












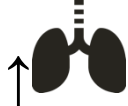














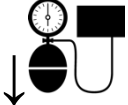


















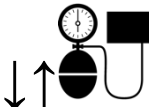







































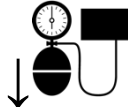

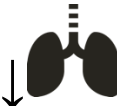




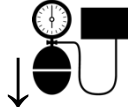



Supplementary Table 2. Overview of Commonly Encountered Toxicidromes\* \*\*














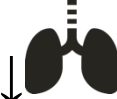






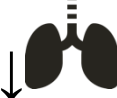




Legend									
									
HR	BP	ECG changes	RR	↑temp	↓temp	Hyper-active bowel sounds	Agitation	Confused	Lethargic/somnolent
Class/Medication	Common overdose symptoms	Common Signs, Symptoms, and Monitoring Parameters						Notes on monitoring duration	
		HR/BP	RR	Temp	Bowels	Mental Status	Other		
<b>Acetaminophen</b>	<ul style="list-style-type: none"> <li>Widely variable based on amount and time from ingestion; may be symptomatic or only develop nausea, vomiting and abdominal pain early.</li> <li>LFTs may rise after 12 hours after ingestion with few signs or symptoms, peaking 2-3 days later. Severe symptoms: those of liver failure, including coagulopathy and encephalopathy, with renal dysfunction and metabolic disturbances.</li> </ul>	No change	No change	No change	No change	 (usually after >48 hours in severe cases)	Nausea, vomiting Abdominal pain LFTs, CBC, INR	<ul style="list-style-type: none"> <li>Severity dependent; hepatic or renal failure would be evident within 72 hours</li> </ul>	
<b>Aspirin (Note: Aspirin has a distinct toxicidrome. Other agents that are NSAIDs (e.g. ibuprofen) are fairly benign in overdose. In massive overdose they may produce drowsiness and metabolic acidosis may rarely be seen)</b>	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> GI upset, tinnitus, tachypnea</li> <li><b>Severe:</b> Metabolic acidosis, diaphoresis, altered mental status, seizures, coma, pulmonary edema</li> </ul>	 			No change or ↓	 	Tinnitus Acid/base abnormality Vomiting Seizures Neuroglycopenia	<ul style="list-style-type: none"> <li>Dependent on salicylate levels; may need initial monitoring of about 24 hours</li> </ul>	












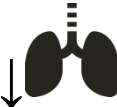










Legend									
									
HR	BP	ECG changes	RR	↑temp	↓temp	Hyper-active bowel sounds	Agitation	Confused	Lethargic/somnolent
Class/Medication	Common overdose symptoms	Common Signs, Symptoms, and Monitoring Parameters						Notes on monitoring duration	
		HR/BP	RR	Temp	Bowels	Mental Status	Other		
<b>Alpha-1 antagonists</b> (e.g. prazosin)	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> hypotension, tachycardia, GI symptoms, mild sedation</li> <li><b>Severe:</b> Hypotension, ECG changes to TdP</li> </ul>	  	No change	No change	No change	 (mild)	Rare: Seizures, agitation, priapism	<ul style="list-style-type: none"> <li>Generally 6-12 hours</li> </ul>	
<b>Alpha-2 agonists</b> (e.g. clonidine, guanfacine)	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> CNS depression, bradycardia, QTc prolongation, initial transient hypertension followed by hypotension</li> <li><b>Severe:</b> CNS depression, cardiac events should be anticipated, hypotension which may be delayed and prolonged.</li> </ul>	  	Variable	No change	No change or ↓	 	May see initial and transient increases to blood pressure and a delayed hypotension after several hours	<ul style="list-style-type: none"> <li>Onset of symptoms within 30-90 minutes</li> <li>Depends on dosage form 4 hours (IR) to 14 hours (ER)</li> <li>Prolonged presentation possible with extended-release forms (24-72 hours)</li> </ul>	














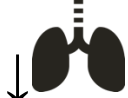






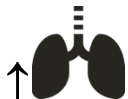



Legend									
									
HR	BP	ECG changes	RR	↑temp	↓temp	Hyper-active bowel sounds	Agitation	Confused	Lethargic/somnolent
Class/Medication	Common overdose symptoms	Common Signs, Symptoms, and Monitoring Parameters						Notes on monitoring duration	
		HR/BP	RR	Temp	Bowels	Mental Status	Other		
<b>Anticholinergic agents</b> (e.g. benzotropine, diphenhydramine)	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> Somnolence, anticholinergic, tachycardia, hypertension, GI symptoms, mental status changes</li> <li><b>Severe:</b> Delirium, agitation, psychosis, hallucinations, seizures, hyperthermia, coma, ECG changes</li> </ul>	  	No change or ↑		↓	 	Hallucination Skin flushing Urinary retention Seizures Gastrointestinal hypomotility	<ul style="list-style-type: none"> <li>Agent and dosage form specific, at least 6 to 8 hours</li> </ul>	
<b>Antipsychotics,</b> presentation represents general class effects, presentation may be agent specific (e.g. risperidone, haloperidol, quetiapine, paliperidone, aripiprazole, olanzapine)	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> Anticholinergic effects, sedation, hypotension mild tachycardia, QTc prolongation</li> <li><b>Severe:</b> CNS depression, anticholinergic poisoning, seizures, tachycardia, hypotension, QTc prolongation, respiratory depression, NMS</li> </ul>	  	↓		No change or ↓	  	Seizures Orthostatic hypotension	<ul style="list-style-type: none"> <li>Variable based on agent, at least 6-8 hours</li> <li>Monitoring for NMS may be warranted for up to 24-72 hours</li> <li>Do not restart antipsychotics until after 14 days of symptom resolution if NMS occurs</li> </ul>	

Legend									
									
HR	BP	ECG changes	RR	↑temp	↓temp	Hyper-active bowel sounds	Agitation	Confused	Lethargic/somnolent
Class/Medication	Common overdose symptoms	Common Signs, Symptoms, and Monitoring Parameters						Notes on monitoring duration	
		HR/BP	RR	Temp	Bowels	Mental Status	Other		
<b>Antihyperglycemics</b>									
Metformin	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> GI symptoms, malaise, and myalgia</li> <li><b>Severe:</b> lactic acidosis, mental status changes, hypotension, and renal failure</li> </ul>	Changes generally only in severe cases	Changes generally only in severe cases	 Hypothermia possible in severe cases	No change or ↑	Changes generally only in severe cases	Glucose monitoring (hypoglycemia unlikely) GI Symptoms Serum creatinine	<ul style="list-style-type: none"> <li>Dosage form specific, at least 8-12 hours</li> </ul>	
Sulfonylureas	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> More directly affects glucose and toxicity is usually secondary to hypoglycemia</li> <li><b>Severe:</b> CNS symptoms resulting from hypoglycemia including seizures, altered mental status, delirium, focal neurologic effects, and coma may result. Potential for dysrhythmias</li> </ul>		Changes generally only in severe cases	No change	No change	   Usually secondary to hypoglycemia	Glucose monitoring	<ul style="list-style-type: none"> <li>Agent and dosage form specific, at least 18 hours (IR) to 24 hours (ER)</li> <li>Hypoglycemia may be present for up to 72 hours</li> </ul>	












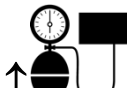

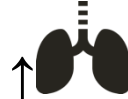



Legend									
									
HR	BP	ECG changes	RR	↑temp	↓temp	Hyper-active bowel sounds	Agitation	Confused	Lethargic/somnolent
Class/Medication	Common overdose symptoms	Common Signs, Symptoms, and Monitoring Parameters						Notes on monitoring duration	
		HR/BP	RR	Temp	Bowels	Mental Status	Other		
<b>Benzodiazepines</b> (e.g. lorazepam, clonazepam, diazepam, alprazolam)	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> CNS/respiratory depression (note: Coingestion of other CNS depressants including alcohol increases risk of effects dramatically)</li> <li><b>Severe:</b> Respiratory depression/arrest. Effects are variable based on specific agent and occurrence of a co-ingestion</li> </ul>	  			↓ or ∅	 	Ataxia Hyporeflexia	<ul style="list-style-type: none"> <li>Agent specific, monitoring for as long as CNS/respiratory depression is evident</li> </ul>	
<b>Beta-blockers</b> (e.g. propranolol, metoprolol, atenolol)	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> bradycardia, hypotension</li> <li><b>Severe:</b> ECG change/conduction delays, hypotension, renal failure, coma and cardiopulmonary arrest, bronchospasm. Propranolol easily crosses the into the CNS and may cause more sedation/seizures</li> </ul>	  	Dyspnea, bronchospasm (especially with history of asthma/COPD)	No change	No change	 	Hypoglycemia Seizures CNS depression	<ul style="list-style-type: none"> <li>Agent and dosage form specific, at least 6 hours or longer with ER products</li> </ul>	

Legend									
									
HR	BP	ECG changes	RR	↑temp	↓temp	Hyper-active bowel sounds	Agitation	Confused	Lethargic/somnolent
Class/Medication	Common overdose symptoms	Common Signs, Symptoms, and Monitoring Parameters						Notes on monitoring duration	
		HR/BP	RR	Temp	Bowels	Mental Status	Other		
Mood Stabilizers (Carbamazepine, divalproex sodium/valproic acid, lamotrigine, lithium)									
Carbamazepine	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> nystagmus, ataxia, hyperreflexia, CNS depression, dystonia, tachycardia, tremor anticholinergic effects</li> <li><b>Severe:</b> coma, seizures, respiratory depression, renal failure, cardiac toxicity, hyponatremia rhabdomyolysis, hepatotoxicity</li> </ul>	  	Depends on severity 	No change	↓		  	LFTs, CBC, electrolytes Anticholinergic effects Seizure Rash Motor symptoms/gait	<ul style="list-style-type: none"> <li>Dosage form specific, minimum of 12 hours (IR) or up to 96 hours (ER)</li> <li>Unpredictable absorption, can check serum levels to ensure declining concentrations</li> </ul>
Divalproex sodium, valproic acid	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> lethargy/sedation, mental status changes, GI symptoms, hyperammonemia, transaminitis, tremor</li> <li><b>Severe:</b> CNS/respiratory depression, ECG changes, tachycardia, hypotension, hypernatremia, hepatotoxicity, hyperammonemia</li> <li><b>Other:</b> Delayed bone marrow suppression, pancreatitis</li> </ul>	  	Depends on severity 	No change			  	LFTs, CBC, electrolytes Nausea, vomiting, diarrhea Motor symptoms/gait	<ul style="list-style-type: none"> <li>Dosage form specific, at least 6 hours (IR) or at least 12-24 hours (ER) or longer if symptomatic</li> <li>Valproic acid levels can be monitored to ensure declining concentrations</li> </ul>

Legend									
									
HR	BP	ECG changes	RR	↑temp	↓temp	Hyper-active bowel sounds	Agitation	Confused	Lethargic/somnolent
Class/Medication	Common overdose symptoms	Common Signs, Symptoms, and Monitoring Parameters						Notes on monitoring duration	
		HR/BP	RR	Temp	Bowels	Mental Status	Other		
Lamotrigine	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> GI ADEs, CNS depression, tremor, xerostomia, vision changes, gait changes, transaminitis</li> <li><b>Severe:</b> ECG changes, electrolyte abnormalities, oculo-gyric crisis, seizures, rhabdomyolysis, coma encephalopathy, and respiratory depression</li> <li><b>Other:</b> seizure, hypersensitivity reactions that may be delayed (3-5 weeks)</li> </ul>	Variable 	Depends on severity 	No change	No change	  	LFTs, CBC  Motor symptoms/gait  Rash	<ul style="list-style-type: none"> <li>Dosage form specific, at least 6-8 hours (IR) or up to 12-24 hours (ER)</li> </ul>	
Lithium	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> Nausea, vomiting, diarrhea, CNS depression, mental status changes, tremor, AKI, serotonergic toxicities, ECG changes (bradycardia, T-wave abnormalities)</li> <li><b>Severe:</b> electrolyte abnormalities, acute kidney injury, seizure, hyperthermia, coma, rigidity, myoclonus, serotonin syndrome. severe ECG changes, hypotension</li> <li><b>Other:</b> sustained effects possible: cerebellar and cognitive dysfunction, EPS-like symptoms</li> </ul>	  	No change	No change		  	Serum creatinine, electrolytes  Nausea, vomiting, diarrhea  Motor symptoms/gait  Serotonin like picture possible	<ul style="list-style-type: none"> <li>Dosage form specific; at least 6 hours (IR) or up to 12 hours (ER)</li> <li>Initial serum levels may not correlate well in acute ingestion</li> </ul>	

Legend									
									
HR	BP	ECG changes	RR	↑temp	↓temp	Hyper-active bowel sounds	Agitation	Confused	Lethargic/somnolent
Class/Medication	Common overdose symptoms	Common Signs, Symptoms, and Monitoring Parameters						Notes on monitoring duration	
		HR/BP	RR	Temp	Bowels	Mental Status	Other		
<b>Opioids</b>	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> Euphoria, drowsiness, constipation, nausea, vomiting, miosis, mild bradycardia, mild hypotension</li> <li><b>Severe:</b> Respiratory depression, hypoxia, coma, bradycardia, prolonged QT, or acute lung injury. Potential for serotonergic effects (especially tramadol, fentanyl, meperidine)</li> </ul>	  					Pulmonary edema  Seizures (with some agents)  Rare: serotonin syndrome	4-6 hours unless: <ul style="list-style-type: none"> <li>ER formulation (12 hours)</li> <li>Buprenorphine or fentanyl patch (6 to 12 hours)</li> <li>Buprenorphine (12 hours)</li> </ul>	
<b>Serotonergic agents</b> Antidepressants (e.g., SSRI, SNRI, TCA), opioid pain medications, various OTCs (e.g. dextromethorphan, St. John's Wort), list not inclusive <b>(Note bupropion is distinct in that it is more likely associated with seizures, agitation, hallucinations, tachycardia, mild hypertension)</b>	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> Somnolence, dizziness, agitation, GI symptoms, tachycardia, palpitations, hypertension, elevated LTFs, and cutaneous vasodilation.</li> <li><b>Severe:</b> CNS depression. serotonin syndrome (clonus, hyperreflexia, altered mental status, or hemodynamic instability), seizures</li> </ul>	  	Depends on severity  				Clonus, muscle rigidity, hyperreflexia  Serum creatinine, creatinine kinase	<ul style="list-style-type: none"> <li>Presentation within hours</li> <li>Resolution in mild-moderate case within 24 to 48 hours.</li> <li>Do not restart serotonergic agents until after complete resolution of symptoms</li> </ul>	



Legend									
									
HR	BP	ECG changes	RR	↑temp	↓temp	Hyper-active bowel sounds	Agitation	Confused	Lethargic/somnolent
Class/Medication	Common overdose symptoms	Common Signs, Symptoms, and Monitoring Parameters						Notes on monitoring duration	
		HR/BP	RR	Temp	Bowels	Mental Status	Other		
<b>Sympathomimetic/stimulants</b>	<ul style="list-style-type: none"> <li><b>Mild-moderate:</b> tachycardia, hypertension, restlessness, agitation</li> <li><b>Severe:</b> ECG changes, arrhythmias, hypertensive crisis, psychosis, hyperreflexia, serotonin syndrome</li> </ul>	  					Tremors Skin flushing, sweating Hyperactivity Seizures	<ul style="list-style-type: none"> <li>Dosage form specific, at least 6-8 hours (IR) or up to 12-24 hours (ER)</li> <li>Many dosage forms exist with differing release mechanisms</li> </ul>	

\*Content adapted from MN Poison Control guidelines, Hoffman R.S., & Howland M, & Lewin N.A., & Nelson L.S., & Goldfrank L.R.(Eds.), (2015). Goldfrank's Toxicologic Emergencies, 10e. McGraw Hill.

\*\*Table used with permission of Mayo Foundation for Medical Education and Research

Abbreviations: ADE = adverse drug events, AKI = acute kidney injury, BP = blood pressure, CBC = complete blood count, COPD = chronic obstructive pulmonary disease, CNS = central nervous system, ECG = electrocardiogram, EPS = extrapyramidal symptoms, ER = extended release, GI = gastrointestinal, HR = heart rate, INR = international normalized ratio, IR = immediate release, LFTs = liver function tests, NMS = neuroleptic malignant syndrome, NSAIDs = non-steroidal anti-inflammatory drugs, OTC = over the counter medications, RR = respiratory rate, SNRI = serotonin and norepinephrine reuptake inhibitor, SSRI = selective serotonin reuptake inhibitor, TCA = tricyclic antidepressant, TdP = torsade de pointes, temp = temperature

Comments:

- Symptom and timing presentation may be variable based acute, acute-on-chronic, or chronic toxicity
- Note medication history and formulations that are delayed/extended-release product; reports exist of symptoms presenting as late as 24+ hours.
- Pharmacobezoars are the result of solid dosage forms conglomerating. They are rare but can significantly alter/delay/prolong presentation
- Always consider unknown co-ingestions