, as indicated by the increasing median age. Use of antidepressants and antipsychotics increased to a high level compared with 2007, indicating that a considerable number of drug addicts also have psychiatric illness.

Simonsen KW et al; Dan Med J 62 (10) pii: A5147 (2015)

from HSDB

/OTHER TOXICITY INFORMATION/ The toxic dose of amphetamine varies widely. ... Severe reactions have occurred with 30 mg, yet doses of 400 to 500 mg are not uniformly fatal. Larger doses can be tolerated after chronic use of the drug.

Hardman, J.G., L.E. Limbird, P.B. Molinoff, R.W. Ruddon, A.G. Goodman (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 9th ed. New York, NY: McGraw-Hill, 1996., p. 220

from HSDB

/OTHER TOXICITY INFORMATION/ Many of those who use amphetamine ... are best described as "recreational" or occasional users, but some become dependent. A small percentage of the latter (eg, those taking the drugs for control of obesity) seem able to restrict drug intake & function productively (stabilized addicts). Others show progressive social & occupational deterioration, punctuated by periods of hospitalization for toxic psychosis. In terms of the compulsion to continue use, the degree to which a drug pervades the life of the user, & the tendency to relapse following withdrawal, some compulsive users of amphetamine ... are addicts. The risk of developing patterns of compulsive use is not limited to those who use drugs intravenously ... It is not clear whether the dependence syndromes caused by amphetamine ... are as persistent as that produced by opioids. In the US the waves of amphetamine use did not leave large numbers of chronic users in their wake. However, many iv users eventually became heroin users.

Gilman, A.G., L.S.Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 7th ed. New York: Macmillan Publishing Co., Inc., 1985., p. 552

from HSDB

/OTHER TOXICITY INFORMATION/ The history, chemistry, pharmacology, medical use, illicit use & addiction & tolerance potential of amphetamines are presented. Although there are few published accounts of death known to result directly from amphetamines, deaths may result indirectly from effects such as violent behavior & hepatitis.
Abstract: PubMed

HART JB, WALLACE J; CLIN TOXICOL 8 (2): 179-90 (1975)

from HSDB

/OTHER TOXICITY INFORMATION/ Few deaths have ... been attributed to amphetamine overdose. Amphetamines have a relatively low ratio of effective dose to fatal dose. Fatalities resulting from amphetamine use are usually the result of one of the following processes: 1) combinations with other drugs; 2) complications of iv injections, such as septicemia, bacterial endocarditis, or homicide, during withdrawal depression.

Casarett, L.J., and J. Doull. Toxicology: The Basic Science of Poisons. New York: MacMillan Publishing Co., 1975., p. 629

from HSDB

/OTHER TOXICITY INFORMATION/ In postmortem cases where the cause of death is hanging, toxicological analyses may be considered unnecessary by some medical examiners, toxicologists, and other persons involved in medico-legal investigations because the cause of death seems "obvious." To ascertain if toxicological analyses are necessary when the cause of death is hanging, all 102 hanging cases (25 females; 77 males) from 2011 to 2013 that came under the jurisdiction of the San Francisco Office of the Chief Medical Examiner were examined from a total of 3912 sudden, unexpected, or violent death cases in the same period. Suicide was the manner of death in 99 of these cases, with two accidental and one undetermined death. The average age of decedents was 43.9 years (median 41), the youngest was an 11-year old male and the oldest was an 86-year old female. Of the 102 cases, 33 had negative toxicology while 69 cases had at least one positive toxicology result. Females were equally likely to have negative or positive results (12 and 13 cases respectively), but males were 37.5% more likely to have positive toxicology (n=56) rather than negative toxicology (n=21). For females, alcohol, mirtazapine, venlafaxine, and trazodone were the top psychoactive substances in peripheral blood while THC, cocaine, hydrocodone, bupropion, olanzapine, doxylamine, quetiapine and dextromethorphan were also reported. For males, alcohol, THC, cocaine, amphetamine, methamphetamine, bupropion, and diphenhydramine were the top psychoactive substances in blood, but several other drugs were also found in individual cases. Our study of hanging cases over a 3-year period support the idea that complete postmortem toxicology investigation of hangings should be performed, even when the "obvious" cause of death is asphyxia due to hanging. Many of these cases involved psychoactive substances (most often alcohol and cannabis), and having such knowledge provides a better understanding of the circumstances surrounding the decedent's death, their possible state of impairment, including the possibility of a staged suicide if the decedent was too impaired to perform a self-hanging.
Abstract: PubMed

San Nicolas AC, Lemos NP; Forensic Sci Int 255: 146-55 (2015)

from HSDB

/OTHER TOXICITY INFORMATION/ In Oslo, the majority of patients with acute poisoning are treated in primary care, at an emergency outpatient clinic with limited diagnostic and treatment resources. We describe the poisonings currently seen in this setting. We compare our findings with previous studies, with special concern for the appearance of new toxic agents, and changes in overall numbers and patterns of poisoning. Observational study. Patients above the age of 12 years presenting at Oslo Accident and Emergency Outpatient Clinic (Oslo Legevakt) with acute poisoning were included consecutively from October 2011 through September 2012. Physicians and nurses registered data on preset forms. Main outcome measures were toxic agents, age, sex, intention, referral and time of presentation. RESULTS: There were 2923 episodes of acute poisoning in 2261 patients. Median age of the patients was 32 years, and 1430 (63%) were males. The most frequent toxic agents were ethanol in 1684 (58%) episodes, heroin in 542 (19 %), benzodiazepines in 521 (18%), amphetamine in 275 (9%), fire smoke in 192 (7%), gamma-hydroxybutyrate (GHB) in 144 (5%), and cannabis in 143 (5%). In 904 (31%) poisonings there were more than one toxic agent. In 493 episodes (17%), the patient was hospitalised, and in 60 episodes (2%) admitted to a psychiatric ward. Most poisonings, 2328 (80%), were accidental overdoses with substances of abuse, 276 (9%) were suicide attempts, and 312 (11%) were accidents. ... The poisonings treated in this primary care setting were mostly due to accidental overdoses with ethanol or other substances of abuse. ...[Vallersnes OM et al; BMC Emerg Med 15: 18 (2015)] Full text: PMC4535826
Abstract: PubMed

from HSDB

/OTHER TOXICITY INFORMATION/ The abuse of amphetamines by combining the oral and inhalation routes of administration usually leads to a more intense effect and/or more toxic effect than if either was taken alone. /Amphetamines/

Young, L.Y., M.A. Koda-Kimble (eds.). Applied Therapeutics. The Clinical Use of Drugs. 6th ed. Vancouver, WA., Applied Therapeutics, Inc. 1995., p. 84-4

from HSDB

/OTHER TOXICITY INFORMATION/ Doses as little as 2 mg, but more likely between 15 and 30 mg, may induce toxic effects. However, even doses of 400-500 mg are not uniformly fatal.

Young, L.Y., M.A. Koda-Kimble (eds.). Applied Therapeutics. The Clinical Use of Drugs. 6th ed. Vancouver, WA., Applied Therapeutics, Inc. 1995., p. 84-5

from HSDB

/OTHER TOXICITY INFORMATION/ Illicit maternal use /of amphetamines is/ associated with intrauterine growth retardation, premature birth, and increased fetal and newborn morbidity. /From table/

Young, L.Y., M.A. Koda-Kimble (eds.). Applied Therapeutics. The Clinical Use of Drugs. 6th ed. Vancouver, WA., Applied Therapeutics, Inc. 1995., p. 45-7

from HSDB

/OTHER TOXICITY INFORMATION/ Intrauterine ... amphetamine exposure may cause neonates to exhibit abnormal sleep patterns, tremors, poor feeding, hypotonia, fever, and vomiting.

Young, L.Y., M.A. Koda-Kimble (eds.). Applied Therapeutics. The Clinical Use of Drugs. 6th ed. Vancouver, WA., Applied Therapeutics, Inc. 1995., p. 81-9

from HSDB

/OTHER TOXICITY INFORMATION/ Amphetamine, and to a lesser extent the secondary amine methamphetamine, are major recreational drugs of abuse in Sweden. These central stimulant amines are identified in blood from roughly 50% of people arrested for driving under the influence of drugs (DUID). However, much less information is available about the presence of amphetamine in blood of drivers killed in road-traffic crashes. This retrospective 10-year study (2001-2010) used a forensic toxicology database (TOXBASE) to retrieve information about road-traffic crashes when the driver had amphetamine and/or methamphetamine in autopsy blood. Forensic toxicology results were available from over 95% of all drivers killed on Swedish roads during this 10-year period. Amphetamine was present in the blood of 106 drivers (3.9%) either alone or together with other psychoactive substances (e.g. alcohol, cannabis, diazepam, alprazolam, etc.). The vast majority of fatalities were male (95%) with a mean age (+/-standard deviation) of 37+/-11.4 years (range 16-67 years). The mean (median) and highest concentrations of amphetamine in femoral blood were 1.36 mg/L (1.0mg/L) and 6.74 mg/L, respectively. Many of the victims (75%) had been arrested previously for use of illicit drugs or DUID. The median number of previous arrests was 4 (range 0-83) and amphetamine or methamphetamine were among the drugs identified in blood samples from 89% of cases (0-100%). The high prevalence of repeat DUID offending and/or use of illicit drugs among the drivers killed in road-traffic crashes suggests that an early intervention and treatment for stimulant abuse might have been more beneficial than conventional punishments for such drug-related crimes
Abstract: PubMed

Jones AW et al; Int J Drug Policy 26 (8): 790-3 (2015)

from HSDB

/OTHER TOXICITY INFORMATION/ The American Psychiatric Association estimates that 3-7% of US school-aged children exhibit attention-deficit/hyperactivity disorder (ADHD). Adderall (amphetamine dextroamphetamine) and a variety of brand names and generic versions of this combination are available by prescription to treat ADHD and narcolepsy. Both immediate and sustained release products are used as are single agent amphetamine medication. Knowing the exact agent ingested can provide information of dose labeled and length of clinical effects. These drugs are used off label by college students for memory enhancement, test taking ability, and for study marathons. These agents are DEA Schedule II controlled substances with high potential for abuse. For humans with ADHD or narcolepsy, standard recommended dosage is 5-60 mg daily. Amphetamine and its analogues stimulate the release of norepinephrine affecting both a- and beta-adrenergic receptor sites. a-Adrenergic stimulation causes vasoconstriction and an increase in total peripheral resistance. beta-Adrenergic receptor stimulation leads to an increase in heart rate, stroke volume, and skeletal muscle blood flow. Clinical signs of Adderall overdose in humans and dogs include hyperactivity, hyperthermia, tachycardia, tachypnea, mydriasis, tremors, and seizures. ... /Adderall/
Abstract: PubMed

Fitzgerald KT, Bronstein AC; Top Companion Anim Med 28 (1): 2-7 (2013)

from HSDB

/OTHER TOXICITY INFORMATION/ Amphetamines have a high potential for abuse. Administration of amphetamines for prolonged periods of time may lead to drug dependence and must be avoided. Particular attention should be paid to the possibility of subjects obtaining amphetamines for non-theraputic use or distribution to others, and the drugs should be prescribed or dispensed sparingly. Misuse of amphetamine may cause sudden death and serious cardiovascular adverse events.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

/OTHER TOXICITY INFORMATION/ Sudden death has been reported in association with CNS stimulant treatment at usual doses in children and adolescents with structural cardiac abnormalities or other serious heart problems. Although some serious heart problems alone carry an increased risk of sudden death, stimulant products generally should not be used in children or adolescents with known serious structural cardiac abnormalities, cardiomyopathy, serious heart rhythm abnormalities, or other serious cardiac problems that may place them at increased vulnerability to the sympathomimetic effects of a stimulant drug.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

/OTHER TOXICITY INFORMATION/ Sudden deaths, stroke, and myocardial infarction have been reported in adults taking stimulant drugs at usual doses for ADHD. Although the role of stimulants in these adult cases is also unknown, adults have a greater likelihood than children of having serious structural cardiac abnormalities, cardiomyopathy, serious heart rhythm abnormalities, coronary artery disease, or other serious cardiac problems. Adults with such abnormalities should also generally not be treated with stimulant drugs.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

12.1.6 Non-Human Toxicity Excerpts

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ Testing for toxicity to the retina has been negative; 10 mg/kg given daily to dogs for three months caused occasional slight ophthalmoscopic appearance of blanching of the fundus, but no histologic change in the retina.

Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 96

from HSDB

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ In rats, continuous admin of amphetamine for 10 days can cause a significant decr in the activity of tyrosine hydroxylase in the nigrostriatum that lasts for more than 3 mo. After chronic use, animals ... begin to exhibit behaviors not seen after initial doses; these incl exaggerated "startle" reactions, dyskinesias, and postural abnormalities.

Gilman, A.G., L.S.Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 7th ed. New York: Macmillan Publishing Co., Inc., 1985., p. 554

from HSDB

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ Linear sweep voltammetry with carbon paste electrodes was used to monitor extracellular ascorbic acid in the caudate nucleus and nucleus accumbens of behaving male Sprague Dawley rats. Amphetamine (2 or 5 mg/kg) was administered 4, 6 and 8 days after surgery. In general the amphetamine-induced incr in ascorbic acid was greater in the caudate /nucleus/ than in the nucleus accumbens. In the nucleus accumbens the amphetamine-induced incr in ascorbic acid was very similar on all test days, but in the caudate /nucleus/ the incr in ascorbic acid produced by 5 mg/kg amphetamine was progressively larger on each test day.
Abstract: PubMed

Mueller K; Brain Res 494 (1): 30-5 (1989)

from HSDB

/BEHAVIORAL STUDIES/ Chronic amphetamine use results in compulsive behavior patterns of searching & examining. In lower animals this stereotyped behavior consists primarily of sniffing, but biting & looking movements are also frequent. In primates, hand eye examination patterns, in addn to the above, are characteristic of amphetamine

induced stereotyped behavior.

Casarett, L.J., and J. Doull. Toxicology: The Basic Science of Poisons. New York: MacMillan Publishing Co., 1975., p. 630

from HSDB

/BEHAVIORAL STUDIES/ Animals self administering ... amphetamine often show a cyclic pattern of use, with periods of spontaneous abstinence interposed between periods of use. A small priming dose during abstinence will reinitiate self admin. With round the clock access to the /drug/ ... there is weight loss, self mutilation, and death within about 2 weeks.

Gilman, A.G., L.S.Goodman, and A. Gilman. (eds.). Goodman and Gilman's The Pharmacological Basis of Therapeutics. 7th ed. New York: Macmillan Publishing Co., Inc., 1985., p. 552

from HSDB

/BEHAVIORAL STUDIES/ Drug Discrimination: Rats learned to discriminate between injection of d,l-amphetamine and saline, and in addition, generalization was obtained with methylphenidate but not with atropine.

Harris LS, Balster RL; p.111-32 in Stimulus Properties of Drugs; Thompson T, Pickens R, eds (1971) as cited in DHHS/NIDA; Research Monograph Series 52: Testing Drugs for Physical Dependence Potential and Abuse Liability p.67 (1984) DHHS Pub No. (ADM)87-1332

from HSDB

/BEHAVIORAL STUDIES/ Drug Discrimination: Animals trained to respond to sedative/hypnotics responded to amphetamine as if it were saline (ie, no cross generalization between drug classes was observed).

Overton DA, Lebman RI; Proc Amer Psychol Assoc (1973) as cited in DHHS/NIDA; Research Monograph Series 52: Testing Drugs for Physical Dependence Potential and Abuse Liability p.67 (1984) DHHS Pub No. (ADM)87-1332

from HSDB

/ALTERNATIVE and IN VITRO TESTS/ Previous research has shown that nitric oxide (NO) synthase inhibitors prevent rodents' sensorimotor gating impairments induced by dopamine releasing drugs, such as amphetamine (Amph) and methylphenidate. The mechanisms of this effect have not been entirely understood. In the present work, we investigated some possible mechanisms by which the NO donor, NOC-12 (3-ethyl-3-(ethylaminoethyl)-1-hydroxy-2-oxo-1-triazene), influence spontaneous and Amph-induced dopamine release, using rat mesencephalic primary cultured neurons preparations. Our results showed that NOC-12 increased dopamine release in a concentration-dependent manner and potentiated the Amph-induced one. Dopamine release induced by NOC-12 was disrupted by N-acetyl-L-cysteine (NAC-a free radical scavenger) and MK-801, a NMDA (N-methyl-D-aspartate) non-competitive antagonist, and was concentration dependently affected by oxadiazolo[4,3]quinoxalin-1-one, an inhibitor of the soluble guanylate cyclase (sGC). In contrast, dopamine released by Amph was facilitated by NAC and by MK-801 and not affected by nifedipine (a L-type-Ca+2 channel blocker), which enhanced NOC-12-induced dopamine release. The present work demonstrates that DA release induced by NOC-12 is partially dependent on sGC and on NMDA activation, and is modulated by L-type Ca+2 channel and the antioxidant NAC. This mechanism differs from the Amph-induced one, which appears not to depend on L-type Ca+2 channel and seems to be facilitated by NMDA channel blocking and by NAC. These results suggest that Amph and NOC-12 induce dopamine release through complementary pathways, which may explain the potentiation of Amph-induced dopamine release by NOC-12. These findings contribute to understand the involvement of NO in dopamine-related neuropsychiatric and neurodegenerative diseases.[Salum C et al; Neurotox Res. 2015 Sep 21.
Abstract: PubMed

Epub ahead of print]

from HSDB

/VETERINARY CASE REPORTS/ Ephedrine & other sympathomimetic drugs such as amphetamine & methylamphetamine, if given in excessive amt, produce signs of sympathetic stimulation, manifested by anxiety & restlessness. If the dosage involved is larger, muscular tremors & even convulsion may occur.

Humphreys, D.J. Veterinary Toxicology. 3rd ed. London, England: Bailliere Tindell, 1988., p. 87

from HSDB

/VETERINARY CASE REPORTS/ The American Psychiatric Association estimates that 3-7% of US school-aged children exhibit attention-deficit/hyperactivity disorder (ADHD). Adderall (amphetamine dextroamphetamine) and a variety of brand names and generic versions of this combination are available by prescription to treat ADHD and narcolepsy. Both immediate and sustained release products are used as are single agent amphetamine medication. Knowing the exact agent ingested can provide information of dose labeled and length of clinical effects. These drugs are used off label by college students for memory enhancement, test taking ability, and for study marathons. These agents are DEA Schedule II controlled substances with high potential for abuse. For humans with ADHD or narcolepsy, standard recommended dosage is 5-60 mg daily. Amphetamine and its analogues stimulate the release of norepinephrine affecting both a- and beta-adrenergic receptor sites. a-Adrenergic stimulation causes vasoconstriction and an increase in total peripheral resistance. beta-Adrenergic receptor stimulation leads to an increase in heart rate, stroke volume, and skeletal muscle blood flow. Clinical signs of Adderall overdose in humans and dogs include hyperactivity, hyperthermia, tachycardia, tachypnea, mydriasis, tremors, and seizures. In addition, Adderall intoxication in dogs has been reported to cause hyperthermia, hypoglycemia, hypersegmentation of neutrophils, and mild thrombocytopenia. Diagnosis can be confirmed by detecting amphetamine in stomach contents or vomitus, or by positive results obtained in urine tests for illicit drugs. Treatment is directed at controlling life-threatening central nervous system and cardiovascular signs. Seizures can be controlled with benzodiazepines, phenothiazines, pentobarbital, and propofol. Cardiac tachyarrhythmias can be managed with a beta-blocker such as propranolol. Intravenous fluids counter the hyperthermia, assist in maintenance of renal function, and help promote the elimination of amphetamine and its analogues. Prognosis after poisoning with Adderall depends upon the severity and duration of clinical signs at presentation. Differential diagnoses that should be considered in cases of suspected amphetamine overdose are any other agents that can cause central nervous system stimulation, tremors, and seizures. This article discusses our present understanding of Adderall intoxication and examines 3 dogs presented to our practice after ingestion of large amounts of the drug. /Adderall/
Abstract: PubMed

Fitzgerald KT, Bronstein AC; Top Companion Anim Med 28 (1): 2-7 (2013)

from HSDB

/OTHER TOXICITY INFORMATION/ The acute toxicity of amphetamine is strongly influenced by certain environmental factors. For example, crowding or aggregation markedly increases the toxicity in mice. ... Elevated environmental temperatures are associated with incr acute toxicity in animals. Hyperpyrexia, perhaps secondary to a hypermetabolic state produced by release of endogenous catecholamines, is a prominent feature of amphetamine poisoning in many species. ... Dehydration has been found to incr amphetamine toxicity in animals, as does forced exercise, various stresses incl cold & high altitude.

Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984., p. III-27

from HSDB

/OTHER TOXICITY INFORMATION/ Experimental regeneration of the lens in amphibian eyes is found to be delayed when the animals are placed in a solution containing amphetamine.

Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 96

from HSDB

/OTHER TOXICITY INFORMATION/ Amphetamine given intramuscularly has been claimed to cause elevation of pressure in eyes with primary glaucoma and not in normal eyes, but this claim needs further investigation with careful attention to gonioscopy and comparative observations with amphetamine. In monkeys no elevation of ocular pressure

has been found when amphetamine is given systemically unless given in doses so large that a rapid rise of blood pressure is induced, which is reflected in a brief small elevation of ocular pressure.

Grant, W.M. Toxicology of the Eye. 3rd ed. Springfield, IL: Charles C. Thomas Publisher, 1986., p. 96

from HSDB

/OTHER TOXICITY INFORMATION/ Amphetamine ... damages cerebral arteries in experimental animal models.

Klaassen, C.D., M.O. Amdur, Doull J. (eds.). Casarett and Doull's Toxicology. The Basic Science of Poisons. 5th ed. New York, NY: McGraw-Hill, 1995., p. 519

from HSDB

12.1.7 Human Toxicity Values

Therapeutic or normal amphetamine blood concentration: 2-3 ug/dL; Toxic amphetamine blood concentration: 50 ug/dL; Lethal amphetamine blood concentration: 200 ug/dL /From table/

Gossel, T.A., J.D. Bricker. Principles of Clinical Toxicology. 3rd ed. New York, NY: Raven Press, Ltd., 1994., p. 420

from HSDB

12.1.8 Non-Human Toxicity Values

LD50 Rat ip 125 mg/kg

Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 245

from HSDB

LD50 Rat sc 39 mg/kg

Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 245

from HSDB

LD50 Mouse oral 22 mg/kg

Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 245

from HSDB

LD50 Mouse ip 16 mg/kg

Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 245

from HSDB

LD50 Mouse sc 2800 ug/kg

Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 245

from HSDB

LD50 Mouse iv 18 mg/kg

Lewis, R.J. Sr. (ed) Sax's Dangerous Properties of Industrial Materials. 11th Edition. Wiley-Interscience, Wiley & Sons, Inc. Hoboken, NJ. 2004., p. 245

from HSDB

12.1.9 National Toxicology Program Reports

Toxicology and carcinogenesis studies were conducted by administering dl-amphetamine sulfate (USP grade) in feed to groups of F344/N rats and B6C3F1 mice of each sex for ... 2 yr. ... Diets containing 0, 20, or 10 ppm dl-amphetamine sulfate was administered to groups of 50 rats or 50 mice of each sex. ... Under the conditions of these 2 yr studies, there was no evidence of carcinogenic activity of dl-amphetamine sulfate for male or female F344/N rats or male or female B6C3F1 mice. /dl-Amphetamine sulfate/

DHHS/NTP; Toxicology & Carcinogenesis Studies of dl-Amphetamine Sulfate in F344/N Rats and B6C3F1 Mice Technical Report Series No. 387 (1991) NIH Publication No. 91-2842

from HSDB

12.1.10 Populations at Special Risk

Hepatic function impairment: Hepatic impairment has the potential to inhibit the elimination of amphetamine and result in prolonged exposures.

Drug Facts and Comparisons 2015. Clinical Drug Information, LLC St. Louis, MO 2015, p. 1302

from HSDB

Renal function impairment: Renal impairment has the potential to inhibit the elimination of amphetamine and result in prolonged exposures.

Drug Facts and Comparisons 2015. Clinical Drug Information, LLC St. Louis, MO 2015, p. 1302

from HSDB

There is some clinical evidence that stimulants may lower the convulsive threshold in patients with prior history of seizures, in patients with prior EEG abnormalities in absence of seizures, and, very rarely, in patients without a history of seizures and no prior EEG evidence of seizures. In the presence of seizures, the drug should be discontinued.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Sudden death has been reported in association with CNS stimulant treatment at usual doses in children and adolescents with structural cardiac abnormalities or other serious heart problems. Although some serious heart problems alone carry an increased risk of sudden death, stimulant products generally should not be used in children or adolescents with known serious structural cardiac abnormalities, cardiomyopathy, serious heart rhythm abnormalities, or other serious cardiac problems that may place them at increased vulnerability to the sympathomimetic effects of a stimulant drug.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

Sudden deaths, stroke, and myocardial infarction have been reported in adults taking stimulant drugs at usual doses for ADHD. Although the role of stimulants in these adult cases is also unknown, adults have a greater likelihood than children of having serious structural cardiac abnormalities, cardiomyopathy, serious heart rhythm abnormalities, coronary artery disease, or other serious cardiac problems. Adults with such abnormalities should also generally not be treated with stimulant drugs.

NIH; DailyMed. Current Medication Information for EVEKEO- amphetamine sulfate tablet (Revised: November 2015). Available from, as of November 23, 2015: http://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=bb12811f-4cce-4010-aa48-d17c46ca1d3a

from HSDB

12.1.11 Protein Binding

15-40%

from DrugBank

12.2 Ecological Information

12.2.1 Environmental Fate/Exposure Summary

Amphetamine's production and administration as a medication and illicit drug may result in its release to the environment through various waste streams. If released to air, a vapor pressure of 0.24 mm Hg at 25 deg C indicates amphetamine will exist solely as a vapor in the atmosphere. Vapor-phase amphetamine will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 3 hrs. Amphetamine does not contain chromophores that absorb at wavelengths >290 nm and, therefore, is not expected to be susceptible to direct photolysis by sunlight. If released to soil, amphetamine is expected to have low mobility based upon an estimated Koc of 760. The pKa of amphetamine is 10.1, indicating that this compound will exist almost entirely in the cation form in the environment and cations generally adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts. Volatilization from moist soil is not expected because the compound exists as a cation and cations do not volatilize. Amphetamine has a low vapor pressure and exists as a liquid under environmental conditions; therefore, amphetamine may volatilize from dry soil. A 76% degradation in 15 days using a river water/sediment bioreator suggests that biodegradation may be an important environmental fate process in soil. If released into water, amphetamine is expected to adsorb to suspended solids and sediment based upon the estimated Koc. An 85% degradation in 15 days using a river water bioreactor suggests tha biodegradation may be an important environmental fate process in water. The pKa indicates amphetamine will exist almost entirely in the cation form at pH values of 5 to 9 and, therefore, volatilization from water surfaces is not expected to be an important fate process. An estimated BCF of 7 suggests the potential for bioconcentration in aquatic organisms is low. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions (pH 5 to 9). Occupational exposure to amphetamine may occur through inhalation and dermal contact with this compound at workplaces where amphetamine is produced or used. Monitoring data indicate that the general population may be exposed to amphetamine via ingestion of contaminated water. Exposure to amphetamine among the general population will be by direct medical treatment and also occurs among those abusing this drug. (SRC)

from HSDB

12.2.2 Artificial Sources

Amphetamine's production and administration as a medication and drug of abuse(1) may result in its release to the environment through various waste streams(SRC).

(1) O'Neil MJ, ed; The Merck Index. 15th ed., Cambridge, UK: Royal Society of Chemistry, p. 99 (2013)

from HSDB

12.2.3 Environmental Fate

TERRESTRIAL FATE: Based on a classification scheme(1), an estimated Koc value of 760(SRC), determined from a structure estimation method(2), indicates that amphetamine is expected to have low mobility in soil(SRC). The pKa of amphetamine is 10.13(3), indicating that this compound will exist almost entirely in the cation form in the environment and cations generally adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts(4). Volatilization from moist soil is not expected because the compound exists as a cation and cations do not volatilize. Amphetamine has a low vapor pressure of 0.24 mm Hg(5) and exists as a liquid under environmental conditions; therefore, amphetamine may volatilize from dry soil. An 76% degradation in 15 days using a river water/sediment bioreator(6) suggests that biodegradation may be an important environmental fate process in soil(SRC).

(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Nov, 2012. Available from, as of Oct 27, 2015: http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm (3) Perrin DD; Dissociation constants of organic bases in aqueous solution. IUPAC Chem Data Ser, Buttersworth, London (1965) (4) Doucette WJ; pp. 141-188 in Handbook of Property Estimation Methods for Chemicals. Boethling RS, Mackay D, eds. Boca Raton, FL: Lewis Publ (2000) (5) Lawrence AH et al; Can J Chem 62: 1886-88 (1984) (6) Bagnall J et al; Water Res 47: 5708-18 (2013)

from HSDB

AQUATIC FATE: Based on a classification scheme(1), an estimated Koc value of 760(SRC), determined from a structure estimation method(2), indicates that amphetamine is expected to adsorb to suspended solids and sediment(SRC). A pKa of 10.24(3) indicates amphetamine will exist almost entirely in the cation form at pH values of 5 to 9 and, therefore, volatilization from water or moist soil surfaces is not expected to be an important fate process(SRC). According to a classification scheme(4), an estimated BCF of 7(SRC), from its log Kow of 1.76(5) and a regression-derived equation(2), suggests the potential for bioconcentration in aquatic organisms is low(SRC). An 85% degradation in 15 days using a river water bioreactor(6) suggests that biodegradation may be an important environmental fate process in water(SRC).

(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Nov, 2012. Available from, as of Oct 27, 2015: http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm (3) Perrin DD; Dissociation constants of organic bases in aqueous solution. IUPAC Chem Data Ser, Buttersworth, London (1965) (4) Franke C

et al; Chemosphere 29: 1501-14 (1994) (5) Hansch C et al; Exploring QSAR. Hydrophobic, Electronic, and Steric Constants. ACS Prof Ref Book. Heller SR, consult. ed., Washington, DC: Amer Chem Soc p. 61 (1995) (6) Bagnall J et al; Water Res 47: 5708-18 (2013)

▸ *from HSDB*

ATMOSPHERIC FATE: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere(1), amphetamine, which has a vapor pressure of 0.24 mm Hg at 25 deg C(2), is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase amphetamine is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals(SRC); the half-life for this reaction in air is estimated to be 3 hrs(SRC), calculated from its rate constant of 4.9X10-11 cu cm/molecule-sec at 25 deg C(SRC) that was derived using a structure estimation method(3). Amphetamine does not contain chromophores that absorb at wavelengths >290 nm(4) and, therefore, is not expected to be susceptible to direct photolysis by sunlight(SRC).

(1) Bidleman TF; Environ Sci Technol 22: 361-367 (1988) (2) Lawrence AH et al; Can J Chem 62: 1886-88 (1984) (3) Meylan WM, Howard PH; Chemosphere 26: 2293-99 (1993) (4) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 8-12 (1990)

▸ *from HSDB*

12.2.4 Biodegredation

AEROBIC: Amphetamine, present at 800 ng/L, decreased in concentration to 120 and 190 ng/L over 15 days using river microcosm bioreactors with and without sediment, respectively, maintained under dark conditions at pH 8.3, 28.5 deg C and 7.1 mg/L dissolved oxygen. River water was collected from the River Avon at Saltford (West of Bath UK), collected during September 2011. Amphetamine, present at 475 ng/L, decreased in concentration to 120 and 0 ng/L in 8 days using river microcosm bioreactors with and without sediment, respectively, maintained under light conditions at pH 8.3, 28.5 deg C and 7.1 mg/L dissolved oxygen. River water was collected from the River Avon at Saltford (West of Bath UK), collected during September 2011(1).

(1) Bagnall J et al; Water Res 47: 5708-18 (2013)

▸ *from HSDB*

12.2.5 Abiotic Degredation

The rate constant for the vapor-phase reaction of amphetamine with photochemically-produced hydroxyl radicals has been estimated as 4.9X10-11 cu cm/molecule-sec at 25 deg C(SRC) using a structure estimation method(1). This corresponds to an atmospheric half-life of about 3 hours at an atmospheric concentration of 5X10+5 hydroxyl radicals per cu cm(1). Amphetamine is not expected to undergo hydrolysis in the environment due to the lack of functional groups that hydrolyze under environmental conditions(2). Amphetamine, present at 820 ng/L, showed no decrease in concentration over 15 days using river microcosm abiotic reactors with and without sediment, respectively, maintained under light conditions at pH 9.3, 29 deg C and 9.0 mg/L dissolved oxygen. River water was from the River Avon at Saltford (West of Bath UK), collected during September 2011(3). Amphetamine does not contain chromophores that absorb at wavelengths >290 nm(2) and, therefore, is not expected to be susceptible to direct photolysis by sunlight(SRC).

(1) Meylan WM, Howard PH; Chemosphere 26: 2293-99 (1993) (2) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 7-4, 7-5, 8-12 (1990) (3) Bagnall J et al; Water Res 47: 5708-18 (2013)

▸ *from HSDB*

12.2.6 Bioconcentration

An estimated BCF of 7 was calculated in fish for amphetamine(SRC), using a log Kow of 1.76(1) and a regression-derived equation(2). According to a classification scheme(2), this BCF suggests the potential for bioconcentration in aquatic organisms is low(SRC).

(1) Hansch C et al; Exploring QSAR. Hydrophobic, Electronic, and Steric Constants. ACS Prof Ref Book. Heller SR, consult. ed., Washington, DC: Amer Chem Soc p. 61 (1995) (2) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Nov, 2012. Available from, as of Oct 27, 2015: http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm/ (3) Franke C et al; Chemosphere 29: 1501-14 (1994)

▸ *from HSDB*

12.2.7 Soil Adsorption/Mobility

Using a structure estimation method based on molecular connectivity indices(1), the Koc of amphetamine can be estimated to be 760(SRC). According to a classification scheme(2), this estimated Koc value suggests that amphetamine is expected to have low mobility in soil. The pKa of amphetamine is 10.13(3), indicating that this compound will exist almost entirely in the cation form in the environment and cations generally adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts(4).

(1) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Nov, 2012. Available from, as of Oct 27, 2015: http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm (2) Swann RL et al; Res Rev 85: 17-28 (1983) (3) Perrin DD; Dissociation constants of organic bases in aqueous solution. IUPAC Chem Data Ser, Buttersworth, London (1965) (4) Doucette WJ; pp. 141-188 in Handbook of Property Estimation Methods for Chemicals. Boethling RS, Mackay D, eds. Boca Raton, FL: Lewis Publ (2000)

▸ *from HSDB*

12.2.8 Volatilization from Water/Soil

A pKa of 10.13(1) indicates amphetamine will exist almost entirely in the cation form at pH values of 5 to 9 and, therefore, volatilization from water or moist soil surfaces is not expected to be an important fate process(SRC). Amphetamine has a low vapor pressure of 0.24 mm Hg(2) and exists as a liquid under environmental conditions; therefore, amphetamine may volatilize from dry soil(SRC).

(1) Perrin DD; Dissociation constants of organic bases in aqueous solution. IUPAC Chem Data Ser, Buttersworth, London (1965) (2) Lawrence AH et al; Can J Chem 62: 1886-88 (1984)

▸ *from HSDB*

12.2.9 Water Concentrations

DRINKING WATER: Amphetamine was present at a 2% frequency (mean concentration was below the limit of quantitation of 0.8 ng/L) with a maximum concentration of 1.7 ng/L using fifty samples of tap water from 43 cities in Spain, sampled from fall 2008 to summer 2009. A maximum concentration of 0.6 ng/L (4% frequency) was reported for 26

samples collected from Europe, Japan and Latin America(1). Amphetamine was not detected in finished drinking water from a treatment plant on the Llobregat River in northeast Spain, monitored from January 2007 to June 2007(2).

(1) Rosa Boleda M et al; Chemosphere 84: 1601-7 (2011) (2) Huerta-Fontela M et al; Environ Sci Technol 42(48): 6809-16 (2008)

from HSDB

SURFACE WATER: Amphetamine was not detected in river water samples from the Llobregat River in northeast Spain and the tributary, Cardener River and Rubi Creek sampled in January, March and May 2007. An estimated load of 4 g/day during January was calculated for the tributary Anoia River(1). Amphetamine estimated loadings of 0.08, 8, 7, 2 and 0.08 g/day were calculated for spring 2006, summer, 2006, fall 2006, winter 2006/2007 and spring 2007, respectively, in samples from the Llobregat River collected near a drinking water plant intake(12). The compound was detected at a mean concentration of 6.8 ng/L (range 1.6-12.1 ng/L; 7% of 28 samples positive) in surface water samples from the Ebro River Basin, Spain, sampled in October 2007 and July 2008(2). Amphetamine was not detected in the Jarama and Manzanares Rivers of the Madrid Region, Spain, sampled in February and March, 2012(3). Global analysis pf freshwater ecosystems reveals that amphetamine is present at a mean concentration of 10.3 ng/L with a mean detection frequency of 29.7%(4).

(1) Huerta-Fontela M et al; Environ Sci Technol 42(48): 6809-16 (2008) (2) Postigo C et al; Environ Int 36(1): 75-84 (2010) (3) Mendoza A et al; Chemosphere 95: 247-55 (2014) (4) Hughes SR et al; Environ Sci Technol 47: 661-77 (2013)

from HSDB

12.2.10 Effluents Concentrations

Amphetamine was present at an average loading rate of 114 and <10 g/day in influent and effluent, respectively, collected from a wastewater treatment plant in conjunction with a US major sporting event (National Football League's Super Bowl). Non-event loadings were 125 and <10 g/day(1). The compound was detected at a mean concentration of 148.0 ng/L (range 3.3-6640 ng/L; 93% of 14 samples positive) in influent sewage samples from the Ebro River Basin, Spain, sampled in October 2007 and July 2008. A median concentration of 25.7 ng/L (range 0.5-7.6 ng/L; 36% of 14 samples positive) was reported for effluent samples(2).

(1) Gerrity D et al: Water Res 45: 5399-11 (2011) (2) Postigo C et al; Environ Int 36(1): 75-84 (2010)

from HSDB

12.2.11 Milk Concentrations

The drug is concentrated in human milk. /From Table 2/

Report of the American Academy of Pediatrics Committee on Drugs in Pediatrics 93 (1): 138 (1994)

from HSDB

Amphetamine readily passes into and is concentrated in breast milk.

Young, L.Y., M.A. Koda-Kimble (eds.). Applied Therapeutics. The Clinical Use of Drugs. 6th ed. Vancouver, WA., Applied Therapeutics, Inc. 1995., p. 84-6

from HSDB

12.2.12 Other Environmental Concentrations

Occupational exposure to amphetamine may occur through inhalation and dermal contact with this compound at workplaces where amphetamine is produced or used. Monitoring data indicate that the general population may be exposed to amphetamine via ingestion of contaminated water. Exposure to amphetamine among the general population will be by direct medical treatment and also occurs among those abusing this drug. (SRC)

from HSDB

13 Literature

13.1 Depositor Provided PubMed Citations

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1 to 5 of 3,005 | 2 | 3 | ... | 601 | Publication Date

PMID	Publication Date	Title	Journal
28506818	2017-12-01	Measuring inhibition of monoamine reuptake transporters by new psychoactive substances (NPS) in real-time using a high-throughput, fluorescence-based assay.	Toxicology in vitro : an international journal published in association with BIBRA
26754951	2016-11-01	Misassembly of full-length Disrupted-in-Schizophrenia 1 protein is linked to altered dopamine homeostasis and behavioral deficits.	Molecular psychiatry
27373168	2016-09-01	Comparative effects of amphetamine-like psychostimulants on rat hippocampal cell genesis at different developmental ages.	Neurotoxicology
25825358	2015-05-01	Involvement of oxidative stress in the regulation of NPY/CART-mediated appetite control in amphetamine-treated rats.	Neurotoxicology
24739405	2014-04-01	Effects of dehydroepiandrosterone in amphetamine-induced schizophrenia models in mice.	Neurosciences (Riyadh, Saudi Arabia)

from PubChem

13.2 NLM Curated PubMed Citations

Download

All NLM Curated PubMed Citations

References by MeSH Subheading

administration and dosage	chemistry	poisoning
adverse effects	classification	radiation effects
agonists	economics	secretion
analogs and derivatives	history	standards
analysis	immunology	supply and distribution
antagonists and inhibitors	isolation and purification	therapeutic use
biosynthesis	metabolism	therapy
blood	pharmacokinetics	toxicity
cerebrospinal fluid	pharmacology	urine
chemical synthesis	physiology	utilization

from PubChem

13.3 Synthesis References

Synthesis Reference

Guohong Wang, "Composition and methods for synthesis of novel tracers for detecting amphetamine and methamphetamine in samples." U.S. Patent US20020090661, issued July 11, 2002.

from DrugBank

13.4 General References

General Reference

Leith NJ, Kuczenski R: Chronic amphetamine: tolerance and reverse tolerance reflect different behavioral actions of the drug. Pharmacol Biochem Behav. 1981 Sep;15(3):399-404.
Abstract: PubMed

from DrugBank

General Reference

Chaudhry IA, Turkanis SA, Karler R: Characteristics of "reverse tolerance" to amphetamine-induced locomotor stimulation in mice. Neuropharmacology. 1988 Aug;27(8):777-81.
Abstract: PubMed

from DrugBank

General Reference

Sax KW, Strakowski SM: Behavioral sensitization in humans. J Addict Dis. 2001;20(3):55-65.
Abstract: PubMed

from DrugBank

General Reference

Sulzer D, Sonders MS, Poulsen NW, Galli A: Mechanisms of neurotransmitter release by amphetamines: a review. Prog Neurobiol. 2005 Apr;75(6):406-33.
Abstract: PubMed

from DrugBank

General Reference

Heal DJ, Smith SL, Gosden J, Nutt DJ: Amphetamine, past and present--a pharmacological and clinical perspective. J Psychopharmacol. 2013 Jun;27(6):479-96. doi: 10.1177/0269881113482532. Epub 2013 Mar 28.
Abstract: PubMed

from DrugBank

13.5 Metabolite References

Download

1 to 1 of 1

PMID	Reference
13298508	ZAPPI F, MILLEFIORINI M: [Treatment of the antabuse-alcohol complication with betaphenylisopropylamine; experimental aspects]. Riv Neurol. 1955 Sep-Oct;25(5):725-32.

from Human Metabolome Database (HMDB)

13.6 Springer Nature References

Download

1 to 5 of 21,553 2 3 ... 4,311 Relevance

Title	Publication Name	Publication Date	PMID
The effect of reserpine on concurrent repeated administration of d-amphetamine	Psychopharmacology	1984	
Argon prevents the development of locomotor sensitization to amphetamine and amphetamine-induced changes in mu opioid receptor in the nucleus accumbens	Medical Gas Research	2014	25606340
Management of Acute and Chronic Drug Abuse of Amphetamines	Substance Abuse	2015	
Interaction between d-amphetamine and ethanol with respect to locomotion, stereotypies, ethanol sleeping time, and the kinetics of drug elimination	Psychopharmacology	1978	
Distribution and Metabolism of Amphetamine in Tolerant Animals	Cocaine and Other Stimulants	1977	

from Springer Nature

13.7 Chemical Co-Occurrences in Literature

Chemical	Display evidence from	Last year	5 years	10 years

Dopamine
CID 681

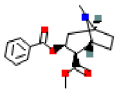
4,443 total articles in PubMed mention dopamine alongside amphetamine Download View in PubMed

Neurochemical evidence that cocaine- and amphetamine-regulated transcript (CART) 55-102 peptide modulates the dopaminergic reward system by decreasing the dopamine release in the mouse nucleus accumbens.
PMID 28802898; Brain research bulletin 2017 Sep;134(?):246-252
Name matches: amphetamine dopamine

Effects of an acute therapeutic or rewarding dose of amphetamine on acquisition of Pavlovian autoshaping and ventral striatal dopamine signaling.
PMID 28882695; Behavioural brain research 2018 Jan;336(?):191-203
Name matches: amphetamine dopamine

Constitutive Ret signaling leads to long-lasting expression of amphetamine-induced place conditioning via elevation of mesolimbic dopamine.
PMID 29031851; Neuropharmacology 2018 Jan;128(?):221-230
Name matches: amphetamine dopamine

Chemical	Display evidence from	Last year	5 years	10 years



Cocaine
CID 446220

3,305 total articles in PubMed mention cocaine alongside amphetamine — Download — View in PubMed

Association of Stimulant Use With Dopaminergic Alterations in Users of Cocaine, Amphetamine, or Methamphetamine: A Systematic Review and Meta-analysis.
PMID 28297025; JAMA psychiatry 2017 May;74(5):511-519 Review Article
Name matches: amphetamine cocaine

Long-acting glucagon-like peptide-1 receptor agonists have direct access to and effects on pro-opiomelanocortin/cocaine- and amphetamine-stimulated transcript neurons in the mouse hypothalamus.
PMID 27186357; Journal of diabetes investigation 2016 Apr;?(?):56-63 Review Article
Name matches: amphetamine cocaine

Neurochemical evidence that cocaine- and amphetamine-regulated transcript (CART) 55-102 peptide modulates the dopaminergic reward system by decreasing the dopamine release in the mouse nucleus accumbens.
PMID 28802898; Brain research bulletin 2017 Sep;134(?):246-252
Name matches: amphetamine cocaine

Methamphetamine
CID 10836

1,807 total articles in PubMed mention methamphetamine alongside amphetamine — Download — View in PubMed

Efficacy and safety of psychostimulants for amphetamine and methamphetamine use disorders: a systematic review and meta-analysis.
PMID 27842569; Systematic reviews 2016 11;5(1):189 Review Article
Name matches: amphetamine methamphetamine

Association of Stimulant Use With Dopaminergic Alterations in Users of Cocaine, Amphetamine, or Methamphetamine: A Systematic Review and Meta-analysis.
PMID 28297025; JAMA psychiatry 2017 May;74(5):511-519 Review Article
Name matches: amphetamine methamphetamine

Epigenetic landscape of amphetamine and methamphetamine addiction in rodents.
PMID 26023847; Epigenetics 2015 Jan;10(7):574-80 Review Article
Name matches: amphetamine methamphetamine

View More Chemical-Chemical Co-Occurrences and Evidence for Amphetamine

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13.8 Chemical-Disease Co-Occurrences in Literature

Disease	Display evidence from	Last year	5 years	10 years

Substance-Related Disorders

2,329 total articles in PubMed mention substance-related disorders alongside amphetamine — Download — View in PubMed

The role of oxidative stress, metabolic compromise, and inflammation in neuronal injury produced by amphetamine-related drugs of abuse.
PMID 18709468; Journal of neuroimmune pharmacology : the official journal of the Society on NeuroImmune Pharmacology 2008 Dec;3(4):203-17 Review Article
Name matches: amphetamine drugs of abuse

Acute total sleep deprivation potentiates amphetamine-induced locomotor-stimulant effects and behavioral sensitization in mice.
PMID 24316348; Pharmacology, biochemistry, and behavior 2014 Feb;117(?):7-16
Name matches: amphetamine behavioral sensitization

The effects of paradoxical sleep deprivation on amphetamine-induced behavioral sensitization in adult and adolescent mice.
PMID 24844977; Psychiatry research 2014 Aug;218(3):335-40
Name matches: amphetamine behavioral sensitization; bs

Schizophrenia

1,012 total articles in PubMed mention schizophrenia alongside amphetamine — Download — View in PubMed

Effects of Amphetamine on Sensorimotor Gating and Neurocognition in Antipsychotic-Medicated Schizophrenia Patients.
PMID 29154367; Neuropsychopharmacology : official publication of the American College of Neuropsychopharmacology 2018 Mar;43(4):708-717
Name matches: amphetamine positive symptoms; schizophrenia

Amphetamine-Induced Striatal Dopamine Release Measured With an Agonist Radiotracer in Schizophrenia.
PMID 29325847; Biological psychiatry 2018 Apr;83(8):707-714
Name matches: amphetamine positive symptoms; sch; schizophrenia

Cocaine- and Amphetamine-Regulated Transcript Peptide (CART) Alleviates MK-801-Induced Schizophrenic Dementia-Like Symptoms.
PMID 29425773; Neuroscience 2018 Apr;375(?):94-107
Name matches: amphetamine schizophrenia; schizophrenic

Disease	Display evidence from Last year 5 years 10 years
Hyperkinesis	983 total articles in PubMed mention hyperkinesis alongside amphetamine Download View in PubMed Transcriptional profiling of SHR/NCrl prefrontal cortex shows hyperactivity-associated genes responsive to amphetamine challenge. PMID 28422445; Genes, brain, and behavior 2017 09;16(7):664-674 Name matches: amphetamine hyperactive; hyperactivity Interference of norepinephrine transporter trafficking motif attenuates amphetamine-induced locomotor hyperactivity and conditioned place preference. PMID 28986281; Neuropharmacology 2018 Jan;128(?):132-141 Name matches: amphetamine hyperactivity; locomotor hyperactivity Diazepam blocks 50 kHz ultrasonic vocalizations and stereotypies but not the increase in locomotor activity induced in rats by amphetamine. PMID 29572651; Psychopharmacology 2018 Jul;235(7):1887-1896 Name matches: amphetamine; dl-amphetamine increase in locomotor activity

View More Chemical-Disease Co-Occurrences and Evidence for Amphetamine

from PubChem

13.9 Chemical-Gene Co-Occurrences in Literature

Gene/Protein	Display evidence from Last year 5 years 10 years
tyrosine hydroxylase	432 total articles in PubMed mention tyrosine hydroxylase alongside amphetamine Download View in PubMed Potential role of tyrosine hydroxylase in the loss of psychostimulant effect of amphetamine under conditions of impaired dopamine transporter activity. PMID 28750831; Behavioural brain research 2017 09;334(?):105-108 Name matches: amphetamine th; tyrosine hydroxylase Dopamine transporter, but not tyrosine hydroxylase, may be implicated in determining individual differences in behavioral sensitization to amphetamine. PMID 16126238; Physiology & behavior 2005 Oct;86(3):347-55 Name matches: amphetamine tyrosine hydroxylase Melatonin inhibits amphetamine-induced increase in alpha-synuclein and decrease in phosphorylated tyrosine hydroxylase in SK-N-SH cells. PMID 18406059; Neuroscience letters 2008 May;436(3):309-13 Name matches: amphetamine th; tyrosine hydroxylase
solute carrier family 6 member 3	431 total articles in PubMed mention solute carrier family 6 member 3 alongside amphetamine Download View in PubMed False-Positive Findings on Dopamine Transporter SPECT Due to Therapeutic Dextroamphetamine and Amphetamine. PMID 29273699; Journal of nuclear medicine technology 2018 Jun;46(2):149-150 Review Article Name matches: amphetamine dopamine transporter Potential role of tyrosine hydroxylase in the loss of psychostimulant effect of amphetamine under conditions of impaired dopamine transporter activity. PMID 28750831; Behavioural brain research 2017 09;334(?):105-108 Name matches: amphetamine dat; dopamine transporter Amphetamine Reverses Escalated Cocaine Intake via Restoration of Dopamine Transporter Conformation. PMID 29175958; The Journal of neuroscience : the official journal of the Society for Neuroscience 2018 Jan;38(2):484-497 Name matches: amphetamine dat; dopamine transporter
neuropeptide Y	360 total articles in PubMed mention neuropeptide y alongside amphetamine Download View in PubMed Role of hypothalamic leptin-LepRb signaling in NPY-CART-mediated appetite suppression in amphetamine-treated rats. PMID 29307696; Hormones and behavior 2018 Feb;98(?):173-182 Name matches: amphetamine neuropeptide y; npy Neuropeptide Y (NPY) or cocaine- and amphetamine-regulated transcript (CART) fiber innervation on central and medial amygdaloid neurons that project to the locus coeruleus and dorsal raphe in the rat. PMID 29625116; Brain research 2018 Jun;1689(?):75-88 Name matches: amphetamine neuropeptide y; npy Hypothalamic neuronal origin of neuropeptide Y (NPY) or cocaine- and amphetamine-regulated transcript (CART) fibers projecting to the tuberomammillary nucleus of the rat. PMID 27923637; Brain research 2017 02;1657(?):16-28 Name matches: amphetamine neuropeptide y; npy

View More Chemical-Gene Co-Occurrences and Evidence for Amphetamine

from PubChem

14 Patents

1. US6384020
2. USRE42096
3. US6605300
4. US6322819
5. USRE41148
6. US8062667
7. US8840924
8. US9017731
9. US8709491
10. US9265737
11. US8747902
12. US8597684
13. US8883217
14. US9675703
15. US9173857
16. US6913768
17. US8846100

from DrugBank

14.1 Depositor-Supplied Patent Identifiers

Download

1 to 5 of 17,631 | 2 | 3 | ... | 3,527 | Relevance

Patent ID	Title	Submitted Date	Granted Date
US8921341	Antiviral compounds	2013-10-08	2014-12-30
US8841278	Antiviral compounds	2013-10-03	2014-09-23
US8575135	Antiviral compounds	2013-03-01	2013-11-05
US8940718	Antiviral compounds	2012-11-16	2015-01-27
US8796276	Heterocyclic compounds for the treatment of neurological and psychological disorders	2012-09-07	2014-08-05

from PubChem

14.2 FDA Orange Book Patents

FDA Orange Book Patents: 1 of 7 (FDA Orange Book Patent ID)	
Patent	8709491
Expiration	Jun 28, 2032
Applicant	NEOS THERAPS
Drug Application	1. N204326 (Prescription Drug: ADZENYS XR-ODT. Ingredients: AMPHETAMINE) 2. N204326 (Prescription Drug: ADZENYS XR-ODT. Ingredients: AMPHETAMINE)

from FDA Orange Book

FDA Orange Book Patents: 2 of 7 (FDA Orange Book Patent ID)	
Patent	9675703
Expiration	Mar 15, 2027
Applicant	TRIS PHARMA INC
Drug Application	N208147 (Prescription Drug: DYANAVEL XR. Ingredients: AMPHETAMINE)

from FDA Orange Book

FDA Orange Book Patents: 3 of 7 (FDA Orange Book Patent ID)	
Patent	9265737
Expiration	Jun 28, 2032
Applicant	NEOS THERAPS
Drug Application	1. N204326 (Prescription Drug: ADZENYS XR-ODT. Ingredients: AMPHETAMINE) 2. N204326 (Prescription Drug: ADZENYS XR-ODT. Ingredients: AMPHETAMINE)

from FDA Orange Book

View All 7 FDA Orange Book Patents

15 Biomolecular Interactions and Pathways

15.1 Biosystems and Pathways

Download

1 to 5 of 44 | 2 | 3 | ... | 9

BioSystems ID	BioSystems Name
547607	Amphetamine addiction
547608	Amphetamine addiction
547615	Amphetamine addiction
547617	Amphetamine addiction
547619	Amphetamine addiction

from PubChem

15.2 DrugBank Interactions

Target	Alpha adrenergic receptor
Action	agonist
PubChem Protein Target	P35348
PubChem Gene Target	ADRA1A
General Function	Protein heterodimerization activity
Specific Function	This alpha-adrenergic receptor mediates its action by association with G proteins that activate a phosphatidylinositol-calcium second messenger system. Its effect is mediated by G(q) and G(11) proteins. Nuclear ADRA1A-ADRA1B heterooligomers regulate phenylephrine(PE)-stimulated ERK signaling in cardiac myocytes.
PubChem Protein Target	P35368
PubChem Gene Target	ADRA1B
General Function	Protein heterodimerization activity
Specific Function	This alpha-adrenergic receptor mediates its action by association with G proteins that activate a phosphatidylinositol-calcium second messenger system. Its effect is mediated by G(q) and G(11) proteins. Nuclear ADRA1A-ADRA1B heterooligomers regulate phenylephrine (PE)-stimulated ERK signaling in cardiac myocytes.
PubChem Protein Target	P25100
PubChem Gene Target	ADRA1D
General Function	Alpha1-adrenergic receptor activity
Specific Function	This alpha-adrenergic receptor mediates its effect through the influx of extracellular calcium.
PubChem Protein Target	P08913
PubChem Gene Target	ADRA2A
General Function	Thioesterase binding
Specific	Alpha-2 adrenergic receptors mediate the catecholamine-induced inhibition of adenylate cyclase through the action of G proteins. The rank order of potency for

Function	agonists of this receptor is oxymetazoline > clonidine > epinephrine > norepinephrine > phenylephrine > dopamine > p-synephrine > p-tyramine > serotonin = p-octopamine. For antagonists, the rank order is yohimbine > phentolamine = mianserine > chlorpromazine = spiperone = prazosin > propanolol > alprenolol = pindolol.
PubChem Protein Target	P18089
PubChem Gene Target	ADRA2B
General Function	Epinephrine binding
Specific Function	Alpha-2 adrenergic receptors mediate the catecholamine-induced inhibition of adenylate cyclase through the action of G proteins. The rank order of potency for agonists of this receptor is clonidine > norepinephrine > epinephrine = oxymetazoline > dopamine > p-tyramine = phenylephrine > serotonin > p-synephrine / p-octopamine. For antagonists, the rank order is yohimbine > chlorpromazine > phentolamine > mianserine > spiperone > prazosin > alprenolol > propanolol > pindolol.
PubChem Protein Target	P18825
PubChem Gene Target	ADRA2C
General Function	Protein homodimerization activity
Specific Function	Alpha-2 adrenergic receptors mediate the catecholamine-induced inhibition of adenylate cyclase through the action of G proteins.
Reference	Leibowitz SF: Reciprocal hunger-regulating circuits involving alpha- and beta-adrenergic receptors located, respectively, in the ventromedial and lateral hypothalamus. Proc Natl Acad Sci U S A. 1970 Oct;67(2):1063-70. Abstract: PubMed
Reference	Reisine TD, U'Prichard DC, Wiech NL, Ursillo RC, Yamamura HI: Effects of combined administration of amphetamine and iprindole on brain adrenergic receptors. Brain Res. 1980 Apr 28;188(2):587-92. Abstract: PubMed

from DrugBank

Target	D(2) dopamine receptor
Action	binder
PubChem Protein Target	P14416
PubChem Gene Target	DRD2
General Function	Potassium channel regulator activity
Specific Function	Dopamine receptor whose activity is mediated by G proteins which inhibit adenylyl cyclase.
Reference	Innis RB, Malison RT, al-Tikriti M, Hoffer PB, Sybirska EH, Seibyl JP, Zoghbi SS, Baldwin RM, Laruelle M, Smith EO, et al.: Amphetamine-stimulated dopamine release competes in vivo for [123I]IBZM binding to the D2 receptor in nonhuman primates. Synapse. 1992 Mar;10(3):177-84. Abstract: PubMed

from DrugBank

Transporter	Solute carrier family 22 member 3
Action	inhibitor
PubChem Protein Target	O75751
PubChem Gene Target	SLC22A3
General Function	Toxin transporter activity
Specific Function	Mediates potential-dependent transport of a variety of organic cations. May play a significant role in the disposition of cationic neurotoxins and neurotransmitters in the brain.
Reference	Wu X, Kekuda R, Huang W, Fei YJ, Leibach FH, Chen J, Conway SJ, Ganapathy V: Identity of the organic cation transporter OCT3 as the extraneuronal monoamine transporter (uptake2) and evidence for the expression of the transporter in the brain. J Biol Chem. 1998 Dec 4;273(49):32776-86. Abstract: PubMed
Reference	Zhu HJ, Appel DI, Grundemann D, Markowitz JS: Interaction of organic cation transporter 3 (SLC22A3) and amphetamine. J Neurochem. 2010 Jul;114(1):142-9. doi: 10.1111/j.1471-4159.2010.06738.x. Epub 2010 Apr 6.

Abstract: PubMed

from DrugBank

View all (16) DrugBank Interactions entries

16 Biological Test Results

16.1 BioAssay Results

Download

Active(30) Inconclusive(23) Inactive(7) Unspecified(82)

1 to 5 of 142 2 3 ... 29 Activity Value

Activity	Activity Value	Activity Type	Target Name	BioAssay Name	BioAssay AID	Substance SID
Active	0.2	IC50	Norepinephrine transporter (Norway rat)	Inhibition of [3H]norepinephrine uptake at NET expressed in rat hypothalamic homogenate containing synaptosomes after 5 mins by scintillation counting analysis	1145573	103164180
Active	0.96	IC50	Slc6a3 - solute carrier family 6 member 3 (Norway rat)	Inhibition of [3H]dopamine uptake at dopamine transporter expressed in rat striatal homogenate after 5 mins by scintillation counting analysis	1145574	103164180
Active	1	IC50	Slc6a2 - solute carrier family 6 (neurotransmitter transporter, noradrenalin), member 2 (house mouse)	Inhibition of noradrenaline transporter in NMRI albino mouse brain assessed as [3H]NA accumulation in hypothalamus after 5 mins	1135979	103164180
Active	2.85	IC50	Cyp2a5 - cytochrome P450, family 2, subfamily a, polypeptide 5 (house mouse)	Inhibitory concentration against mouse cytochrome P450 2A5	241174	103164180
Active	3.5	IC50	CYP2A6 - cytochrome P450 family 2 subfamily A member 6 (human)	Inhibitory concentration against human cytochrome P450 2A6	241172	103164180

from PubChem

17 Classification

17.1 Ontologies

17.1.1 MeSH Tree

Refine/Analyze Download

1 to 1 of 1 Tree View

Amphetamine

from MeSH

17.1.2 ChEBI Ontology

Refine/Analyze Download

1 to 1 of 1 Tree View

1-phenylpropan-2-amine

from ChEBI

17.1.3 KEGG: ATC

Refine/Analyze Download

1 to 1 of 1 Tree View

Amfetamine (INN) <US>

from KEGG

17.1.4 KEGG: Target-based Classification of Drugs

Refine/Analyze Download

1 to 1 of 1 Tree View

Amfetamine (INN) <US>

from KEGG

17.1.5 KEGG: Drug Classes

Refine/Analyze Download

1 to 1 of 1 Tree View

Amfetamine

from KEGG

17.1.6 WHO ATC Classification System

Refine/Analyze Download

1 to 1 of 1 Tree View

N06BA01 - Amfetamine

from WHO ATC

17.1.7 WIPO IPC

Refine/Analyze Download

1 to 10 of 5,510 2 3 ... 551 Tree View

A61P11/04 - for throat disorders

A61P11/06 - Antiasthmatics

A61P11/08 - Bronchodilators

A61P11/10 - Expectorants

A61P11/12 - Mucolytics

A61P11/14 - Antitussive agents

A61P11/16 - Central respiratory analeptics

A61P13/00 - Drugs for disorders of the urinary system

A61P13/02 - of urine or of the urinary tract, e.g. urine acidifiers

A61P13/06 - Anti-spasmodics

from WIPO

17.1.8 ChemIDplus

Refine/Analyze Download

1 to 10 of 74 2 3 ... 8 Tree View

Adrenergic Agents

Adrenergic Uptake Inhibitors

Autonomic Agents

Central Nervous System Agents

Central Nervous System Stimulants

ClinicalTrials.gov

DART

CAMEO

ChEBI

CTD

from ChemIDplus

17.1.9 CAMEO Chemicals

Refine/Analyze Download

1 to 1 of 1 Tree View

Amines, Phosphines, and Pyridines

from CAMEO Chemicals

17.1.10 ChEMBL Target Tree

Refine/Analyze Download

1 to 6 of 6 Tree View

Cytochrome P450 2A5
Cytochrome P450 2A6
Serotonin receptor
SLC06 neurotransmitter transporter family
SLC22 family of organic cation and anion transporters
Unclassified protein

from ChEMBL

18 Information Sources

1. CAMEO Chemicals /source/CAMEO Chemicals
   AMPHETAMINE
   https://cameochemicals.noaa.gov/chemical/4862 https://cameochemicals.noaa.gov/chemical/4862
   CAMEO Chemical Reactivity Classification
   https://cameochemicals.noaa.gov/browse/react https://cameochemicals.noaa.gov/browse/react

2. ChemIDplus /source/ChemIDplus
   Amphetamine
   https://chem.nlm.nih.gov/chemidplus/sid/0000300629 https://chem.nlm.nih.gov/chemidplus/sid/0000300629
   ChemIDplus Chemical Information Classification
   https://chem.sis.nlm.nih.gov/chemidplus/chemidheavy.jsp https://chem.sis.nlm.nih.gov/chemidplus/chemidheavy.jsp

3. DTP/NCI /source/DTP/NCI
   dextroamphetamine
   https://dtp.cancer.gov/dtpstandard/servlet/dwindex?searchtype=NSC&outputformat=html&searchlist=73713 https://dtp.cancer.gov/dtpstandard/servlet/dwindex?searchtype=NSC&outputformat=html&searchlist=73713
   AMPHETAMINE
   https://dtp.cancer.gov/dtpstandard/servlet/dwindex?searchtype=NSC&outputformat=html&searchlist=27159 https://dtp.cancer.gov/dtpstandard/servlet/dwindex?searchtype=NSC&outputformat=html&searchlist=27159

4. DrugBank /source/DrugBank
   Amphetamine
   http://www.drugbank.ca/drugs/DB00182 http://www.drugbank.ca/drugs/DB00182
   http://www.drugbank.ca/drugs/DB00182#targets http://www.drugbank.ca/drugs/DB00182#targets
   http://www.drugbank.ca/drugs/DB00182#transporters http://www.drugbank.ca/drugs/DB00182#transporters
   http://www.drugbank.ca/drugs/DB00182#enzymes http://www.drugbank.ca/drugs/DB00182#enzymes

5. EPA DSStox /source/EPA DSStox
   Amphetamine
   https://comptox.epa.gov/dashboard/dsstoxdb/results?search=DTXSID4022600 https://comptox.epa.gov/dashboard/dsstoxdb/results?search=DTXSID4022600

6. European Chemicals Agency (ECHA) /source/European Chemicals Agency (ECHA)
   α-methylphenethylamine
   https://echa.europa.eu/information-on-chemicals https://echa.europa.eu/information-on-chemicals
   amphetamine
   https://echa.europa.eu/substance-information/-/substanceinfo/100.005.543 https://echa.europa.eu/substance-information/-/substanceinfo/100.005.543
   Amphetamine
   https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/51547 https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/51547

7. Human Metabolome Database (HMDB) /source/Human Metabolome Database (HMDB)
   Amphetamine
   http://www.hmdb.ca/metabolites/HMDB0014328 http://www.hmdb.ca/metabolites/HMDB0014328

8. LiverTox /source/LiverTox
   Amphetamines
   https://livertox.nlm.nih.gov/Amphetamines.htm https://livertox.nlm.nih.gov/Amphetamines.htm

9. NCIt /source/NCIt
   Amphetamine
   https://ncit.nci.nih.gov/ncitbrowser/ConceptReport.jsp?dictionary=NCI_Thesaurus&ns=NCI_Thesaurus&code=C62006 https://ncit.nci.nih.gov/ncitbrowser/ConceptReport.jsp?dictionary=NCI_Thesaurus&ns=NCI_Thesaurus&code=C62006

10. HSDB /source/HSDB
    AMPHETAMINE
    https://toxnet.nlm.nih.gov/cgi-bin/sis/search/r?dbs+hsdb:@term+@rn+@rel+300-62-9 https://toxnet.nlm.nih.gov/cgi-bin/sis/search/r?dbs+hsdb:@term+@rn+@rel+300-62-9

11. ClinicalTrials.gov /source/ClinicalTrials.gov
    Amphetamine
    https://clinicaltrials.gov/ https://clinicaltrials.gov/

12. DailyMed /source/DailyMed
    AMPHETAMINE
    https://dailymed.nlm.nih.gov/dailymed/search.cfm?labeltype=all&query=AMPHETAMINE https://dailymed.nlm.nih.gov/dailymed/search.cfm?labeltype=all&query=AMPHETAMINE

13. FDA Medication Guides /source/FDA Medication Guides
    Dyanavel XR
    https://www.accessdata.fda.gov/drugsatfda_docs/label/2017/208147s003lbl.pdf#page=15 https://www.accessdata.fda.gov/drugsatfda_docs/label/2017/208147s003lbl.pdf#page=15
    Adzenys ER
    https://www.accessdata.fda.gov/drugsatfda_docs/label/2017/204325s000lbl.pdf#page=26 https://www.accessdata.fda.gov/drugsatfda_docs/label/2017/204325s000lbl.pdf#page=26

14. FDA Orange Book /source/FDA Orange Book
    AMPHETAMINE ADIPATE; AMPHETAMINE SULFATE; DEXTROAMPHETAMINE ADIPATE; DEXTROAMPHETAMINE SULFATE
    https://www.fda.gov/Drugs/InformationOnDrugs/ucm129662.htm https://www.fda.gov/Drugs/InformationOnDrugs/ucm129662.htm

15. MassBank of North America (MoNA) /source/MassBank of North America (MoNA)
    Amphetamine
    http://mona.fiehnlab.ucdavis.edu/spectra/browse?inchikey=KWTSXDURSIMDCE-UHFFFAOYSA-N http://mona.fiehnlab.ucdavis.edu/spectra/browse?inchikey=KWTSXDURSIMDCE-UHFFFAOYSA-N

16. SpectraBase /source/SpectraBase

https://spectrabase.com/spectrum/KG2ZMkRiald https://spectrabase.com/spectrum/KG2ZMkRiald
https://spectrabase.com/spectrum/4t8YzswbTNu https://spectrabase.com/spectrum/4t8YzswbTNu
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Dopamine Uptake Inhibitors
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LinkOut is a service that allows one to link directly from NCBI databases to a wide range of information and services beyond NCBI systems.
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