

The Toxicology Investigators Consortium Case Registry— The 2012 Experience

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Abstract In 2010, the American College of Medical Toxicology (ACMT) established its Case Registry, the Toxicology Investigators Consortium (ToxIC). All cases are entered prospectively and include only suspected and confirmed toxic exposures cared for at the bedside by board-certified or board-eligible medical toxicologists at its participating sites. The primary aims of establishing this Registry include the development of a realtime toxico-surveillance system in order to identify and describe current or evolving trends in poisoning and to develop a research tool in toxicology. ToxIC allows for extraction of data from medical records from multiple sites across a national and international network. All cases seen by medical toxicologists at participating institutions were entered into the database. Information characterizing patients entered in 2012 was tabulated and data from the previous years including 2010 and 2011 were included so that cumulative numbers and trends could be described as well. The current

report includes data through December 31st, 2012. During 2012, 38 sites with 68 specific institutions contributed a total of 7,269 cases to the Registry. The total number of cases entered into the Registry at the end of 2012 was 17,681. Emergency departments remained the most common source of consultation in 2012, accounting for 61 % of cases. The most common reason for consultation was for pharmaceutical overdose, which occurred in 52 % of patients including intentional (41 %) and unintentional (11 %) exposures. The most common classes of agents were sedative-hypnotics (1,422 entries in 13 % of cases) non-opioid analgesics (1,295 entries in 12 % of cases), opioids (1,086 entries in 10 % of cases) and antidepressants (1,039 entries in 10 % of cases). N-acetylcysteine (NAC) was the most common antidote administered in 2012, as it was in previous years, followed by the opioid antagonist naloxone, sodium bicarbonate, physostigmine and flumazenil. Anti-crotalid Fab fragments were administered in 109 cases or 82 % of cases in which a snake envenomation occurred. There were 57 deaths reported in the Registry in 2012. The most common associated agent alone or in combination was the non-opioid analgesic acetaminophen, being reported in 10 different cases. Other common agents and agent classes involved in death cases included ethanol, opioids, the anti-diabetic agent metformin, sedatives-hypnotics and cardiovascular agents, in particular amlodipine. There were significant trends identified during 2012. Abuse of over-the-counter medications such as dextromethorphan remains prevalent. Cases involving dextromethorphan continued to be reported at frequencies higher than other commonly abused drugs including many stimulants, phencyclidine, synthetic cannabinoids and designer amphetamines such as bath salts. And, while cases involving synthetic cannabinoids and psychoactive bath salts remained relatively constant from 2011 to 2012 several designer amphetamines and novel psychoactive substances were first reported in the Registry in

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Table 1 Institutions contributing cases to the registry in 2012

USA
Boston, MA
Beth Israel Deaconess Medical Center
Boston Children's Hospital
Charlotte, NC
Carolinas Medical Center
Chicago, IL
John H. Stroger, Jr. Hospital of Cook County
Cincinnati, OH
Cincinnati Children's Hospital Medical Center
Dallas, TX
Parkland Memorial Hospital
Children's Medical Center of Dallas
UT Southwestern Medical Center
Denver, CO
Denver Health
Porter and Littleton Adventist Hospital
Swedish Medical Center
University of Colorado Hospital
Evanston, IL
NorthShore University HealthSystem
Fresno, CA
UCSF Fresno Medical Center
Grand Rapids, MI
Spectrum Health Hospitals
Harrisburg, PA
Harrisburg Hospital
Hartford, CT
Connecticut Children's Medical Center
Hartford Hospital
U Conn Health Center/John Dempsey Hospital
Indianapolis, IN
IU Health University Hospital
IU Health Methodist Hospital
Wishard Memorial Hospital
Riley Hospital for Children
Kansas City, MO
Children's Mercy Hospitals & Clinics
Long Island, NY
North Shore University Hospital
Long Island Jewish Medical Center
Milwaukee, WI
Froedtert Hospital
New York, NY
Bellevue Hospital Center
NYU Langone Medical Center
New York City VA Hospital
Mount Sinai Hospital
Staten Island University Hospital
Newark, NJ

Table 1 (continued)

Newark Beth Israel Medical Center
University Hospital
New Brunswick, NJ
Robert Wood Johnson University Hospital
Omaha, NE
University of Nebraska Medical Center
Philadelphia, PA
Einstein Medical Center Philadelphia,
Einstein Medical Center Elkins Park,
Einstein Medical Center Montgomery
Hahnemann University Hospital
Mercy Fitzgerald Hospital
Mercy Philadelphia Hospital
St. Christopher's Hospital for Children
Phoenix, AZ
Banner Good Samaritan Medical Center
Phoenix Children's Hospital
Pittsburgh, PA
UPMC Presbyterian/Shadyside
UPMC Children's Hospital of Pittsburgh
Portland, OR
Oregon Health and Science University Hospital
Doernbecher Children's Hospital
Richmond, VA
VCU Medical Center
Rochester, NY
Strong Memorial Hospital
Highland Hospital
Huther, Doyle
San Antonio, TX
San Antonio Military Medical Center
St Paul, MN
Regions Hospital
St Louis, MO
Barnes Jewish Hospital
Worcester, MA
UMass Memorial Medical Center
Non-US sites
Blacktown, New South Wales, Australia
Blacktown and Mt. Druitt Hospital
Haifa, Israel
Rambam Health Care Campus
Toronto, Canada
Sick Children's Hospital

2012 including the NBOME compounds or “N-bomb” agents. LSD cases also spiked dramatically in 2012 with an 18-fold increase from 2011 although many of these cases are thought to be ultra-potent designer amphetamines misrepresented as “synthetic” LSD. The 2012 Registry included over 400 Adverse Drug Reactions (ADRs) involving 4 % of all Registry cases with 106 agents causing at least 2 ADRs. Additional data including supportive cares, decontamination, and chelating agent use are also included in the 2012 annual report. The Registry remains a valuable toxicosurveillance and research tool. The ToxIC Registry is a unique tool for identifying and characterizing confirmed cases of significant or potential toxicity or complexity to require bedside care by a medical toxicologist.

Table 2 Number of registry cases enrolled by month

	2010	2011	2012	Totals
January	46	442	590	1,078
February	99	505	789	1,393
March	155	775	484	1,414
April	277	617	529	1,423
May	207	323	511	1,041
June	312	501	638	1,451
July	364	684	630	1,678
August	556	573	622	1,751
September	500	430	580	1,510
October	472	636	746	1,854
November	574	478	561	1,613
December	383	503	589	1,475
TOTAL	3,945	6,467	7,269	17,681

Keywords Poisonings · Registry · Overdose · Toxicology · Medical toxicology

The Toxicology Investigators Consortium (Toxic) case Registry was established in 2010 by the American College of Medical Toxicology (ACMT) as a prospective toxicosurveillance and research tool. Since all cases on the Registry have had formal consultation by a medical toxicologist they represent particularly severe or potentially severe toxicities. A full description of the Registry has been previously published [1]. Participating sites record all cases cared for at the bedside or in a clinic by medical toxicologists. Previous Annual Reports have been published reflecting the 2010 and 2011 data [2, 3].

Table 3 Demographics of registry cases

	2010 (%)	2011 (%)	2012 (%)	Total (%)
Male	1,864 (47)	3,166 (49)	3,741 (51)	8,771 (50)
Female	1,701 (43)	3,301 (51)	3,526 (49)	8,528 (48)
Pregnant	18 (0)	52 (2)	40 (1)	110 (1)
Unspecified	380 (10)	0 (0)	2 (0)	382 (2)
TOTAL	3,945	6,467	7,269	17,691
<2 years	138 (3)	235 (4)	256 (4)	629 (4)
2–6	212 (5)	320 (5)	361 (5)	893 (5)
7–12	100 (3)	124 (2)	156 (2)	380 (2)
13–18	489 (12)	954 (15)	1,069 (15)	2,512 (14)
19–65	2,659 (67)	4,496 (70)	4,904 (67)	12,059 (68)
66–89	183 (5)	338 (5)	404 (6)	925 (5)
>89 years	0 (0)	0 (0)	10 (0)	10 (0)
Unspecified	164 (4)	0 (0)	109 (1)	273 (2)
TOTAL	3,945	6,467	7,269	17,681

Table 4 Referral sources for medical toxicology consultations

Referral source	2010 ^a (%)	2011 ^b (%)	2012 ^c (%)	Total (%)
Emergency department (ED)	2037 (52)	3431 (52)	4423 (61)	10118 (54)
Request from another hospital service (not ED)	399 (10)	1043 (16)	960 (13)	2946 (16)
Outside hospital transfer	522 (13)	804 (12)	867 (12)	2343 (13)
Admitting service	38 (1)	0 (0)	532 (7)	570 (3)
Primary care provider or other outpatient ^d treating physician	262 (6)	335 ^d (5)	481 (7)	1070 (6)
Poison center	196 (5)	114 (7)	128 (2)	748 (4)
Self-referral ^f	93 (2)	63 (1)	93 (1)	254 (1)
Employer/independent med eval/workmen's comp	32 (1)	67 (1)	46 (1)	167 (1)
Other or unknown	412 (10)	7 (0)	8 (0)	427 (2)
Industrial hygienist	2 (0)	0 (0)	0 (0)	2 (0)

^a Referral source was documented in 90 % of cases in 2010 some entries had more than one referral source

^b Referral source was documented in 85 % of cases in 2011 some entries had more than one referral source

^c Referral source was documented in 99 % of cases in 2012 some entries had more than one referral source

^d In 2011 Primary Care Physician category changed to Primary Care Physician/All Outpatient Providers

^e In many cases multiple referral sources were selected

^f Refers to self-referral to outpatient clinic

Several enhancements to the main Registry occurred in 2012 including the integration of new focused data collection sub-registries for prospective multi-site studies. The first sub-registry was developed for patients who ingest caustics and the second for those who have received lipid resuscitation therapy. Also in 2012, a Steering Committee was created with specific goals such as establishing a data entry and collection quality control and assurance program in order to increase the accuracy and fidelity of data collection. Steering Committee members include the Principle Investigators of the Registry along with several medical toxicologists who have been active in case entry, site recruitment and in surveillance since the Registry's inception.

This is the third annual report and it includes both the 2012 experience and comprehensive and comparative data from the first 2 years of the registry (2010–2011). Registry data is described cumulatively for drug classes and for specific drugs and chemicals within each class as well as compared across time in order to demonstrate trends and for the purpose of surveillance. This report also provides data on toxidromes, supportive care and specific treatments provided during the encounter.

Methods

All participating centers aim to enter all of their medical toxicology consultations into the Registry. Case entry is done online using a password-protected user-friendly interface developed and maintained by ACMT and overseen by the ToxIC Steering Committee. The Registry is Health Insurance Portability and Accountability Act (“HIPAA”) compliant and no patient identifiers are provided on the database. Participation in the Registry is done pursuant to local Institutional Review Board (IRB) policies and procedures as well as the Western Institutional Review Board. Thirty five medical toxicology practices treating patients at 65 institutions distributed throughout the United States plus three international sites contributed cases to the registry in 2012. A list of institutions participating in the Registry during 2012 is provided in Table 1.

The information stored on the database includes demographic and detailed clinical data obtained through medical toxicology consultation on the patient’s exposure or encounter including signs, symptoms, clinical course, and treatment. For this report, consultation refers to all patient encounters whether admitted to the medical toxicology service on an inpatient unit or when the toxicologist served as consultant. Outpatient and Emergency Department encounters are also referred to as consultations as long as a formal medical toxicology consultation was done and include documentation in the patients’ record detailing the consultation.

Information about a patient encounter is collected and subsequently entered into the online data interface. Multiple fields are populated for each patient involving check offs or drop-down boxes. There are free text fields for additional information, such as signaling new, unusual or sentinel cases as well as for entry of the substances or species (i.e., envenomation) involved. A data dictionary was added to the 2012 Registry to facilitate accurate collection and naming of specific substances or drugs.

For this report, a search was made of the database assessing the parameters in each field between the data of January 1, 2012 and December 31, 2012. For comparative purposes, and when such data exists, the 2010, 2011, and 2012 as well as cumulative 2010–2012 data are shown.

Results

Total numbers of cases entered include 3,936 in 2010, 6,456 in 2011, and 7,269 in 2012, for a cumulative number of Registry cases of 17,681 by December 31, 2012. The total number of sites actively entering cases in 2012 was 38 which increased from 28 in 2011. Case accrual by month through the end of 2012 is included in Table 2. The mean rate of case accrual in 2012 was 606 cases per month, which is an increase from 539 cases per month in 2011 and 329 cases per month in 2010. The busiest months for consultations in 2012 were in February with 789 consultations and October with 746. Demographic data about patients in the Registry is included in Table 3; in

Table 5 Reasons for medical toxicology consultation

	2010 (%)	2011 (%)	2012 (%)
Intentional exposure—pharmaceutical	1,675 (43)	2,499 (39)	3,002 (41)
Intentional exposure—non-pharmaceutical	200 (5)	535 (8)	883 (12)
Unintentional exposure—pharmaceutical	557 (14)	761 (12)	805 (11)
Unintentional exposure—non-pharmaceutical	198 (5)	293 (5)	324 (4)
Drug abuse—illicit/non-prescription drug abuse	521 (13)	348 (5)	708 (10)
Drug abuse—prescription	531 (13)	442 (7)	392 (5)
Drug abuse—over-the-counter (added partway through 2012)	NA (0)	NA (0)	31 (0)
Ethanol abuse	NA (0)	325 (5)	361 (5)
Withdrawal	296 (8)	325 (5)	460 (6)
Adverse drug effect	35 (1)	95 (1)	120 (2)
Adverse drug reaction	116 (3)	229 (4)	371 (5)
Envenomation -total	137 (3)	220 (3)	202 (3)
Envenomation -snake	61 (2)	120 (2)	124 (2)
Envenomation -spider	10 (0)	33 (1)	38 (1)
Envenomation -other	0 (0)	6 (0)	25 (0)
Organ system dysfunction	114 (3)	116 (2)	312 (4)
Interpretation of laboratory data	79 (2)	178 (3)	161 (2)
Occupational evaluation	120 (3)	195 (3)	116 (2)
Environmental evaluation	93 (2)	199 (3)	138 (2)
Case entries per year ^a	3,936	6,456	7,269

^a The (%) represents the % of time that a reason for medical toxicology consultation was used out of the total case entries per year not the total number of reasons for medical toxicology consultation. Often case entries included more than one reason for toxicology consultation (i.e., illicit drug abuse and alcohol abuse). The total number of Reasons for consultation in 2012 was 8,573. The percentages thus do not add up to 100 %

Table 6 Agent class involved in consultation

Agent class	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
Sedative-hypnotics/muscle relaxants	783 (20)	1,492 (23)	1,422 (20)	3,697 (21)
Non-opioid analgesics	854 (22)	1,368 (21)	1,295 (12)	3,517 (20)
Antidepressants	659 (16)	1,029 (16)	1,039 (18)	2,727 (15)
Opioids	619 (17)	1,100 (10)	1,086 (15)	2,805 (16)
Antihistamines and anticholinergics	378 (10)	549 (8)	457 (6)	1,384 (8)
Cardiovascular agents	334 (8)	631 (10)	616 (8)	1,581 (9)
Stimulants and sympathomimetics	247 (6)	774 (12)	692 (10)	1,713 (10)
Psychoactive agents	135 (3)	360 (6)	460 (4)	955 (5)
Ethanol	371 (10)	580 (9)	850 (12)	1,801 (10)
Antipsychotics	366 (9)	587 (9)	551 (8)	1,504 (8)
Lithium	78 (2)	100 (2)	133 (2)	311 (2)
Anticonvulsants and mood stabilizers (non-antipsychotic)	218 (6)	451 (7)	339 (5)	1,008(6)
Caustic agents	45 (1)	93 (1)	47 (1)	185 (1)
Non-ethanol alcohols (toxic, ketones, ethers)	93 (2)	145 (2)	121 (2)	359 (2)
Envenomations	105 (3)	183 (3)	196 (3)	484 (3)
Anti-diabetic	65 (1)	113 (2)	138 (2)	316 (2)
Hydrocarbons	50 (1)	67 (1)	45 (1)	162 (1)
Metal and metalloids	154 (4)	322 (5)	227 (3)	703 (4)
Gases, vapors and irritants	63 (2)	169 (3)	129 (2)	361 (3)
GI	14 (0)	50 (1)	30 (0)	94 (0)
Pulmonary	9 (0)	17 (0)	16 (0)	42 (0)
Endocrine	9 (0)	37 (0)	49 (1)	95 (0)
Chemotherapeutics	5 (0)	20 (0)	12 (0)	37 (0)
Antibiotics, antivirals, antifungals	38 (1)	107 (1)	62 (1)	207 (1)
Herbals, supplements, vitamins	48 (1)	76 (1)	50 (1)	174 (1)
Plants, mushrooms and molds	18 (0)	78 (1)	52 (1)	148 (1)
ADRs	NA (0)	593 (6)	405 (6)	998 (5)
Anesthetic agents local and general	16 (0)	21 (0)	30 (0)	67 (0)
WMD, NBC, Radioactive	0 (0)	7 (0)	4 (0)	121(1)
Total agents involved in consultations	5,774	11,119	10,553	27,556

Cases often included more than one agent class in multi-drug exposures thus total number of drugs is more than the total number of cases per year

The % is of the annual number of cases and not of the total agents involved in consultations, i.e., there were 1,422 sedatives reported in 2012 out of a total of 7,296 cases (sedatives were reported in 20 % of all cases)

Table 7 Top types of toxidrome identified

	2010 N (%)	2011 N (%)	2012 N (%)
Sedative-hypnotic	327 (44)	653 (38)	621 (40)
Anticholinergic	175 (23)	407 (23)	357 (23)
Sympathomimetic syndrome	73	205	200
	73 (10)	205 (12)	200 (13)
Opioid	104 (14)	314 (18)	198 (13)
Serotonin syndrome	54 (14)	147 (8)	163 (10)
Neuroleptic malignant syndrome	9 (1)	7 (0)	17 (1)
Sympatholytic syndrome	0 (0)	2 (0)	6 (0)
Cholinergic	3 (0)	5 (0)	8 (0)
Total cases with toxidromes	745	1,740	1,570

2012, 67 % of consultations involved patients 19–65 years old, 26 % involved pediatric patients ages 18 years or less and 6 % involved patients aged >65 years old. Forty-nine percent of the consultations involved female patients in 2012. Table 4 shows the referral source for medical toxicology consultations. As shown in Table 4, 61 % of consultations came from the emergency department in 2012 and 12 % were transferred from other hospitals to ToxIC sites.

In 2012, 41 % of cases were intentional pharmaceutical exposures, which was the most common reason for the encounter in the Registry. Many cases were coded for more than one reason (e.g. “Intentional Exposure—Pharmaceutical” and “Drug Abuse—Prescription”). Intentional exposures for non-pharmaceuticals were the second most common reason for case encounters (12 %) followed by unintentional exposures with pharmaceuticals (11 %). Drug abuse-related case entries remained a common cause of consultation in 2012 with 10 %

Table 8 Deaths reported to the registry 2012

Case #	Age	Gender	Specific agents involved in fatality
Adults 19–65 years of age			
1	60	F	Hydrocodone, acetaminophen, tramadol and citalopram
2	47	F	Acetaminophen and ethanol
3	20	F	Acetaminophen
4	43	F	Acetaminophen and carbamazepine
5	41	F	Acetaminophen
6	61	F	Acetaminophen, amitriptyline, gabapentin, citalopram and hydrocodone
7	62	F	Amlodipine and metoprolol
8	54	M	Amlodipine, bupropion, quetiapine, lisinopril and acetaminophen
9	58	F	Acetaminophen, aspirin and lamotrigine
10	22	M	Aspirin and ethanol
11	19–65	M	Non-specified benzodiazepines and opioids
12	19–65	F	Clonazepam
13	22	M	Cocaine and amphetamine
14	19–65	F	Digoxin
15	48	F	Diltiazepam, tramadol, gabapentin and zolpidem
16	50	F	Domperidone
17	19–65	F	Doxepin
18	30	M	Ethanol
19	36	M	Ethylene glycol
20	32	F	Ethanol
21	36	M	Fentanyl patch
22	61	M	Gabapentin, ibuprofen, hydroxyzine and paroxetine
23	19–65	M	Heroin
24	28	F	Hydrocodone and ibuprofen
25	42	M	Hydrogen sulfide
26	53	F	Metformin
27	55	M	Metformin
28	41	M	Methadone
29	19–65	M	Methadone
30	19–65	M	Methadone and ethanol
31	19–65	M	Methanol
32	51	M	Naloxone ^a
33	55	F	Acetaminophen
34	20	F	Quetiapine
35	50	F	Quetiapine
36	19–65	F	Sulfasalazine
37	53	F	Temazepam and acetaminophen
38	49	M	Cocaine, trazodone, benztropine, lisinopril, amlodipine, and benzonatate
39	54	M	Unknown meds/drugs
40	60	M	Unknown meds/drugs
41	50	F	Unknown meds/drugs
42	26	M	Unknown meds/drugs
Pediatrics (0–18 years)			
43	<2	M	Morphine
44	<2 (21 months)	F	Unknown meds/drugs
45	2 to 6	M	Unknown meds/drugs
46	2 to 6	F	Unknown meds/drugs
47	16	F	Propranolol

Table 8 (continued)

Case #	Age	Gender	Specific agents involved in fatality
48	13 to 18	F	Unknown meds/drugs
Adults >65 years of age			
49	77	F	Valproic acid
50	>65	M	Paraquat
51	66	F	Unknown meds/drugs
52	66	F	Metformin
53	>65	F	Glimepride, warfarin, KCl, atenolol, citalopram, and diazepam
54	>65	F	Bupropion, buspirone, and clonazepam
55	>65	M	Unknown meds/drugs
56	88	M	Insulin
57	89	M	Amlodipine, metformin, and gabapentin

^a Naloxone was used in the reversal of an opioid overdose in this case in which a precipitated withdrawal appeared to have caused the death

of all cases related to illicit drug abuse. Prescription drug abuse accounted for 5 % of cases in 2012 down from 13 % in 2010. All drug and alcohol abuse or drug and alcohol withdrawal-related consultations combined accounted for 27 % of Registry cases in 2012. Table 5 shows the frequency of medical toxicology consultations sorted by the reason a consultation was obtained.

Sedative-hypnotics and muscle relaxants with 1,422 exposures (20 % of all 2012 entries) were the most common class of agents responsible for medical toxicology consultation. Clonazepam was the most frequently encountered sedative encountered followed by alprazolam. Sedative-hypnotics and muscle relaxants surpassed non-opioid analgesics (20 %) as the most common class of medications encountered during toxicology consultations in 2012. Exposure rates and Registry entries for different exposure classes are included in Table 6. Opioids (16 %) and antidepressants (15 %) were the third and fourth most common agents described in medical toxicology consultation in 2012.

Table 7 features the major types of toxidromes identified in Registry entries by year. In 2012, specific toxidromes were identified in 22 % of all Registry cases entered. A sedative-hypnotic toxidrome was identified in 40 % of the cases identified as having a toxidrome, the anticholinergic toxidromes was identified in 23 %, a sympathomimetic toxidromes in 13 %, an opioid toxidromes in 13 % and serotonin syndrome was described in 10 % of these cases.

During 2012, patient deaths occurred in 57 cases. This is compared to 35 reported deaths in 2011. The 2010 report did not include fatality data. Table 8 further describes the 2012 fatalities by age, gender, and agents reported in consult. Table 9 compares the frequency of specific agents reported for 2011, 2012 and cumulatively. The most common agent identified either as sole drug or in combination with other agents in 2012 deaths, was the non-opioid analgesic acetaminophen which was reported in ten different cases. The next

most frequently cited agent in death cases was ethanol with reported as co-ingestant in five reports followed by amlodipine, gabapentin, and metformin in four cases each. Acetaminophen was reported in three cases as isolated agent and in seven cases along with other agents. Non-opioid analgesics were the most common class of drug cited in death cases. Other common classes included opioids (methadone, hydrocodone, heroin, fentanyl, and tramadol) sedatives (including benzodiazepines, and gabapentin) and cardiovascular medications (amlodipine, digoxin, lisinopril, atenolol, metoprolol, and propranolol). Out of the 57 reported cases, 29 cases involved single drugs, 18 included multiple agents and 10 involved unknown agent or agent combinations.

There were six pediatric fatalities with one in the 13–18 years range with unknown agents ingested and another 16-year-old female ingesting propranolol. There were two death cases in the 2–6-year-old age group with unknown agents involved and two cases reported occurring in children less than 2 years of age. One of these was due to accidental morphine ingestion and the other was from unknown agents. The rest of the fatalities were in adults with 7 involving individuals >65 years old and 44 cases occurring in the 19–65 year-old age range. Fifty-four percent (31 of 57) of fatality cases were in women compared to 2011 where females were reported in just one third (14 of 35) of death cases.

In 2012, intentional exposure to pharmaceutical agents was the most common method of exposure associated with death with 25 reports followed by unintentional exposure to pharmaceuticals with 11. Illicit drug abuse was reported twice and prescription drug abuse was reported three times in the fatality cases. Adverse Drug Reactions resulting in death also occurred; in fact, three out of the four metformin deaths were cited due to adverse drug reactions (ADRs).

Sedative-hypnotic and muscle relaxant agents are shown in Table 10. Agents in these classes involved 13 % of all agents and 20 % of all the cases that were entered into ToxIC in 2012.

Table 9 Registry top causes of death

	2011 N	2012 N	Total N
Acetaminophen (alone or in formulation)	6	10	16
Alprazolam	1	0	1
Ethanol	0	5	5
Amlodipine	2	4	6
Gabapentin	0	4	4
Metformin	2	4	6
Citalopram	0	3	3
Cyclobenzaprine	1	0	1
Hydrocodone	0	3	3
Methadone	1	3	4
Quetiapine	1	3	4
Aspirin	0	2	2
Bupropion	0	2	2
Clonazepam	0	2	2
Cocaine	0	2	2
Ibuprofen	0	2	2
Lisinopril	0	2	2
Quetiapine	0	2	2
Tramadol	0	2	2
Amityriptyline	0	1	1
Amphetamine	1	1	2
Atenolol	0	1	1
Benzonatate	0	1	1
Benztropine	0	1	1
Brompheniramine	1	0	1
Bupropion	1	0	1
Buspirone	0	1	1
Carbamazepine	0	1	1
Carbon Monoxide	6	0	6
Clonidine	1	0	1
Codeine	1	0	1
Dextromethorphan	1	0	1
Diazepam	1	1	2
Digoxin	1	1	2
Diltiazem	0	1	1
Diphenhydramine	3	0	3
Domperidone	0	1	1
Doxepin	0	1	1
Ethylene Glycol	1	1	2
Fentanyl (patch)	0	1	1
Glimepride	0	1	1
Guaifenesin	1	0	1
Heroin	3	1	4
Hydrogen sulfide	0	1	1
Hydroxyzine	0	1	1
Insulin	0	1	1
Lamotrigine	2	1	3
Lithium	1	0	1
Melatonin	1	0	1

Table 9 (continued)

	2011 N	2012 N	Total N
Methanol	1	1	2
Methylphenidate	1	0	1
Metoprolol	1	1	2
Morphine	1	1	2
Naloxone (<i>precipitated w/d</i>)	0	1	1
Nebivolol	1	0	1
Non-specific benzodiazepine	0	1	1
Non-specific opioid	0	1	1
Oxycodone	5	0	5
Paraquat	0	1	1
Paroxetine	0	1	1
Potassium Chloride (KCl)	0	1	1
Pregabalin	1	0	1
Propranolol	0	1	1
Psychoactive Bath Salts	1	0	1
Sitagliptin	1	0	1
Sulfasalazine	0	1	1
Temazepam	0	1	1
Trazodone	0	1	1
Valproic acid	0	1	1
Warfarin	0	1	1
Zolpidem	0	1	1
Unknown agent(s)	4	10	14

Benzodiazepines accounted for 54 % of cases in this category. Among the benzodiazepines, the most common was clonazepam, identified in 31 % of all benzodiazepine entries and 17 % of total sedative-hypnotics and muscle relaxants, followed by alprazolam in 26 %, lorazepam in 19 %, and diazepam in 9 % of the benzodiazepine entries for 2012. Zolpidem (8 %) and gabapentin (8 %) were the most common non-benzodiazepine sedative-hypnotic exposure in 2012. Muscle relaxants accounted for 21 % of the cases in this category while within the muscle relaxants group cyclobenzaprine encountered most frequently (45 %) of the muscle relaxants followed by carisoprodol (29 %) and baclofen (18 %).

Non-opioid analgesic agents are reported in Table 11. Acetaminophen was again the most common non-opioid analgesic reported in 2012 reported in 67 % of all non-opioid analgesic agent entries. Acetaminophen was reported in 12 % of all Registry cases in 2012. Salicylates (18 %) and non-salicylate non-steroidal anti-inflammatory agents (NSAIDs) made up the rest of this category (15 %). Ibuprofen was the most common NSAID reported (12 %) followed by naproxen (2 %). Aspirin was responsible for nearly all the salicylate entries again in 2012.

Table 12 shows the antidepressant agents. The most frequently encountered antidepressant in 2012 was trazodone

Table 10 Sedative-hypnotics/muscle relaxant agents

	Agent	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
Benzodiazepines	Clonazepam	180 (21)	262 (18)	242 (17)	684 (18)
	Alprazolam	145 (17)	253 (17)	204 (14)	602 (16)
	Lorazepam	102 (12)	159 (11)	147 (10)	408 (11)
	Diazepam	38 (5)	81 (5)	73 (5)	192 (5)
	Unspecified BZDs	0 (0)	62 (4)	59 (4)	121 (3)
	Temazepam	17 (2)	34 (2)	27 (2)	78 (2)
	Midazolam	3 (0)	10 (1)	5 (0)	18 (0)
	Chlordiazepoxide	3 (0)	4 (0)	4 (0)	11 (0)
	Triazolam	0 (0)	4 (0)	0 (0)	4 (0)
	Chlorazepate	1 (0)	3 (0)	2 (0)	6 (0)
	Flurazepam	0 (0)	2 (0)	0 (0)	2 (0)
	Brotizolam	0 (0)	1 (0)	1 (0)	2 (0)
	Oxazepam	0 (0)	1 (0)	5 (0)	6 (0)
	Flunitrazepam	0 (0)	0 (0)	1 (0)	1 (0)
Subtotal—benzodiazepine agents		489 (58)	876 (54)	770 (54)	2135 (57)
Muscle relaxants	Cyclobenzaprine	66 (8)	118 (8)	135 (9)	319 (9)
	Carisoprodol	48 (6)	94 (6)	88 (6)	230 (6)
	Baclofen	25 (3)	43 (3)	53 (4)	121 (3)
	Methocarbamol	5 (0)	9 (0)	4 (0)	18 (0)
	Metaxalone	0 (0)	5 (0)	6 (0)	11 (0)
	Chlorzoxazone	0 (0)	1 (0)	1 (0)	2 (0)
	Orphenadrine	2 (0)	0 (0)	1 (0)	3 (0)
	Tizanidine	4 (0)	0 (0)	7 (0)	11 (0)
	Unknown muscle relaxant	0 (0)	0 (0)	4 (0)	4 (0)
Subtotal—muscle relaxant agents		150 (18)	270 (18)	299 (21)	715 (19)
Barbiturates	Butalbital	25 (3)	34 (2)	34 (2)	93 (2)
	Phenobarbital	12 (1)	19 (1)	17 (1)	48 (1)
	Unknown Barbiturate	0 (0)	6 (0)	5 (0)	11 (0)
	Butabarbital	0 (0)	2 (0)	0 (0)	2 (0)
	Pentobarbital	0 (0)	1 (0)	0 (0)	1 (0)
	Secobarbital	0 (0)	0 (0)	1 (0)	1 (0)
Subtotal—barbiturate agents		37 (4)	65 (4)	57(4)	156 (4)
Z-drugs (non-benzodiazepine GABA-a Agonists)	Zolpidem	80 (10)	132 (9)	118 (8)	330 (9)
	Eszopiclone	7 (1)	5 (0)	6 (0)	18 (0)
	Zaleplon	1 (0)	1 (0)	0 (0)	2 (0)
	Zopiclone	10 (1)	1 (0)	6 (0)	17 (0)
Subtotal—z drugs or non-benzodiazepine GABA-A agonists		98 (12)	139	130 (9)	367 (10)
Other sedatives	Gabapentin	43 (5)	89 (6)	117 (8)	249 (7)
	Pregabalin	11 (1)	15 (1)	19 (1)	45 (1)
	Buspirone	5 (1)	32 (2)	25 (2)	62 (2)
	Meprobamate	1 (0)	4 (0)	1 (0)	6 (0)
	Aminobutyric acid	0 (0)	1 (0)	0 (0)	1 (0)
	Chloral hydrate	1 (0)	1 (0)	2 (0)	4 (0)
	Dichloralphenazone	1 (0)	0 (0)	1 (0)	2 (0)
	Ramelteon	1 (0)	0 (0)	1 (0)	2 (0)
	Unknown or other sedatives	0 (0)	3 (0)	0 (0)	1 (0)
Subtotal—other sedative agents		98 (12)	145 (10)	166 (12)	374 (10)
Totals sedative-hypnotics/muscle relaxant agents		837	1,492	1,422	3,751

% is from the total number in the overall agent class unless otherwise noted in the text (i.e., clonazepam is 31 % of all benzodiazepines but 17 % of the total number of sedative-hypnotics and muscle relaxants included in Table 9)

Table 11 Non-opioid analgesics

	Agent	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
NSAIDS	Acetaminophen	602 (70)	903 (64)	863 (67)	2368 (66)
	Ibuprofen	82 (10)	154 (11)	157 (12)	393 (11)
	Naproxen	21 (2)	35 (2.5)	30 (2)	86 (2)
	Diclofenac	0 (0)	6 (0)	5 (0)	11 (0)
	Unidentified	0 (0)	3 (0)	5 (0)	8 (0)
	Celecoxib	0 (0)	3 (0)	0 (0)	3 (0)
	Indomethacin	1 (0)	2 (0)	0 (0)	3 (0)
	Nabumetone	2 (0)	2 (0)	1 (0)	5 (0)
	Ketoprofen	0 (0)	1 (0)	1 (0)	2 (0)
	Ketorolac	0 (0)	1 (0)	0 (0)	1 (0)
	Meloxicam	0 (0)	1 (0)	1 (0)	2 (0)
	Etodolac	2 (0)	0 (0)	2 (0)	4 (0)
	Flurbiprofen	1 (0)	0 (0)	0 (0)	1 (0)
	Piroxicam	1 (0)	0 (0)	0 (0)	1 (0)
	Sulindac	0 (0)	0 (0)	2 (0)	2 (0)
Mefenamic acid	0 (0)	0 (0)	1 (0)	1 (0)	
Salicylates	Acetylsalicylic acid	137 (15)	247 (17)	192 (15)	576 (16)
	Unspecified/other salicylates	0 (0)	60 (4)	35 (3)	95 (3)
Other	Ziconotide	1 (0)	3 (0)	0 (0)	4 (0)
Total		850	1,421	1,295	3,566

Table 12 Antidepressant agents

	Agent	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
SSRIs	Citalopram	106 (14)	142 (15)	125 (12)	373 (14)
	Escitalopram	23 (3)	38 (3)	46 (4)	107 (4)
	Fluoxetine	43 (4)	80 (8)	57 (5)	180 (7)
	Paroxetine	35 (5)	32 (4)	27 (3)	94 (3)
	Sertraline	47 (4)	67 (7)	85 (8)	199 (7)
	Fluvoxamine	2 (0)	6 (1)	4 (0)	12 (0)
	Vilazodone	0 (0)	0 (0)	2 (0)	2 (0)
	Unspecified SSRI	2 (0)	6 (1)	11 (1)	19 (1)
	Subtotal SSRIs		258 (39)	371 (36)	357 (34)
SNRIs	Venlafaxine	37 (5)	84 (8)	72 (7)	193 (7)
	Duloxetine	24 (3)	42 (4)	45 (4)	111 (4)
	Desvenlafaxine	5 (1)	7 (1)	11 (1)	23 (1)
	Milnacipran	0 (0)	1 (0)	2 (0)	3 (0)
Subtotal SNRIs		66 (10)	134 (13)	130 (13)	330 (12)
Tricyclics	Amitriptyline	95 (14)	114 (11)	123 (12)	332 (12)
	Nortriptyline	19 (3)	15 (1)	17 (2)	51 (2)
	Doxepin	10 (1)	27 (2)	46 (4)	83 (3)
	Imipramine	6 (1)	7 (1)	0 (0)	13 (0)
	Clomipramine	1 (0)	4 (0)	2 (0)	7 (0)
	Unspecified TCA	1 (0)	6 (1)	0 (0)	7 (0)
	Subtotal TCAs		132 (20)	173 (17)	188 (18)
Atypical	Bupropion	99 (14)	162 (15)	157 (15)	418 (15)
	Mirtazapine	10 (1)	46 (4)	45 (4)	101 (4)
	Nefazodone	1 (0)	0 (0)	0 (0)	1 (0)
	Trazodone	90 (13)	135 (13)	161 (15)	386 (14)
Subtotal atypicals		200 (30)	343 (34)	363 (35)	906 (33)
MAOIs	Phenelzine	3 (0)	1 (0)	0 (0)	4 (0)
	Tranylcypromine	0 (0)	1 (0)	1 (0)	2 (0)
Subtotal MAOIs		3 (0)	2 (0)	1 (0)	6 (0)
Totals		659	1,023	1,039	2,721

(15 %) followed by bupropion (15 %), amitriptyline (12 %) and citalopram (12 %). Selective serotonin reuptake inhibitors (SSRIs) were the most common class of antidepressant reported (34 %) followed by tricyclic antidepressants (TCAs) (18 %) and serotonin–norepinephrine reuptake inhibitors (SNRIs) (13 %). Amitriptyline was the most common of the TCAs and venlafaxine was the most common SNRIs (7 %) in 2012.

Opioids and opiates accounted for 1,086 entries in 2012 (Table 13). The most common category was the semisynthetic opioid agents with 55 % of all opioid entries. Oxycodone was the most common semisynthetic opioid reported in 2012 accounting for 40 % of all semisynthetic opioids. Oxycodone was also the most common opioid overall in 2012 reported in 22 % of all opioid agent entries. The synthetics, with methadone, tramadol, and fentanyl topping the list, made up 29 % of the opioid agents in 2012. Methadone was the most common synthetic opioid accounting for 14 % of total opioid agent entries and 46 % of all synthetic opioid entries. Tramadol was reported in 10 % of opioid-related entries. Buprenorphine, the

Table 13 Opioid analgesic agents

	Agents	2010 (%)	2011 (%)	2012 (%)	Total (%)
Opiates	Morphine	37 (5)	56 (5)	69 (6)	162 (6)
	Codeine	23 (3)	12 (1)	22 (3)	57 (2)
	Opium tincture	0 (0)	1 (0)	1 (0)	2 (0)
Semisynthetic opioids	Oxycodone	142 (23)	252 (23)	238 (22)	632 (22)
	Hydrocodone	110 (18)	160 (15)	136 (13)	406 (14)
	Heroin	61 (10)	134 (12)	137 (13)	332 (12)
	Buprenorphine	20 (3)	49 (4)	50 (5)	119 (4)
	Hydromorphone	14 (2)	24 (2)	23 (2)	61 (2)
	Oxymorphone	2 (0)	11 (1)	10 (1)	23 (1)
Synthetic opioids	Methadone	98 (16)	155 (14)	147 (14)	400 (14)
	Tramadol	49 (8)	98 (9)	104 (10)	251 (9)
	Fentanyl	36 (6)	50 (5)	46 (4)	132 (5)
	Propoxyphene	19 (3)	12 (1)	7 (1)	38 (1)
	Meperidine	2 (0)	3 (0)	3 (0)	8 (0)
	Loperamide	0 (0)	1 (0)	2 (0)	3 (0)
	Sufentanil	0 (0)	1 (0)	1 (0)	2 (0)
	Tapentadol	1 (0)	1 (0)	7 (1)	9 (0)
	Diphenoxylate	1 (0)	0 (0)	0 (0)	1 (0)
	Pentazocine	1 (0)	0 (0)	1 (0)	2 (0)
Unspecified opiates	19 (0)	34 (2)	66 (6)	119 (4)	
Opioid antagonists ^a	Naloxone	9 (1)	42 (4)	14 (1)	65 (2)
	Naltrexone	0 (0)	4 (0)	2 (0)	6 (0)
Totals		644	1,100	1,086	2,830

^a Opioid antagonist when not in use specifically as an antidote (i.e., when used as part of an addiction therapy program such as naltrexone for alcohol or opioid addiction, or when an adverse event occurs during the use of diverted or injected Suboxone™)

Table 14 Antihistamine and anticholinergic agents

Agents		2010 (%)	2011 (%)	2012 (%)	Total (%)
Antihistamines	Diphenhydramine	234 (65)	299 (60)	229 (50)	762 (58)
	Hydroxyzine	34 (9)	62 (12)	59 (13)	155 (12)
	Chlorpheniramine	11 (3)	27 (5)	22 (5)	60 (5)
	Prochlorperazine	3 (1)	7 (1)	5 (1)	15 (1)
	Pyrilamine	1 (0)	6 (1)	6 (1)	13 (1)
	Cetirizine	3 (1)	5 (1)	6 (1)	14 (1)
	Dimenhydrinate	5 (1)	5 (1)	2 (0)	12 (1)
	Loratidine	3 (1)	5 (1)	4 (1)	12 (1)
	Meclizine	4 (1)	4 (1)	3 (1)	11 (1)
	Promethazine	10 (3)	4 (1)	31 (7)	45 (3)
	Brompheniramine	0 (0)	3 (1)	3 (1)	6 (0)
	Cyproheptadine	1 (0)	3 (1)	9 (2)	13 (1)
	Fexofenadine	1 (0)	2 (0)	3 (1)	6 (0)
	Pheniramine	11 (3)	2 (0)	1 (0)	14 (1)
	Unspecified	1 (0)	23 (5)	18 (4)	42 (3)
Total antihistamines		322 (90)	457 (91)	401 (88)	1180 (90)
Anticholinergic agents	Benztropine	21 (6)	21 (4)	30 (7)	72 (5)
	Hyoscyamine	3 (1)	7 (1)	5 (1)	15 (1)
	Oxybutinin	3 (1)	6 (1)	2 (0)	11 (1)
	Tolterodine	0 (0)	4 (1)	0 (0)	4 (0)
	Atropine	3 (1)	2 (0)	3 (1)	8 (1)
	Donnatol	1 (0)	2 (0)	1 (0)	4 (0)
	Scopolamine	2 (0)	2 (0)	3 (1)	7 (1)
	Clidinium	0 (0)	1 (0)	0 (0)	1 (0)
	Dicyclomine	0 (0)	1 (0)	7 (2)	8 (1)
	Fesoterodine	0 (0)	1 (0)	0 (0)	1 (0)
	Glycopyrrolate	1 (0)	1 (0)	1 (0)	3 (0)
	Trihexyphenidyl	2 (0)	0 (0)	4 (0)	6 (0)
	Totals anticholinergic agents		36 (10)	48 (9)	56 (12)
Totals		358	505	457	1,320

partial agonist used in the treatment of opioid-dependence (often simply referred to as Suboxone™ which is the most common formulation containing buprenorphine) was reported in just fewer than 5 % of all opioid entries again in 2012. Heroin use remained high in 2012 with 13 % of cases involving opioid agents due to heroin. There were 137 heroin-related entries in 2012 up from 134 in 2011.

Table 14 shows the antihistamine and anticholinergic agents with 457 cases involving agents from this class reported in 2012. Diphenhydramine was the most common antihistamines and anticholinergic agents in 2012 (50 %) followed by hydroxyzine (13 %), benztropine (7 %), and promethazine (7 %).

Cardiovascular agents are listed in Tables 15 and 16. Antihypertensive agents are included in Table 15 and anticoagulant, antiplatelet and antilipid agents are included in Table 16. The most common categories of cardiovascular agents included the beta blockers (27 %), sympatholytics which were

primarily clonidine (19 %), calcium channel antagonists (18 %), cardiac glycosides (9 %) and angiotensin-converting enzyme (ACE) inhibitors (7 %). Propranolol was the most common beta blocker in 2012, accounting for 37 % of all beta blocker entries. Metoprolol (36 %) was reported with nearly the same frequency. The most common sympatholytic was clonidine, which accounted for nearly three quarters (72 %) of the sympatholytic cases. The most common calcium channel antagonist was amlodipine (44 %) followed by diltiazem (27 %) and verapamil (20 %). Digoxin was specified in 98 % of the cardiac glycoside entries and the most common ACE inhibitor reported was lisinopril (87 %). Hydrochlorothiazide was the most common diuretic reported (50 %) followed by furosemide (29 %). Simvastatin was the most common antilipid agent (35 %) and warfarin (67 %) was the most common anticoagulant encountered. Dabigatran was reported in 15 % of anticoagulant entries in 2012.

Table 17 shows agents reported as stimulants and sympathomimetics. While there had been a large increase in these agents from 2010 to 2011 the 2012 data remained stable compared to 2011. Amphetamines and stimulant-type attention-deficit hyperactivity disorder (ADHD) disorder type medications as well as designer amphetamines including mephedrone, methylenedioxypyrovalerone (MDPV) and other amphetamines often referred to as “psychoactive bath salts” are included in Table 17. Cocaine remains the most common stimulant reported in 2012 (32 %) followed by methamphetamine (11 %), amphetamine (11 %), caffeine (10 %), and methylphenidate (8 %). Psychoactive bath salts and designer amphetamines represented 6 % of the stimulant entries with methylenedioxymethylamphetamine (MDMA) being the most common (4 %) followed by mephedrone (2 %). “Other” designer amphetamines and psychoactive bath salts (including unidentified recreational stimulants identified as bath salts) accounted for 6 % of all stimulant cases.

Agents classified as psychoactive drugs are included in Table 18. In 2012, marijuana and dextromethorphan were both reported in 29 % of the entries with psychoactive agents reported. Synthetic cannabinoid use (i.e., K2 or Spice) remained flat and was reported in 11 % of all cases involving psychoactive agents. While an overall small number LSD cases were reported (18 times in 2012 accounting for 4 % of psychoactive agent entries) this is markedly up from a single entry for LSD in 2011. Phencyclidine was reported in 95 entries (21 %) up from 57 (16 %) the previous year.

Table 19 shows the number of cases involving ethanol. Cases involving ethanol increased from 2011 to 2012. Ethanol was reported 850 times in 2012 up from 580 in 2011.

Table 20 shows the antipsychotic agent exposures. The atypical antipsychotics were the most common type of antipsychotic reported with 88 % of all antipsychotic entries involving atypical agents. Quetiapine was the most common

Table 15 Cardiovascular agents (% is of each individual agent group (i.e., metoprolol is % of all beta blockers, amlodipine is % of all CCA))

	Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)	
Beta blocker agents	Metoprolol	31 (42)	62 (47)	55 (36)	148 (41)	
	Propranolol	16 (22)	31 (23)	57 (37)	104 (29)	
	Atenolol	25 (34)	28 (21)	34 (22)	87 (24)	
	Nebivolol	0 (0)	2 (2)	3 (2)	5 (1)	
	Nadolol	1 (1)	4 (3)	2 (1)	7 (2)	
	Betaxolol	1 (1)	2 (2)	0 (0)	3 (1)	
	Bisoprolol	0 (0)	2 (2)	0 (0)	2 (1)	
	Sotolol	0 (0)	2 (2)	2 (1)	4 (1)	
	Unspecified beta blocker	0 (0)	0 (0)	1 (1)	1 (0)	
Total beta blocker agents		74 (24)	133 (23)	154 (27)	361 (25)	%Total
Combined alpha-beta blocking agents	Carvedilol	10 (91)	16 (73)	22 (69)	48 (74)	
	Labetolol	1 (9)	6 (27)	10 (31)	17 (26)	
Total combined alpha-beta blocking agents		11 (4)	22 (4)	32 (6)	65 (4)	%Total
Calcium channel antagonist agents	Amlodipine	27 (47)	47 (40)	45 (44)	119 (43)	
	Diltiazepam	12 (21)	26 (22)	28 (27)	66 (24)	
	Verapamil	13 (23)	33 (28)	20 (20)	66 (24)	
	Nifedipine	4 (7)	9 (8)	8 (8)	21 (8)	
	Nicardepine	0 (0)	2 (2)	0 (0)	2 (1)	
	Felodipine	1 (2)	0 (0)	0 (0)	1 (0)	
	Unspecified calcium channel antagonist	0 (0)	0 (0)	1 (1)	1 (0)	
Total calcium channel antagonists		57 (18)	117 (20)	102 (18)	276 (19)	%Total
Cardiac glycosides	Digoxin	35 (100)	55 (98)	50 (98)	140 (99)	
	Digitoxin	0 (0)	1 (1)	0 (0)	1 (0)	
	Unspecified cardiac glycoside	0 (0)	0 (0)	1 (2)	1 (0)	
Total cardiac glycosides		35 (11)	56 (10)	51 (9)	142 (10)	%Total
Ace inhibitor agents	Lisinopril	35 (90)	49 (86)	34 (87)	118 (87)	
	Enalapril	3 (8)	1 (2)	3 (8)	7 (5)	
	Ramipril	0 (0)	2 (4)	1 (3)	3 (2)	
	Quinapril	1 (2)	0 (0)	1 (3)	2 (1)	
	Benazepril	0 (0)	3 (5)	0 (0)	3 (2)	
	Captopril	0 (0)	1 (2)	0 (0)	1 (1)	
	Fosinopril	0 (0)	1 (2)	0 (0)	1 (1)	
Total ace inhibiting agents		39 (13)	57 (10)	39 (7)	135 (9)	%Total
Angiotensin receptor blockers (ARBs)	Valsartan	2 (67)	8 (73)	5 (30)	15 (50)	
	Losartan	0 (0)	0 (0)	5 (30)	5 (17)	
	Candesartan	0 (0)	0 (0)	3 (19)	3 (10)	
	Olmesartan	1 (33)	1 (9)	2 (13)	4 (13)	
	Irbesartan	0 (0)	1 (9)	1 (6)	2 (7)	
	Eprosartan	0 (0)	1 (9)	0 (0)	1 (3)	
	Total Angiotensin receptor blockers (ARBs)		3 (1)	11 (2)	16 (3)	30 (2)
Vasodilating agents (nitrates and other vasodilators)	Hydralazine	1 (25)	3 (30)	7 (54)	11 (41)	
	Isosorbide	1 (25)	1 (10)	2 (15)	4 (15)	
	Nitroglycerin	0 (0)	4 (40)	1 (8)	5 (19)	
	Nitroprusside	1 (25)	1 (10)	1 (8)	3 (11)	
	Isosorbide mononitrate	0 (0)	0 (0)	0 (0)	0 (0)	
	Unspecified nitrate	0 (0)	0 (0)	1 (8)	1 (4)	
	Minoxidil	1 (25)	1 (10)	1 (8)	3 (11)	
Total vasodilating agents		4 (1)	10 (2)	13 (2)	27 (2)	%Total
Alpha-1 antagonists	Prazosin	2 (33)	3 (27)	5 (25)	10 (27)	
	Terazosin	0 (0)	3 (27)	4 (20)	7 (19)	
	Doxazosin	0 (0)	1 (91)	4 (20)	5 (14)	
	Alfuzosin	1 (17)	0 (0)	0 (0)	1 (3)	

Table 15 (continued)

	Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)	
Total alpha-1 antagonists	Tamsulosin	3 (50)	4 (36)	7 (35)	14 (38)	
		6 (2)	11 (2)	20 (4)	37 (3)	%Total
Sympatholytics	Clonidine	63 (90)	93 (85)	81 (76)	237 (83)	
	Guanfacine	7 (10)	17 (15)	24 (23)	48 (17)	
	Dexmedetomidine	0 (0)	0 (0)	1 (1)	1 (0)	
Total sympatholytics		70 (23)	110 (19)	106 (19)	286 (20)	%Total
Antiarrhythmics	Amiodarone	1 (100)	0 (0)	1 (17)	2 (14)	
	Dofetilide	0 (0)	1 (14)	1 (17)	2 (14)	
	Flecainide	0 (0)	2 (29)	2 (33)	4 (29)	
	Propafenone	0 (0)	1 (14)	0 (0)	1 (7)	
	Quinidine	0 (0)	1 (14)	0 (0)	1 (7)	
	Sotalol	0 (0)	2 (29)	2 (33)	4 (29)	
Total antiarrhythmics		1 (0)	7 (1)	6 (1)	14 (1)	%Total
Diuretics	Hydrochlorothiazide	8 (73)	25 (61)	12 (50)	45 (59)	
	Furosemide	0 (0)	8 (20)	7 (29)	15 (20)	
	Acetazolamide	1 (9)	0 (0)	2 (8)	3 (4)	
	Chlorothalidone	0 (0)	1 (2)	2 (8)	3 (4)	
	Spiroglactone	0 (0)	3 (7)	1 (4)	4 (5)	
	Torsemide	1 (9)	1 (2)	0 (0)	2 (3)	
	Triamterene	1 (9)	3 (7)	0 (0)	4 (5)	
Total diuretics		11 (4)	41 (7)	24 (4)	76 (5)	%Total
Totals all Antihypertensives + arrhythmics		311	575	563	1,449	

atypical antipsychotic reported (48 %) followed by risperidone (13 %), olanzapine (11 %), and aripiprazole (9 %). Haloperidol was reported in 6 % of antipsychotic entries. The most common phenothiazine reported was chlorpromazine (3 %).

Lithium was listed separately from the antipsychotics and anticonvulsant mood stabilizers in Table 21. Lithium was reported 133 times in 2012 up from 100 the previous year.

Table 22 includes the anticonvulsant and non-antipsychotic mood stabilizing agents (excluding lithium). Valproic acid (28 %) followed by lamotrigine (27 %) were the most common two agents from this class in 2012. Lamotrigine increased accounting for 27 % of reports involving anticonvulsants and non-antipsychotic mood stabilizing agents in 2012 up from 19 % in 2011. Phenytoin was encountered much less frequently in 2012 making up 11 % of entries in 2012 down from 25 % in 2011.

Table 23 includes the gastrointestinal (GI) agents. Omeprazole (25 %) followed by ondansetron (18 %) were the two most common GI agents reported in 2012.

Anti-diabetic agents are shown in Table 24 with sulfonylureas (28 %), metformin (28 %), and insulins (19 %) the most frequent types of anti-diabetic agents reported.

Guaifenesin (38 %) followed by albuterol (25 %) were the most common pulmonary agents reported in 2012 described in Table 25. Endocrine agents are described in Table 26, chemotherapeutic agents in Table 27 and antibiotics in

Table 16 Cardiovascular agents II—antilipid, anticoagulant, antiplatelet

Agent type	Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)	
Anticoagulant	Warfarin	11 (92)	25 (47)	22 (67)	58 (43)	
	Dabigatran	0 (0)	1 (3)	5 (15)	6 (4)	
	Enoxaparin	1 (8)	1 (3)	2 (6)	4 (3)	
	Dalteparin	0 (0)	0 (0)	2 (6)	2 (1)	
	Fondaparinux	0 (0)	2 (6)	0 (0)	2 (1)	
	Rivaroxaban	0 (0)	0 (0)	2 (6)	2 (1)	
	Unspecified anticoagulants	0 (0)	1 (3)	0 (0)	1 (1)	
Total anticoagulants		12 (55)	30 (50)	33 (62)	75 (55)	% of total
Antiplatelets	Argatroban	0 (0)	1 (2)	0 (0)	1 (1)	
	Clopidogrel	0 (0)	4 (7)	3 (10)	7 (87)	
Total antiplatelets		0 (0)	5 (8)	3 (6)	8 (6)	% of total
Antilipids	Simvastatin	5 (23)	14 (23)	6 (11)	25 (47)	
	Lovastatin	0 (0)	3 (2)	1 (2)	4 (3)	
	Atorvastatin	1 (5)	3 (2)	3 (6)	7 (5)	
	Pravastatin	1 (5)	1 (1)	1 (2)	3 (2)	
	Rosuvastatin	1 (5)	2 (2)	2 (4)	5 (4)	
	Ezetimibe	0 (0)	1 (1)	0 (0)	1 (1)	
	Fenofibrate	1 (5)	1 (1)	3 (6)	5 (4)	
Gemfibrozil	1 (5)	1 (1)	1 (2)	3 (2)		
Total antilipids		10 (45)	26 (43)	17 (32)	53 (39)	% of total
Total antilipid, anticoagulant, antiplatelet—CV agents B		22	61	53	136	

Table 17 Stimulant and sympathomimetic agents

	Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)	
Amphetamine derivatives	Amphetamine	40 (13)	141 (18)	73 (11)	254 (14)	
	Methamphetamine	38 (13)	70 (9)	74 (11)	182 (10)	
	Dextroamphetamine	26 (9)	35 (6)	43 (6)	104 (6)	
	Lisdexamfetamine	6 (2)	12 (2)	12 (2)	30 (2)	
	Pseudoephedrine	7 (2)	10 (2)	13 (2)	30 (2)	
	Ephedrine	0 (0)	1 (0)	2 (0)	3 (0)	
	Phenylephrine	4 (1)	14 (2)	9 (1)	27 (2)	
	Benzphetamine	0 (0)	0 (0)	1 (0)	1 (0)	
Psychoactive bath salts and designer amphetamines	MDPV	0 (0)	14 (2)	4 (1)	18 (1)	
	Mephedrone	1 (0)	49 (6)	16 (2)	66 (4)	
	MDMA	12 (4)	14 (2)	30 (4)	56 (3)	
	MDE	0 (0)	0 (0)	1 (0)	1 (0)	
	2CI (2,5-dimethoxy-4-iodophenethylamine)	0 (0)	0 (0)	1 (0)	1 (0)	
	MEC	0 (0)	0 (0)	1 (0)	1 (0)	
	Desoxypradol	0 (0)	1 (0)	0 (0)	1 (0)	
	Alpha-pyrrolidinovalerophenone	1 (0)	0 (0)	4 (1)	5 (0)	
	NBOME compounds	0 (0)	0 (0)	1 (0)	1 (0)	
	Other bath salt, cathinone, designer stimulant	Other	2 (1)	40 (5)	44 (6)	86 (5)
Other stimulants	Cocaine	102 (33)	237 (31)	221 (32)	560 (32)	
	Caffeine	31 (11)	67 (9)	66 (10)	164 (9)	
	Methylphenidate	24 (8)	34 (4)	52 (8)	110 (6)	
	Atomoxetine	2 (1)	6 (1)	14 (2)	22 (1)	
	Dexmethylphenidate	2 (1)	3 (0)	4 (1)	9 (1)	
	Phentermine	2 (1)	2 (0)	2 (0)	6 (0)	
	Ethylphenidate	0 (0)	1 (0)	0 (0)	1 (0)	
	Isometheptene	1 (0)	1 (0)	1 (0)	3 (0)	
	Modafinil	1 (0)	3 (0)	1 (0)	5 (0)	
	Methylhexanamine	0 (0)	2 (0)	0 (0)	2 (0)	
	Unspecified stimulant	0 (0)	4 (1)	2 (0)	6 (0)	
	Totals all stimulant agents		302	761	692	1,755

Table 18 Psychoactive agents including dextromethorphan. Cannabinoids (THC and synthetics), DXM, GHB, dissociatives, and hallucinogens

	Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)
Cannabinoids	Marijuana or other cannabis product	27 (20)	123 (34)	135 (29)	285 (30)
	Synthetic (K2)	11 (8)	40 (11)	50 (11)	101 (11)
	Pharmaceutical THC (i.e., dronabinol)	0 (0)	1 (0)	2 (0)	3 (0)
Dissociatives	Dextromethorphan	65 (46)	120 (34)	132 (29)	317 (33)
	Phencyclidine (PCP)	22 (16)	57 (16)	95 (21)	174 (18)
	Ketamine	1 (0)	2 (0)	4 (1)	7 (1)
	Methoxetamine	0 (0)	0 (0)	2 (2)	2 (0)
Hallucinogens	LSD	6 (1)	4 (1)	18 (4)	28 (3)
	Dimethyltryptamine or other tryptamines	0 (0)	1 (0)	6 (1)	7 (1)
Gammhydroxybutyrate (GHB) and related agents	GHB	0 (0)	4 (1)	10 (2)	14 (1)
	1,4 BD	1 (0)	1 (0)	0 (0)	2 (0)
	GBL	1 (0)	0 (0)	1 (0)	2 (0)
Other psychoactive agents	Ibogain	0 (0)	0 (0)	1 (0)	1 (0)
	<i>Salvia divinorum</i>	0 (0)	4 (1)	1 (0)	5 (1)
Psychoactive plants ingested recreationally	<i>Argyrea nervosa</i> (Hawaiian baby woodrose seeds)	0 (0)	0 (0)	1 (0)	1 (0)
	<i>Datura stramonium</i> (jimson weed)	1 (0)	0 (0)	2 (0)	3 (0)
Totals all psychoactives		135	357	460	952

Table 19 Ethanol

Agent	2010	2011	2012	Total
Ethanol and alcoholic beverages	371	580	850	1,801

Table 28. Anesthetic agents including local and general anesthetics are included in Table 29.

The non-ethanol alcohols including the “toxic” alcohols ethylene glycol and methanol are included in Table 30. Ethylene glycol was reported in 51 % followed by isopropyl alcohol (26 %), acetone (6 %) and methanol (5 %).

Table 31 includes cases involving hydrocarbons. The most common hydrocarbon agents reported were gasoline (11 %) and benzene (11 %). A total of 45 hydrocarbon exposures were reported in 2012.

Table 32 shows the number of cases involving metals and metalloids. Lead (22 %) surpassed iron (18 %) as the most common metal type reported in 2012. Mercury (15 %), cobalt (10 %), and chromium (9 %) were common metal and metalloid agents reported in 2012.

Table 33 shows the gas, vapors, dust, and irritant agents. Carbon monoxide was the most common reported agent in this class again in 2012 with 80 entries (67 %). Chlorine (6 %)

Table 21 Lithium

Agent	2010	2011	20	12 Total
Lithium	78	100	133	311

and cyanide exposure (4 %) were the two next most common gas exposures in 2012.

Table 34 shows caustic agent entries. Acids made up 26 % of caustic exposures with hydrochloric (3 %) and hydrofluoric (6 %) acids reported in a similar number of case entries. Alkaline substances made up 34 % of caustic exposures and sodium hydroxide (36 %) was the most common alkaline agent reported.

Table 35 shows herbals, supplement, and vitamin agents. Table 36 describes plant and fungi exposures.

Envenomation cases make up Table 37. Snakebites make up the majority of envenomation entries again in 2012. *Crotalus* species or “rattlesnakes” make up the majority of snake envenomation entries. Rattlesnakes were reported in 43 % of all envenomation cases. *Agkistrodon contortrix* or “copperhead” snakes were the second most frequently reported species with 20 % of cases from copperhead envenomation in 2012. *Loxosceles reclusa* or “brown recluse” spiders accounted for 20 cases (10 %) of envenomation and *Lactrodectus*

Table 20 Antipsychotic agents

Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)
Atypical				
Quetiapine	178 (49)	260 (44)	263 (48)	701 (46)
Risperidone	43 (12)	72 (12)	73 (13)	188 (12)
Olanzapine	37 (10)	69 (12)	63 (11)	169 (11)
Aripiprazole	23 (6)	63 (11)	50 (9)	136 (9)
Ziprasidone	17 (5)	28 (5)	24 (4)	69 (5)
Clozapine	13 (4)	21 (3)	10 (2)	44 (3)
Paliperidone	0 (0)	3 (0)	0 (0)	3 (0)
Asenapine	1 (0)	2 (0)	0 (0)	3 (0)
Iloperidone	1 (0)	0 (0)	0 (0)	1 (0)
Total atypical antipsychotics	313 (84)	518 (87)	483 (88)	1,314 (87)
Phenothiazines and other 1st generation				
Chlorpromazine	11 (3)	14 (2)	16 (3)	41 (3)
Perphenazine	6 (2)	7 (1)	7 (1)	20 (1)
Prochlorperazine	3 (1)	6 (1)	5 (1)	14 (1)
Thioridazine	2 (0)	1 (0)	0 (0)	3 (0)
Loxapine	2 (0)	5 (1)	6 (1)	13 (1)
Thiothixene	0 (0)	3 (0)	1 (0)	4 (0)
Fluphenazine	2 (0)	1 (0)	2 (0)	5 (0)
Pericyazine	2 (0)	1 (0)	0 (0)	3 (0)
Pimozide	0 (0)	1 (0)	0 (0)	1 (0)
Total phenothiazines and other 1st gen	28 (8)	39 (7)	37 (7)	104 (7)
Butyrophenones				
Haloperidol	30 (8)	36 (6)	31 (6)	97 (6)
Totals	371	593	551	1,515

Table 22 Anticonvulsant agents and mood stabilizers (non lithium or antipsychotic)

Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)
Valproic acid	46 (28)	86 (25)	96 (28)	228 (27)
Lamotrigine	35 (21)	65 (19)	92 (27)	192 (23)
Carbamazepine	25 (15)	38 (11)	49 (14)	112 (13)
Phenytoin	23 (14)	88 (25)	37 (11)	148 (17)
Fosphenytoin	1 (0)	0 (0)	1 (0)	2 (0)
Topiramate	19 (12)	32 (9)	29 (9)	80 (9)
Oxcarbazepine	9 (5)	26 (7)	17 (5)	52 (6)
Levetiracetam	2 (0)	6 (0)	8 (2)	16 (2)
Felbamate	1 (0)	1 (0)	0 (0)	2 (0)
Lacosamide	1 (0)	1 (0)	2 (0)	4 (0)
Primidone	1 (0)	2 (0)	5 (1)	8 (1)
Tiagabine	1 (0)	1 (0)	2 (0)	4 (0)
Zonisamide	1 (0)	1 (0)	1 (0)	3 (0)
Totals	165	347	339	851

mactans or “black widows” accounted for 15 (8 %). Scorpions accounted for 9 % of envenomations with most scorpion envenomations unspecified in terms of type of scorpion.

Table 38 describes agents involved in weapons of mass destruction (WMD), nuclear and biologic chemicals (NBC) and riot agent exposures. Household products not falling into any of the agent classes listed thus far were not included separately in a table as most agents that fell into this category

were included as specific products or with generic names. The majority of these agents were soaps, detergents, and cleaning agents.

ADR-related consultations shown in Table 39. Lithium (7 %) remained the most common agent reported in ADRs followed by digoxin (4 %). There were 102 different specific medications described in Table 39. Only drugs listed at least twice were included in the ADR table.

Table 40 includes information about antidotes used during 2012. *N*-acetylcysteine (NAC) was the most frequently administered antidote in 2012 making up 30 % of all antidote entries. Naloxone was the second most common antidote used (19 %) followed by sodium bicarbonate (12 %), physostigmine (11 %), and flumazenil (7 %).

Table 41 describes antivenom use. CroFab was used 109 times (83 % of antivenom entries) followed by scorpion antivenom (10 %) and spider antivenom (5 %). Other snake antivenoms were used twice (2 %) in 2012.

Table 42 includes chelators used by medical toxicologists in 2012. Succimer (DMSA) was reported 18 times (51 %) followed by deferoxamine 6 times (17 %) and British Anti Lewisite (BAL) 5 times (14 %). The other chelators used were ethylenediaminetetraacetic acid (EDTA) (11 %), unithiol (DMPS) (3 %) and penicillamine (3 %).

Table 43 shows decontamination treatments utilized in 2012. Activated charcoal topped the list with 280 entries (81 % of decontamination events), followed by whole bowel irrigation with 41 occurrences (14 %) and gastric lavage with 22 occurrences (6 %).

Table 23 GI agents including antacids, PPIs, other GI

	Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)
Proton pump inhibitors (PPIs) and antacids	Omeprazole	3 (25)	9 (19)	7 (25)	19 (21)
	Esomeprazole	1 (8)	2 (4)	0 (0)	2 (2)
	Lansoprazole	0 (0)	2 (4)	0 (0)	2 (2)
	Pantoprazole	0 (0)	1 (2)	2 (7)	3 (3)
	Ranitidine	2 (17)	9 (19)	1 (4)	12 (13)
	Famotidine	0 (0)	3 (6)	2 (7)	5 (6)
	Other agents (promotility, antiemetic)	Metoclopramide	2 (17)	6 (13)	2 (7)
Domperidone		0 (0)	0 (0)	1 (4)	1 (1)
Ondansetron		2 (17)	4 (8)	5 (18)	11 (12)
Dicyclomine		1 (8)	3 (6)	1 (4)	5 (6)
Bismuth subsalicylate		0 (0)	2 (4)	2 (7)	4 (5)
Docusate		1 (8)	2 (4)	1 (4)	4 (5)
Polyethylene glycol		0 (0)	2 (4)	1 (4)	3 (3)
Simethicone		0 (0)	1 (2)	1 (4)	2 (2)
Drotaverine		0 (0)	0 (0)	1 (4)	1 (1)
Sucralfate		0 (0)	1 (2)	0 (0)	1 (1)
Sulfasalazine		0 (0)	1 (2)	1 (4)	2 (2)
Senna		0 (0)	3 (6)	2 (8)	5 (6)
Total GI agents			12	54	30

Table 24 Diabetic agents

Agent type	Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)
Biguanides	Metformin	22 (34)	29 (26)	41 (28)	92 (29)
Insulins	Insulins	16 (25)	35 (31)	41 (28)	92 (29)
Sulfonylureas	Glyburide	10 (15)	20 (18)	26 (19)	56 (18)
	Glipizide	7 (11)	14 (13)	22 (16)	43 (14)
	Glimepiride	8 (12)	6 (5)	7 (5)	21 (7)
	Tolbutamide	0 (0)	1 (1)	0 (0)	1 (0)
	Unspecified sulfonylurea	0 (0)	1 (1)	0 (0)	1 (0)
Other agents	Pioglitazone	1 (2)	3 (3)	0 (0)	4 (1)
	Nateglinide	0 (0)	2 (2)	0 (0)	2 (0)
	Sitagliptin	0 (0)	1 (1)	1 (1)	2 (0)
	Liraglutide	1 (2)	0 (0)	0 (0)	1 (0)
Totals		65	112	138	315

Drug and toxin elimination treatments are described in Table 44. Hemodialysis was reported 126 times (46 %) followed by urinary alkalinization with 61 occurrences (22 %). Multidose activated charcoal (MDAC) was used in 53 cases (19 %) and continuous renal replacement therapy (CVVHD) was reported 35 times (13 %).

Non-pharmacologic support is described in Table 45. The most common non-pharmacologic support used in 2012 included intravenous fluid resuscitation, reported 1,294 times (67 %), followed by intubation and ventilator management reported 555 times (29 %). Cardiopulmonary resuscitation (CPR) was done in 36 cases.

Benzodiazepines were the most common agents used for pharmacologic support by medical toxicologists with 1,242 cases using these agents in patient care (57 %). Antipsychotics were used in 9 % of cases involving pharmacologic support, vasopressors in 9 % and non-benzodiazepine anticonvulsants

Table 25 Pulmonary agents, decongestants and mucolytics

Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)
Guaifenesin	6 (33)	8 (30)	6 (38)	20 (34)
Albuterol	1 (6)	4 (15)	4 (25)	9 (15)
Theophylline	2 (11)	2 (7)	1 (6)	5 (8)
Diphylline	0 (0)	1 (4)	0 (0)	1 (2)
Montelukast	0 (0)	1 (4)	1 (6)	2 (3)
Terbutaline	0 (0)	1 (4)	0 (0)	1 (2)
Benzonatate	2 (11)	4 (15)	1 (6)	7 (11)
Tetrahydrozoline	3 (17)	2 (7)	0 (0)	5 (8)
Oxymetazoline	0 (0)	1 (4)	0 (0)	1 (2)
Unspecified	4 (22)	3 (11)	3 (19)	10 (16)
Totals	18	27	16	61

Table 26 Endocrine agents—non-diabetic

Agent	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
Levothyroxine and thyroxine	3 (21)	15 (41)	32 (65)	50 (50)
Prednisone	3 (21)	8 (17)	7 (14)	18 (18)
Desmopressin	1 (7)	2 (4)	1 (2)	4 (4)
Finasteride	0 (0)	2 (4)	0 (0)	2 (2)
Anabolic steroids	0 (0)	1 (2)	2 (4)	3 (3)
Estrogens	3 (21)	0 (0)	3 (6)	6 (6)
Calcitonin	0 (0)	1 (2)	0 (0)	1 (1)
Fludricortisone	0 (0)	1 (2)	0 (0)	1 (1)
Hydrocortisone	0 (0)	1 (2)	1 (2)	2 (2)
Glucagon-like-peptide 1	0 (0)	1 (2)	0 (0)	1 (1)
Methimazole	0 (0)	1 (2)	0 (0)	1 (1)
Methylprednisolone	1 (7)	1 (2)	1 (2)	3 (3)
Progesterone	1 (7)	1 (2)	1 (2)	3 (3)
Triiodothyronine	0 (0)	1 (2)	1 (2)	2 (2)
Other thyroid hormone product	0 (0)	1 (2)	0 (0)	1 (1)
Totals	14	37	49	100

in 5 %. Other drugs used in pharmacologic support by medical toxicologists are included in Table 46.

Discussion

2012 marks the third year of data collection for the ACMT ToxIC Registry; 17,681 cases were entered by December 31st, 2012. Additional enhancements and development of the Registry infrastructure were completed in 2012 including the

Table 27 Chemotherapeutic agents

Agent	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
Cyclosporine	2 (22)	3 (15)	0 (0)	5 (12)
Colchicine	3 (33)	7 (35)	1 (8)	11 (27)
Interferon alpha	1 (11)	2 (10)	0 (0)	3 (7)
Methotrexate	0 (0)	2 (10)	6 (50)	8 (20)
Sirolimus	2 (22)	2 (10)	0 (0)	4 (10)
Sorafenib	0 (0)	1 (5)	0 (0)	1 (2)
Tacrolimus	0 (0)	1 (5)	2 (17)	3 (7)
Tamoxifen	0 (0)	1 (5)	1 (8)	2 (5)
Topotecan	0 (0)	1 (5)	0 (0)	1 (2)
Azathioprine	1 (11)	0 (0)	0 (0)	1 (2)
Doxorubicin	0 (0)	0 (0)	1 (8)	1 (2)
Ifosfamide	0 (0)	0 (0)	1 (8)	1 (2)
Total	9	20	12	41

Table 28 Antimicrobials (antibiotics, antivirals, antifungals)

Agent	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
Abacavir	0 (0)	2 (2)	1 (2)	3 (1)
Acyclovir	1 (3)	1 (1)	1 (2)	3 (1)
Amantadine	1 (3)	3 (3)	4 (7)	8 (4)
Amoxicillin	0 (0)	7 (7)	4 (7)	11 (5)
Atazanavir	0 (0)	1 (1)	1 (2)	2 (1)
Azithromycin	0 (0)	2 (2)	4 (7)	6 (3)
Cefepime	0 (0)	0 (0)	1 (2)	1 (0)
Ceftriaxone	1 (3)	1 (1)	0 (0)	2 (1)
Cephelexin	3 (8)	5 (5)	1 (2)	9 (4)
Ciprofloxacin	1 (3)	2 (2)	3 (5)	6 (3)
Clarithromycin	0 (0)	0 (0)	1 (2)	1 (0)
Clindamycin	0 (0)	6 (6)	2 (3)	8 (4)
Dapsone	0 (0)	3 (3)	3 (5)	6 (3)
Darunavir	0 (0)	1 (1)	0 (0)	2 (1)
Doxycycline	2 (5)	1 (1)	0 (0)	3 (1)
Efavirenz	0 (0)	2 (2)	0 (0)	2 (1)
Emtricitabine	0 (0)	3 (3)	1 (2)	4 (2)
Erythromycin	1 (3)	2 (2)	0 (0)	3 (1)
Fluconazole	0 (0)	0 (0)	1 (2)	1 (1)
Isoniazid	11 (28)	7 (7)	6 (10)	24 (12)
Lamivudine	0 (0)	1 (0)	2 (3)	3 (1)
Levofloxacin	0 (0)	1 (1)	1 (2)	2 (1)
Linezolid	2 (5)	2 (2)	0 (0)	2 (1)
Maraviroc	0 (0)	1 (1)	0 (0)	1 (1)
Metronidazole	2 (5)	5 (5)	2 (3)	9 (4)
Minocycline	0 (0)	2 (2)	0 (0)	2 (1)
Moxifloxacin	0 (0)	1 (1)	1 (2)	2 (1)
Nafcillin	0 (0)	1 (1)	0 (0)	1 (1)
Nevirapine	0 (0)	1 (1)	1 (2)	2 (1)
Nitrofurantoin	0 (0)	1 (1)	1 (2)	2 (1)
Penicillin	2 (5)	2 (2)	0 (0)	4 (2)
Piperacillin	0 (0)	2 (2)	0 (0)	2 (1)
Raltegravir	0 (0)	1 (1)	1 (2)	2 (1)
Ribavirin	0 (0)	1 (1)	1 (2)	2 (1)
Rifampin	0 (0)	0 (0)	1 (0)	1 (1)
Ritonavir	2 (5)	3 (3)	2 (3)	7 (3)
Sulfamethoxazole	3 (8)	14 (13)	4 (7)	21 (10)
Tazobactam	0 (0)	1 (1)	0 (0)	1 (0)
Tenofovir	0 (0)	0 (0)	1	(2) 1 (0)
Tetracycline	3 (8)	0 (0)	2 (3)	5 (2)
Trimethoprim-sulfamethoxazole	4 (10)	12 (11)	4 (7)	20 (10)
Vancomycin	1 (3)	1 (1)	4 (7)	6 (3)
Totals	40	107	62	203

addition of a data dictionary to facilitate agent entry and surveillance. Several noteworthy publications were generated

Table 29 Anesthetics-local and general

Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)		
Local anesthetics	Lidocaine	2 (50)	6 (60)	8 (50)	16 (53)	
	Benzocaine	2 (50)	2 (20)	3 (19)	7 (23)	
	Bupivacaine	0 (0)	1 (10)	2 (13)	3 (10)	
	Articaine	0 (0)	0 (0)	1 (6)	1 (3)	
	Menthol	0 (0)	0 (0)	1 (6)	1 (3)	
	Ropivacaine	0 (0)	0 (0)	1 (6)	1 (3)	
	Mepivacaine	0 (0)	1 (10)	0 (0)	1 (3)	
	TOTALS	4	10	16	30	
	General anesthetics	Ketamine	1 (20)	2 (22)	6 (46)	9 (33)
		Propofol	1 (20)	4 (44)	4 (31)	9 (33)
Sevoflurane		1 (20)	1 (11)	1 (8)	3 (11)	
Isoflurane		0 (0)	1 (11)	1 (8)	2 (8)	
Dexmedetomidine		0 (0)	0 (0)	1 (8)	1 (4)	
Etomidate		0 (0)	1 (11)	0 (0)	1 (4)	
Nitrous oxide		1 (20)	0 (0)	0 (0)	1 (4)	
Unspecified general anesthetic		1 (20)	0 (0)	0 (0)	1 (4)	
Totals		5	9	13	27	
Neuromuscular blocking agents		Succinylcholine	0 (100)	2 (100)	1 (100)	3 (100)
Totals	9	21	30	30		

from Registry data in 2012 including a report describing important new information on infant and toddler poisonings [4]. Additional work involving toxico-surveillance began in 2012 including preliminary development of a prospective Registry for cases involving prescription opioid abuse.

Table 30 Non-ethanol alcohols, methanol, isopropyl alcohol, ethylene glycol, other

Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)
Ethylene glycol	41 (43)	68 (47)	62 (51)	171 (48)
Isopropanol	20 (21)	34 (24)	31 (26)	85 (24)
Methanol	17 (18)	19 (13)	6 (5)	42 (12)
Acetone	3 (3)	8 (6)	7 (6)	18 (5)
Propylene glycol	0 (0)	5 (3)	4 (3)	9 (3)
Diethylene glycol	3 (3)	0 (0)	2 (2)	5 (1)
Glycol ether	4 (4)	3 (2)	1 (1)	8 (2)
2-butoxyethanol	0 (0)	1 (1)	0 (0)	1 (0)
Methyl ethyl ketone	0 (0)	1 (1)	1 (1)	2 (0)
Butanol	2 (2)	1 (1)	1 (1)	4 (1)
Diethyl ether	0 (0)	1 (1)	1 (1)	2 (0)
Triethylene glycol monobutyl ether	1 (1)	0 (0)	0 (0)	1 (0)
Other alcohols, glycols, ethers	4 (4)	3 (2)	5 (4)	12 (3)
Totals	95	144	121	360

Table 31 Hydrocarbons

Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)	
Aliphatic	Methane	2 (4)	6 (9)	4 (9)	12 (8)
	Hexane	2 (4)	2 (3)	0 (0)	4 (3)
	Other aliphatic	0 (0)	4 (6)	0 (0)	4 (3)
Aromatic	Benzene	3 (6)	3 (5)	5 (11)	11 (7)
	Naphthalene	0 (0)	3 (5)	2 (5)	5 (3)
	Xylene	3 (6)	3 (5)	1 (2)	7 (4)
	Ethylbenzene	0 (0)	2 (3)	1 (2)	3 (2)
	Toluene	0 (0)	1 (2)	3 (7)	4 (3)
	Other	Gasoline	1 (2)	4 (6)	5 (11)
Kerosene		2 (4)	3 (5)	1 (2)	6 (2)
Mineral oil		0 (0)	1 (2)	1 (2)	2 (1)
Paraffin oil		0 (0)	1 (2)	2 (5)	3 (2)
Tetrachloroethylene		1 (2)	5 (8)	0 (0)	6 (2)
Methylene chloride		1 (2)	4 (6)	2 (5)	7 (4)
Trichloroethylene		4 (8)	2 (3)	1 (2)	7 (4)
Difluoroethane		3 (6)	1 (2)	3 (7)	7 (4)
Dichloroethane		0 (0)	1 (2)	0 (0)	1 (0)
Ethyl chloride		0 (0)	1 (2)	1 (2)	2 (1)
Chlorofluorocarbons		0 (0)	1 (2)	1 (2)	2 (1)
Other hydrocarbons	28 (56)	16 (25)	12 (27)	56 (36)	
Totals	50	67	45	159	

Table 32 Metals and metalloids

Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)
Lead	30 (20)	46 (14)	49 (22)	125 (18)
Iron	12 (8)	48 (15)	41 (18)	101 (15)
Chromium	4 (3)	41 (13)	20 (9)	45 (6)
Cobalt	1 (0)	40 (13)	23 (10)	64 (9)
Arsenic	14 (9)	32 (10)	14 (6)	60 (9)
Cadmium	31 (20)	25 (8)	9 (4)	65 (9)
Mercury	21 (14)	25 (8)	33 (15)	79 (11)
Selenium	31 (21)	24 (8)	9 (4)	64 (9)
Coppers	1 (0)	6 (2)	4 (2)	11 (2)
Aluminum	2 (1)	4 (1)	5 (2)	11 (2)
Cesium	0 (0)	4 (1)	1 (0)	5 (1)
Vanadium	0 (0)	0 (0)	3 (1)	3 (0)
Thallium	0 (0)	4 (1)	1 (0)	5 (1)
Magnesium	0 (0)	3 (1)	0 (0)	3 (0)
Gadolinium	1 (0)	2 (1)	1 (0)	4 (1)
Gold	1 (0)	2 (1)	0 (0)	3 (0)
Nickel	1 (0)	2 (1)	3 (1)	6 (1)
Barium chromate	0 (0)	1 (0)	1 (0)	2 (0)
Beryllium	0 (0)	1 (0)	1 (0)	2 (0)
Platinum	0 (0)	1 (0)	2 (1)	3 (1)
Rhodium	0 (0)	1 (0)	0 (0)	1 (0)
Uranium	0 (0)	0 (0)	2 (1)	2 (0)
Tungsten	0 (0)	0 (0)	1 (0)	1 (0)
Other metals	0 (0)	6 (2)	4 (2)	10 (2)
Totals	150	318	227	695

Table 33 Gas, vapors, irritants

Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)
Carbon monoxide	44 (63)	130 (73)	80 (67)	254 (71)
Chlorine	9 (13)	9 (5)	7 (6)	25 (7)
Smoke	0 (0)	9 (5)	4 (3)	13 (4)
Cyanide	3 (4)	2 (1)	5 (4)	10 (3)
Hydrogen sulfide	2 (3)	2 (1)	2 (2)	6 (2)
Arsine gas	0 (0)	1 (0)	4 (3)	5 (1)
Phosphine	0 (0)	0 (0)	4 (3)	4 (1)
Bromine	0 (0)	1 (0)	1 (1)	2 (0)
Natural gas	0 (0)	1 (0)	4 (3)	5 (1)
Oxides of nitrogen	0 (0)	3 (2)	1 (1)	4 (1)
Petroleum vapors	0 (0)	2 (1)	4 (3)	6 (2)
Polyurethane vapors	0 (0)	1 (0)	0 (0)	1 (0)
Dust	5 (7)	4 (2)	4 (3)	13 (4)
Soot	0 (0)	1 (0)	0 (0)	1 (0)
Other vapors, fumes or gases	7 (10)	12 (7)	9 (8)	28 (3)
Totals	70	178	129	377

Sedative-hypnotics remained the most common agents reported in 2012. Clonazepam and alprazolam remained at the top of the list. Sedative-hypnotics and muscle relaxants are frequently reported in cases involving prescription abuse and are only secondary to opioid analgesics in this respect. Many of the opioid-related fatalities that occur in the USA also

Table 34 Caustic Agents

Agent	2010 (%)	2011 (%)	2012 (%)	Total (%)	
Acids	Hydrochloric acid	4 (8)	14 (15)	3 (6)	21 (11)
	Citric acid	0 (0)	4 (4)	0 (0)	4 (2)
	Acetic acid	4 (8)	2 (2)	1 (2)	7 (4)
	Hydrofluoric acid	0 (0)	2 (2)	3 (6)	5 (2)
	Sulfuric acid	1 (2)	1 (1)	0 (0)	2 (1)
	Phosphoric acid	0 (0)	1 (1)	0 (0)	1 (0)
	Nitric acid	0 (0)	0 (0)	2 (4)	2 (1)
	Phenol	2 (4)	1 (1)	0 (0)	3 (2)
	Other acid	2 (4)	2 (2)	3 (6)	7 (4)
Bases	Sodium hydroxide	5 (10)	21 (23)	8 (17)	34 (18)
	Sodium hypochlorite	13 (27)	20 (22)	1 (2)	34 (18)
	Ammonia	4 (8)	7 (8)	5 (11)	16 (8)
	Potassium hydroxide	3 (6)	3 (3)	4 (9)	10 (5)
	Ammonia chloride	3 (6)	0 (0)	1 (2)	4 (2)
	Ammonium nitrates	1 (2)	0 (0)	0 (0)	1 (0)
Hydrogen peroxide	Hydrogen peroxide	1 (2)	1 (1)	8 (17)	10 (5)
	Other caustic	3 (6)	11 (12)	3 (6)	17 (9)
Other caustics	Other caustic	3 (6)	3 (3)	8 (17)	14 (7)
Totals	45	98	47	189	

Table 35 Herbatals, supplements, vitamins

Agent	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
<i>Aethusa cynapium</i>	0 (0)	0 (0)	1 (2)	1 (0)
<i>Artemisia</i> sp. (mugwort)	1 (3)	0 (0)	0 (0)	1 (0)
Caper bush	0 (0)	1 (1)	0 (0)	1 (0)
Chicory	0 (0)	1 (1)	0 (0)	1 (0)
<i>Citronella</i>	1 (3)	1 (1)	0 (0)	2 (1)
<i>Echinacea</i>	1 (3)	2 (2)	0 (0)	3 (2)
<i>Sambucus</i> sp. (elderberry extract)	0 (0)	1 (1)	0 (0)	1 (0)
Ephedra	0 (0)	1 (1)	1 (2)	2 (1)
Eucalyptus oil	0 (0)	1 (1)	0 (0)	1 (0)
Fox nut	0 (0)	1 (1)	0 (0)	1 (0)
Fragrant lemongrass oil	0 (0)	1 (1)	0 (0)	1 (0)
<i>Panax</i> sp. (ginseng)	0 (0)	1 (1)	2 (4)	3 (2)
Grapefruit extract	0 (0)	1 (1)	0 (0)	1 (0)
Jojoba oil	0 (0)	1 (1)	0 (0)	1 (0)
Melatonin	1 (3)	10 (10)	10 (20)	21 (11)
Probiotics	0 (0)	1 (1)	0 (0)	1 (0)
<i>Prunus cerasus</i>	0 (0)	0 (0)	1 (2)	1 (0)
<i>Ruta graveolens</i> (Ruta 6)	6 (15)	1 (1)	0 (0)	7 (4)
<i>Seman persicae</i> (peach kernel)	0 (0)	1 (1)	1 (2)	2 (1)
<i>Serenoa repens</i> (saw palmetto)	0 (0)	0 (0)	1 (2)	1 (0)
Soy lecithin	0 (0)	1 (1)	1 (2)	2 (1)
St. John's wort (<i>Hypericum perforatum</i>)	0 (0)	1 (1)	0 (0)	1 (0)
Tamarisk	0 (0)	1 (1)	0 (0)	1 (0)
Tea tree oil	0 (0)	1 (1)	0 (0)	1 (0)
Tuckahoe (<i>Wolfiporia extensa</i>)	0 (0)	1 (1)	0 (0)	1 (0)
<i>Urtica</i> sp. (nettle leaf)	1 (3)	0 (0)	0 (0)	1 (0)
<i>Valeriana officinalis</i>	0 (0)	1 (1)	1 (2)	2 (1)
Whey protein concentrate	0 (0)	1 (1)	0 (0)	1 (0)
Yarrow	0 (0)	1 (1)	0 (0)	1 (0)
Yerba mate	0 (0)	1 (1)	0 (0)	1 (0)
Yohimbine	0 (0)	1 (1)	1 (2)	2 (1)
Other herbal or supplement	14 (35)	16 (15)	8 (16)	38 (20)
Totals	25 (63)	52 (50)	28 (56)	95 (51)
Vitamins				
Multivitamins (MVI)	1 (3)	11 (10)	5 (10)	17 (9)
Vitamin D	1 (3)	9 (9)	0 (0)	10 (5)
Calcium	1 (3)	8 (5)	0 (0)	9 (5)
Potassium	4 (10)	5 (5)	1 (2)	10 (5)
Zinc	5 (13)	5 (5)	2 (4)	12 (6)
Vitamin C (ascorbic acid)	1 (3)	3 (3)	1 (2)	4 (2)
Vitamin B9 (folic acid)	0 (0)	3 (3)	1 (2)	4 (2)
Vitamin B3 (niacin)	1 (3)	2 (2)	7 (14)	10 (5)
Prenatal vitamins	0 (0)	2 (2)	2 (4)	4 (2)
Biotin	0 (0)	1 (1)	0 (0)	1 (0)

Table 35 (continued)

Agent	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
Vitamin B12 (cyanocobalamin)	0 (0)	1 (1)	1 (2)	2 (1)
Vitamin B1 (thiamine)	2 (5)	1 (1)	1 (2)	2 (1)
Vitamin K (phytonadione)	0 (0)	1 (1)	0 (0)	1 (0)
Vitamin A	1 (3)	0 (0)	1 (2)	2 (1)
Vitamin E	0 (0)	0 (0)	1 (2)	1 (0)
Totals vitamins	15 (38)	52 (50)	22 (44)	92 (49)
Totals	40	104	50	194

Table 36 Plants and fungi (mushrooms)

Agent	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
Plants				
<i>Atropa belladonna</i> (deadly nightshade)	1 (4)	0 (0)	1 (2)	2 (2)
<i>Areca catechu</i> (betel nut)	0 (0)	1 (2)	0 (2)	1 (1)
<i>Datura innoxia</i> (moonflower)	0 (0)	1 (2)	6 (12)	7 (5)
<i>Nerium oleander</i> (oleander)	1 (4)	0 (0)	0 (2)	1 (1)
<i>Parthenocissus quinquefolia</i> (Virginia creeper)	1 (4)	0 (0)	0 (2)	1 (1)
<i>Taxus</i> sp. (yew)	2 (7)	0 (0)	0 (2)	2 (2)
<i>Thevetia peruviana</i> (yellow oleander)	0 (0)	1 (2)	1 (2)	2 (2)
Unspecified or other plant	2 (7)	1 (2)	2 (4)	5 (4)
Total plants	7 (25)	4 (7)	10 (19)	21 (15)
Mushrooms				
<i>Amanita bisporigera</i> (destroying angel)	0 (0)	0 (0)	1 (2)	1 (1)
<i>Amanita</i> sp.	2 (7)	3 (5)	4 (8)	10 (7)
<i>Galerina</i>	0 (0)	1 (2)	0 (0)	1 (1)
<i>Morcella</i> sp. (morel)	0 (0)	1 (2)	0 (0)	1 (1)
Psylocybin containing	1 (4)	1 (2)	2 (4)	4 (3)
Unspecified cyclopeptide-containing	0 (0)	3 (5)	1 (2)	4 (3)
Unspecified non-toxic	1 (4)	0 (0)	1 (2)	2 (2)
Unspecified mushrooms	1 (4)	10 (17)	6 (12)	17 (12)
Total mushrooms	5 (18)	19 (32)	15 (29)	39 (26)
Molds				
Unspecified molds	13 (46)	36 (61)	27 (52)	76 (55)
<i>Stachybotrys</i> sp.	2 (7)	0 (0)	0 (2)	2 (1)
<i>Aspergillus</i>	1 (4)	0 (0)	0 (2)	1 (1)
Total molds	16 (57)	36 (61)	27 (52)	79 (57)
Totals	28	59	52	139

Table 37 Envenomations

Envenomation type	Species	2010 (%)	2011 (%)	2012 (%)	Total (%)
Snake	Rattlesnake (unspecified)	39 (36)	53 (29)	57 (29)	149 (31)
	<i>Crotalus</i> sp.	5 (5)	3 (2)	25 (13)	33 (7)
	<i>Crotalus atrox</i> (western diamond back)	0 (0)	2 (1)	2 (1)	4 (1)
	<i>Crotalus scutulatus</i> (Mojave rattlesnake)	0 (0)	0 (0)	1 (0)	1 (0)
	<i>Crotalus horridus</i> (timber rattlesnake)	1 (1)	1 (0)	0 (0)	2 (0)
	<i>Crotalus mitchelii</i> (speckled rattlesnake)	0 (0)	1 (0)	0 (0)	1 (0)
	<i>Sistrurus miliarius</i> (pygmy rattlesnake)	0 (0)	1 (0)	0 (0)	1 (0)
	<i>Crotalus viridis viridis</i> (prairie rattlesnake)	1 (1)	0 (0)	0 (0)	2 (0)
	<i>Agkistrodon contortrix</i> (copperhead)	20 (19)	41 (22)	39 (20)	100 (20)
	<i>Agkistrodon</i> sp.	0 (0)	0 (0)	3 (2)	3 (0)
	Unspecified snake	2 (2)	11 (6)	2 (1)	15 (31)
	<i>Agkistrodon piscivorus</i> (water moccasin)	0 (0)	3 (2)	2 (1)	5 (1)
	<i>Vipera palestinae</i> (Palestine viper)	0 (0)	2 (1)	0 (0)	2 (0)
	<i>Bitis gabonica</i> (Gabon viper)	0 (0)	1 (0)	0 (0)	1 (0)
	<i>Coluber jugularis</i> (black whip snake)	0 (0)	1 (0)	0 (0)	1 (0)
	<i>Bothriechis schlegelii</i> (eyelash viper)	1 (1)	0 (0)	0 (0)	1 (0)
	<i>Micrurus</i> sp. (eastern coral snake)	1 (1)	0 (0)	0 (0)	1 (0)
	Nonvenous snake—unspecified	0 (0)	2 (1)	2 (1)	4 (1)
	Totals snakes		70 (65)	122 (66)	133 (68)
Spiders	<i>Loxosceles reclusa</i> (brown recluse)	9 (8)	19 (10)	20 (10)	48 (10)
	<i>Latrodectus mactans</i> (black widow)	0 (0)	7 (4)	15 (8)	22 (5)
	Wolf spider	0 (0)	1 (0)	1 (0)	2 (0)
	Orb weaver spider	0 (0)	0 (0)	1 (0)	1 (0)
	Unspecified spider	1 (1)	3 (2)	3 (2)	7 (2)
Total spiders		10 (9)	30 (16)	40 (20)	80 (16)
Scorpions	Unspecified scorpions	26 (24)	21 (11)	12 (6)	59 (12)
	<i>Centuroides sculpturatus</i> (bark scorpion)	0 (0)	5 (2)	6 (3)	11(2) (1)
Total scorpions		26 (24)	26 (14)	18 (9)	70 (14)
Other	<i>Pterois</i> sp. (lion fish)	0 (0)	1 (0)	1 (0)	2 (0)
	<i>Heloderma suspectum</i> (gila monster)	0 (0)	2 (1)	0 (0)	2 (0)
	Portuguese man-of-war	0 (0)	1 (0)	0 (0)	1 (0)
	Other envenomations	2 (2)	2 (1)	4 (2)	8 (2)
Totals other		2 (2)	6 (4)	5 (3)	13 (3)
Total envenomations		108	184	196	488

Table 38 WMD, NBC and riot control agent exposures

	Agent	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
WMD or warfare agent	Ricin	0 (0)	1 (14)	3 (75)	4 (33)
	Trichothecene mycotoxin	0 (0)	0 (0)	1 (25)	1 (8)
	Osmium tetraoxide	0 (0)	1 (14)	0 (0)	1 (8)
Riot control agents	Unspecified	0 (0)	1 (14)	0 (0)	1 (8)
Radiation	Radiation various	0 (0)	3 (43)	0 (0)	3 (25)
	Radon	1 (100)	0 (0)	0 (0)	1 (8)
Explosive	Cyclotrimethylenetrinitramine (RDX)	0 (0)	1 (14)	0 (0)	1 (8)
Totals		1	7	4	12

Table 39 Adverse drug reactions in the registry

Agent	2011 N (%)	2012 N (%)	Total N (%)
Lithium	24 (4)	30 (7)	54 (5)
Digoxin	22 (4)	16 (4)	38 (4)
Acetaminophen	21 (4)	6 (1)	27 (3)
Trazodone	15 (3)	7 (2)	22 (2)
Citalopram	14 (2)	11 (3)	25 (3)
Quetiapine	14 (2)	7 (2)	21 (2)
Valproic acid	14 (2)	7 (2)	21 (2)
Oxycodone	13 (2)	14 (3)	27 (3)
Risperidone	12 (2)	10 (3)	22 (2)
Venlafaxine	12 (2)	7 (2)	19 (2)
Bupropion	11 (2)	4 (1)	15 (2)
Olanzapine	11 (2)	2 (0)	13 (1)
Diphenhydramine	10 (2)	4 (1)	14 (1)
Lamotrigine	10 (2)	7 (2)	17 (2)
Lisinopril	10 (2)	2 (0)	12 (1)
Clonazepam	9 (2)	7 (2)	16 (2)
Fluoxetine	9 (2)	4 (1)	13 (1)
Haloperidol	9 (2)	6 (2)	15 (2)
Aripiprazole	8 (1)	3 (1)	11 (1)
Clozapine	8 (1)	2 (0)	10 (1)
Fentanyl	8 (1)	7 (2)	15 (2)
Lorazepam	8 (1)	5 (1)	13 (1)
Metoprolol	8 (1)	2 (0)	10 (1)
Mirtazepine	8 (1)	2 (0)	10 (1)
Phenytoin	8 (1)	9 (3)	17 (2)
Baclofen	7 (1)	7 (2)	14 (1)
Busparone	7 (1)	5 (1)	12 (1)
Ethanol	7 (1)	4 (1)	11 (1)
Hydrocodone	7 (1)	2 (0)	9 (1)
Methadone	7 (1)	7 (2)	14 (1)
Methylphenidate	NA (0)	7 (2)	7 (1)
Hydromorphone	7 (1)	2 (0)	9 (1)
Benzotropine	6 (1)	4 (1)	10 (1)
Caffeine	6 (1)	2 (0)	8 (1)
Carbamazepine	6 (1)	4 (1)	10 (1)
Dextromethorphan	6 (1)	6 (1)	12 (1)
Glyburide	6 (1)	5 (1)	11 (1)
Metformin	6 (1)	5 (1)	11 (1)
Setraline	6 (1)	9 (2)	15 (2)
Tramadol	6 (1)	5 (1)	11 (1)
Alprazolam	5 (1)	4 (1)	9 (1)
Carisoprodol	5 (1)	2 (0)	7 (1)
Clonidine	5 (1)	2 (0)	7 (1)
Diltiazepam	5 (1)	4 (1)	9 (1)
Gabapentin	5 (1)	6 (1)	11 (1)
Hydrochlorothiazide	5 (1)	5 (1)	10 (1)
Morphine	5 (1)	3 (1)	8 (1)
Omeprazole	5 (1)	2 (0)	7 (1)
Prednisone	5 (1)	5 (1)	10 (1)

Table 39 (continued)

Agent	2011 N (%)	2012 N (%)	Total N (%)
Propranolol	5 (1)	2 (0)	7 (1)
Sulfamethoxazole	5 (1)	2 (0)	7 (1)
Ziprasidone	5 (1)	2 (0)	7 (1)
Zolpidem	5 (1)	2 (0)	7 (1)
Amitriptyline	4 (1)	4 (1)	8 (1)
Amphetamine	4 (1)	2 (0)	6 (1)
Aspirin	4 (1)	2 (0)	6 (1)
Cyclobenzaprine	4 (1)	2 (0)	6 (1)
Duloxetine	4 (1)	4 (1)	8 (1)
Hydroxyzine	4 (1)	2 (0)	6 (1)
Ibuprofen	4 (1)	2 (0)	6 (1)
Promethazine	4 (1)	2 (0)	6 (1)
Trimethoprim	4 (1)	2 (0)	6 (1)
Verapamil	4 (1)	2 (0)	6 (1)
Amlodipine	3 (1)	2 (0)	5 (1)
Atenolol	3 (1)	2 (0)	5 (1)
Buprenorphine	3 (1)	2 (0)	5 (1)
Carvedilol	3 (1)	2 (0)	5 (1)
Codeine	3 (1)	2 (0)	5 (1)
Dextroamphetamine	3 (1)	4 (1)	7 (1)
Diazepam	3 (1)	2 (0)	5 (1)
Doxepine	NA (0)	2 (0)	2 (0)
Escitalopram	3 (1)	2 (0)	5 (1)
Loxapine	3 (1)	2 (0)	5 (1)
Metronidazole	3 (1)	2 (0)	5 (1)
Prochlorperazine	3 (1)	2 (0)	5 (1)
Propofol	3 (1)	3 (1)	6 (1)
Ranitidine	3 (1)	2 (0)	5 (1)
Topiramate	3 (1)	2 (0)	5 (1)
Amoxicillin	2 (0)	2 (0)	4 (0)
Atomoxetine	2 (0)	2 (0)	4 (0)
Azithromycin	2 (0)	2 (0)	4 (0)
Benzocaine	NA (0)	2 (0)	2 (0)
Chromium	2 (0)	2 (0)	4 (0)
Cobalt	2 (0)	2 (0)	4 (0)
Cocaine	2 (0)	2 (0)	4 (0)
Dabigatran	NA (0)	2 (0)	2 (0)
Dapsone	2 (0)	2 (0)	4 (0)
Dilantin	2 (0)	NA (0)	2 (0)
Disulfiram	2 (0)	NA (0)	2 (0)
Doxylamine	2 (0)	2 (0)	4 (0)
Famotidine	2 (0)	NA (0)	2 (0)
Fluvoxamine	2 (0)	NA (0)	2 (0)
Fondaparinux	2 (0)	NA (0)	2 (0)
Furosemide	2 (0)	NA (0)	2 (0)
Glimepride	NA (0)	2 (0)	2 (0)
Glipizide	NA (0)	2 (0)	2 (0)
Guanfacine	2 (0)	NA (0)	2 (0)
Hyosyamine	2 (0)	5 (1)	7 (1)

Table 39 (continued)

Agent	2011 N (%)	2012 N (%)	Total N (%)
Iron	0	2 (0)	2 (0)
Isoniazid	2 (0)	3 (1)	5 (1)
Linezolid	2 (0)	NA (0)	2 (0)
Methotrexate	NA (0)	2 (0)	2 (0)
Naloxone	2 (0)	NA (0)	2 (0)
Oxcarbazepine	2 (0)	2 (0)	4 (0)
Perphenazine	2 (0)	NA (0)	2 (0)
Phentermine	NA (0)	3 (1)	3 (0)
Piperacillin	2 (0)	2 (0)	4 (0)
Polyethylene glycol	2 (0)	2 (0)	4 (0)
Pregabalin	2 (0)	3 (1)	5 (1)
Pseudoephedrine	2 (0)	NA (0)	2 (0)
Ritonavir	2 (0)	NA (0)	2 (0)
Senna	2 (0)	NA (0)	2 (0)
Tolterodine	2 (0)	2 (0)	4 (0)
Triamterine	2 (0)	0 (0)	2 (0)
Vancomycin	NA (0)	2 (0)	2 (0)
Warfarin	2 (0)	NA (0)	2 (0)
	593	405	998

involve sedative-hypnotics and muscle relaxants as co-ingestants. This combination is particularly lethal in that the degree of impairment to respiration and ventilation may be more severe when these agents are taken together. With nearly 1,500 sedative-hypnotic and muscle relaxant entries occurring annually the ToxIC Registry this represents an excellent mode of toxico-surveillance as well as a source for prospective study regarding the role of sedatives in poisonings and prescription drug abuse-related hospitalizations in particular.

2012 data also confirms the ongoing role of over-the-counter agents in medication abuse. Dextromethorphan was one of the most commonly abused psychoactive agents in 2012 with more references than other commonly abused drugs such as amphetamine or methamphetamine. Dextromethorphan was also reported more frequently than synthetic cannabinoids and designer amphetamines including MDMA and psychoactive bath salts in 2012. In 2012, drug abuse was split into multiple different categories in order to better track the role specific medications in these cases. This occurred halfway through the year in 2012. These modifications to the Registry data entry form will allow for better identification and toxico-surveillance regarding drug abuse-related hospitalizations.

Oxycodone was again the most common opioid encountered in patients seen by medical toxicologists in 2012. Opioids were encountered nearly 1,100 times in 2012. The data regarding prescription opioid exposures appears essentially stable with no major increases or decreases involving specific

Table 40 Antidotal agents reported to have been used in cases in the registry

Antidote	2010 N (%)	2011 N (%)	2012 N (%)	Total N (%)
2-Pam	0 (0)	1 (0)	3 (0)	4 (0)
Atropine	1 (1)	30 (1)	29 (1)	60 (1)
Botulinum antitoxin	0 (0)	1 (0)	4 (0)	5 (0)
Bromocriptine	0 (0)	1 (0)	2 (0)	3 (0)
Calcium	2 (2)	65 (0)	52 (2)	119 (2)
Carnitine	0 (0)	14 (0)	35 (2)	49 (1)
Cyproheptadine	0 (0)	24 (1)	17 (1)	41 (1)
Dantrolene	0 (0)	2 (0)	5 (0)	7 (0)
Ethanol	0 (0)	5 (0)	0 (0)	5 (0)
Digoxin Fab	1 (1)	20 (1)	24 (1)	45 (1)
Flumazenil	9 (12)	155 (6)	182 (7)	346 (7)
Folate	1 (1)	54 (2)	46 (2)	111 (2)
Fomepizole	4 (5)	103 (4)	68 (3)	175 (3)
Glucagon	2 (2)	66 (2)	52 (2)	130 (3)
Hydroxocobalamin	0 (0)	8 (0)	10 (0)	18 (0)
Hyperinsulinemia euglycemia therapy (HIT)	1 (1)	28 (1)	16 (0)	45 (1)
Lipid rescue	1 (1)	20 (1)	23 (1)	44 (1)
Methylene blue	0 (0)	5 (0)	12 (0)	17 (0)
N-acetylcysteine (NAC)	27 (35)	798 (30)	707 (29)	1,532 (30)
Naloxone	17 (22)	498 (19)	458 (19)	973 (19)
Nitrites	0 (0)	2 (0)	2 (0)	4 (0)
Octreotide	1 (1)	19 (1)	24 (1)	44 (1)
Physostigmine	11 (14)	228 (9)	262 (11)	501 (10)
Pyridoxine	1 (1)	28 (1)	7 (0)	36 (1)
Sodium bicarbonate	14 (18)	315 (12)	288 (12)	617 (12)
Thiamine	3 (4)	109 (4)	81 (3)	193 (4)
Thiosulfate	0 (0)	3 (0)	4 (0)	7 (0)
Vitamin K	3 (4)	48 (2)	15 (0)	66 (1)
Totals	78	2,651	2,428	5,157

opioids over the past 2 years. Heroin, which had shown an increase from 2010 to 2011, remained a common cause of opioid-related consultation in 2012. With the further attention to prescription opioid abuse by the legal and medical establishments in 2012, many experts believe heroin use will

Table 41 Antivenom use

Antivenom	2012 N (%)
CroFab	109 (83)
Other snake antivenom	2 (2)
Scorpion	13 (10)
Spider	7 (5)
Total	131

Table 42 Chelators used

Chelators	2012 N (%)
DMSA	18 (51)
Deferoxamine	6 (17)
BAL	5 (14)
EDTA	4 (11)
DMPS	1 (3)
Penicillamine	1 (3)
Total	35

continue to increase in the coming years. The ToxIC Registry is involved in active surveillance regarding prescription and illicit opioid-related abuse and hospitalizations. In 2013, a major sub-Registry study of cases involving misuse of prescription opioids was initiated.

While 2011 marked dramatic increases in designer drug-related hospitalizations compared to 2010, broad federal and state legislation introduced in the summer of 2012 appeared to be effective in reducing Emergency Department visits and hospitalization related to these substances. In fact, 2012 data regarding synthetic and designer drugs remained relatively flat compared to 2011 and some of the more common chemicals that had been sold as psychoactive bath salts such as MDPV and mephedrone, saw significant decreases in 2012 Registry data. Overall-stimulant related entries decreased slightly from 761 in 2011 to 692 in 2012 despite more centers entering cases. Cocaine remained the most common stimulant agent reported in 2012 as it was in 2010 and 2011. Psychostimulant use remained relatively constant although certain agents fluctuated in prevalence; amphetamine was reported less frequently while methylphenidate reports doubled in 2012. This data indicates that psychostimulants continue to cause significant morbidity and mortality in the US.

Several new designer drugs were encountered in 2012 with the “N-Bomb” agents (*N*-benzyl-ortho-methoxy 2C compounds), ultra-potent hallucinogenic amphetamines active in the 200–500 microgram range, newly identified in Registry entries in 2012. 2012 LSD reports increased dramatically and while not analytically confirmed it is thought that several of

Table 43 Decontamination

Decontamination	2012 N (%)
Activated charcoal	280 (81)
Gastric lavage	22 (6)
Sorbitol	1 (0)
Whole bowel irrigation	41 (12)
Total	344

Table 44 Toxin elimination treatments reported in 2012

Elimination	2012 N (%)
Urinary alkalization	61 (22)
Continuous renal replacement therapy (CVVHD, etc.)	35 (12)
MDAC	53 (19)
Hemodialysis	126 (46)
Total	275

the LSD related cases were actually NBOME compounds misrepresented as “synthetic LSD”.

Whether synthetic cannabinoid and designer amphetamine drug use will show additional evidence of decreasing in 2013 remains to be seen; however, and regardless of this, novel substances continue to be reported regularly and remain a significant cause of morbidity and public health concern with several designer amphetamines in addition to the NBOME compounds being reported for the first time in the Registry in 2012. A real time toxico-surveillance system that can identify hospitalized patients and evolving and concerning trends related to synthetic and designer drug is increasingly important. This area represents an ongoing area of development and toxico-surveillance for the ToxIC Registry.

Limitations

The data reported herein is subject to several important limitations. ToxIC Registry numbers and trends should not be taken as representative of the use of these agents in the general population as the data reflects only those cases cared for at the bedside by medical toxicologists. This makes the sample representative of cases in which significant morbidity was experienced as cases in which patients were not hospitalized or had minimal signs or symptoms of toxicity are most likely

Table 45 Non-pharmacologic support

Non-pharmacologic support	2012 N (%)
IV fluid resuscitation	1,294 (66)
Intubation/ventilatory management	555 (28)
CPR	36 (2)
Hyperbaric oxygen	16 (1)
Transfusion	12 (1)
Pacemaker	8 (1)
Cardioversion	5 (0)
Other	17 (1)
Total	1,943

Table 46 Pharmacologic support utilized in cases reported to the Registry in 2012

Pharmacologic support	2012 N (%)
Benzodiazepines	1,242 (57)
Antipsychotics	205 (9)
Vasopressors	198 (9)
Anticonvulsants	113 (5)
Glucose >5 %	83 (4)
Opioids	83 (4)
Steroids	39 (2)
Albuterol and other bronchodilators	35 (2)
Neuromuscular blockers	26 (1)
Beta blockers	17 (1)
Antihypertensives	16 (1)
Antiarrhythmics	13 (1)
Clonidine	13 (1)
Phenobarbital	8 (0)
Vasodilators	8 (0)
Antiemetics	6 (0)
Propofol	5 (0)
Total ^a	2,172

^a Only support used more than five specific times were included in the above table. The total number of times “Pharmacologic Support” was used, however, was left intact. Often single entries were agents that should have been included only as antidote (i.e., naloxone) and not indicated as used for pharmacologic support

underrepresented in the Registry. As a result, the Registry is more of a marker of significant toxicity or morbidity associated with drug and chemical exposures and envenomations than it is of general population exposures.

Another limitation is that in most cases the history of exposure is self-reported or comes from third-party sources. Inaccuracies in this aspect of data collection are a limitation in any data set of this type.

Quality assurance has remained an area of intense interest in the Toxicology Investigators Consortium. The ToxIC Steering Committee has developed a strategy to implement a quality assurance program which will introduce an additional degree of monitoring and lead to fewer inaccuracies and more complete case entries. Despite this, there may be some data that is incompletely or inaccurately reported. To this extent, it is most likely outcome data that are incomplete however, as evidenced by the increase in death cases reported in the Registry in 2012. Sites have been reminded to enter complete cases and to modify entries with significant developments after initially entered into the Registry. The possibility of incomplete data reporting should be less likely in subsequent years as the Registry further develops. Starting in 2012, death as an outcome was mandated to be reported to the Registry.

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Conflicts of Interest None

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