

Overview of the National Poison Data System (NPDS) and its Applications for Biosurveillance

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Objectives

- Provide an overview of NPDS
- Describe system use for public health surveillance
- Identify events detected using syndromic surveillance
- Illustrate use during outbreaks
- Discuss future plans



What is NPDS?

- Operated by the American Association of Poison Control Centers (AAPCC) in collaboration with Centers for Disease Control and Prevention National Center for Environmental Health (NCEH)
- Web-based application for the analysis, visualization, and reporting of near real-time data from 61 regional Poison Centers (PCs)
- Only source for national chemical and toxic exposure and poisoning surveillance data from PCs



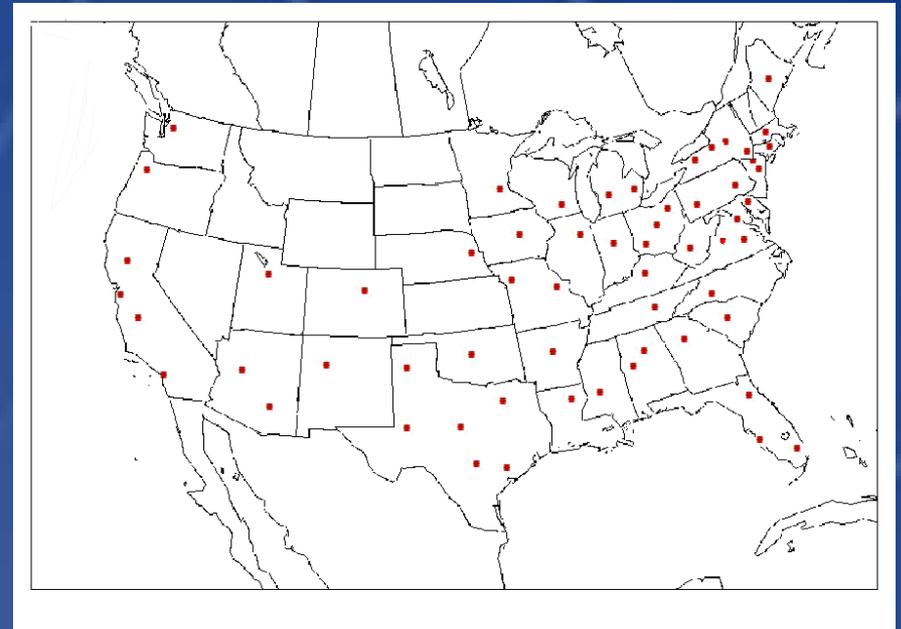
NPDS Surveillance Goals

- Improve public health surveillance for chemical and toxin exposures and associated human illness
- Identify potential chemical exposure events to enable a rapid and appropriate public health response
- Find potential cases and provide situational awareness during an event



NPDS Public Health Partners

- Poison Centers
- AAPCC
- CDC
- State and local health departments



Poison Centers



- National toll-free number available 24/7
- Specialists in poison information (SPIs) include medical toxicologists, registered nurses, doctors of pharmacy, others
 - Collect and code call data using standard protocols
 - Give public and professional education
 - Provide exposure management
- Calls from the public (~85%) and health care professionals (~15%) seeking information, diagnostic or treatment recommendations





Calls to PCs

- More than 4.2 million calls in 2007
- Exposure Calls
 - Concern about exposure to a substance
 - ~ 60% (2.6 million) calls
- Information calls
 - No exposure reported by caller
 - ~40% (1.6 million) calls
- Data entered into regional PC server as caller provides it
- Median time to upload to NPDS is 14 minutes



NPDS Data Elements

- Date/time of call
- PC managing call
- Caller zip code, state
- Species
- Age
- Sex
- Call type (exposure, information)
- Reason for call
- Acuity
- Exposure
- Exposure quantity
- Exposure duration
- Exposure route
- Number of substances
- Exposure site
- Caller site
- Management site
- Multiple patients
- Clinical effects
- Decontamination
- Management
- Treatment
- Medical outcome
- Level of healthcare provided



AAPCC

- Manages, maintains, and oversees development of NPDS
- Oversees toxicosurveillance team
 - Review NPDS anomalies daily
 - Make decisions regarding their PH importance in concert with NCEH
 - Provide a link between CDC and individual PCs for additional information

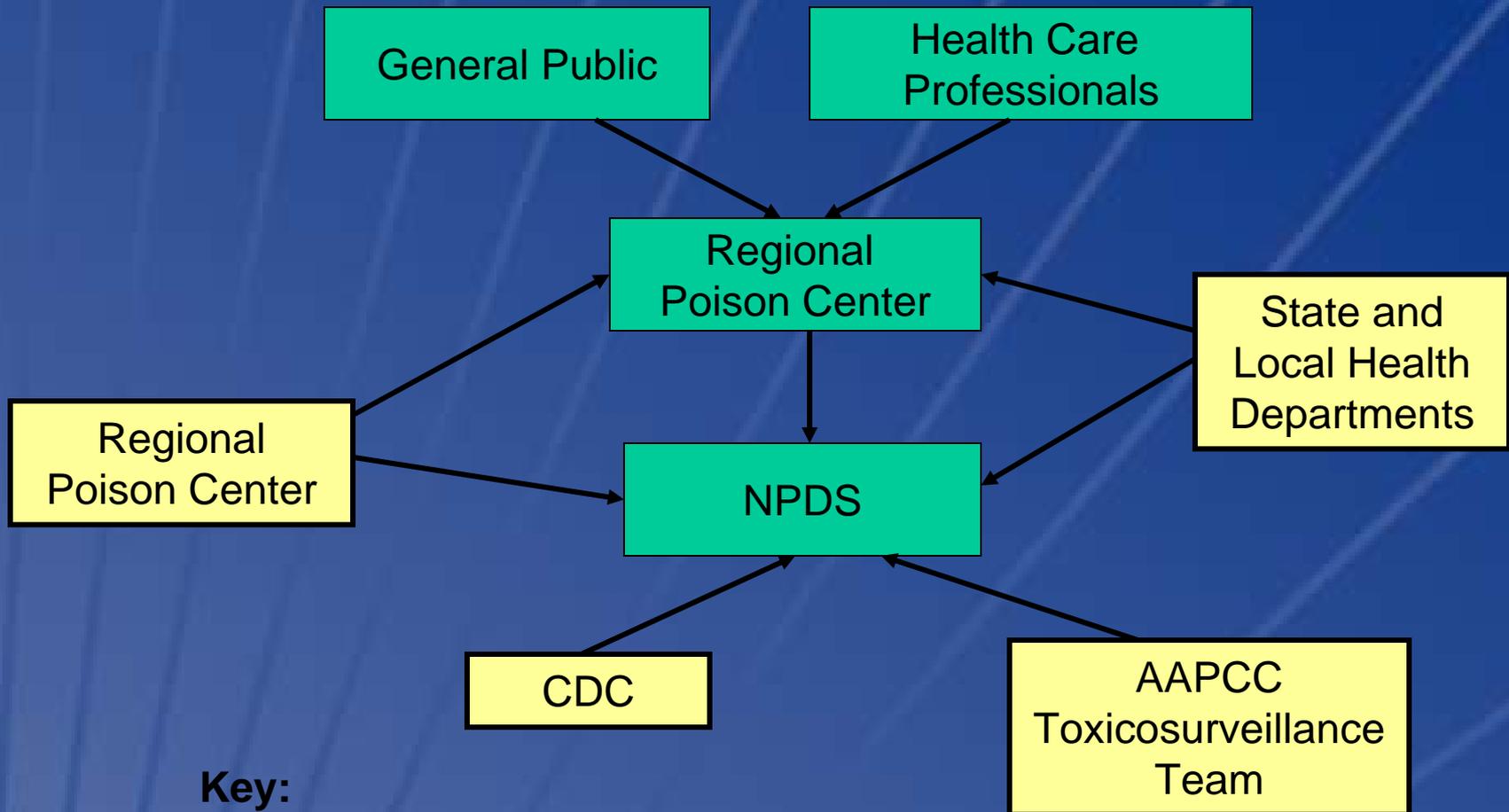


Public Health

- CDC NCEH
 - Use NPDS for ongoing public health surveillance and situational awareness
 - Creates surveillance definitions and monitors trends using NPDS
 - Communicates with toxicosurveillance team and state/local health departments as necessary
- State and local health departments
 - Relationship between states and PCs varies
 - Some states access NPDS or receive data from individual PCs for PH surveillance



NPDS Data Flow



Key:

Data Source

NPDS User





Surveillance Methods: Cluster Detection

- Call Volume
 - Number of hourly calls (total, human exposure)
 - Threshold: historical baseline average + 3 standard deviations (SD)
- Clinical effects
 - Signs, symptoms, or laboratory abnormalities
 - Number of clinical effects during 24 hr period
 - Threshold: historical baseline average + 2 SD



Surveillance Methods: Identifying Individual Potential Cases

- Case-based definitions
 - Individual callers meeting a set of user defined criteria
 - Exposure to a specific substance
 - One or more clinical effects
 - Demographic characteristics
 - Especially useful during an outbreak when the agent and/or symptoms of affected persons are known



Examples of Case-Based Definitions

Definition Name	NPDS Query Description
Arsenic	Human exposure to arsenic (pesticide or excluding pesticide) with caller reported symptoms of hypotension, abdominal pain, diarrhea, and either nausea or vomiting
Botulism	Human exposure to botulism, or caller reported symptoms of blurred vision, photophobia, or visual defect without ocular irritation/pain, as well as symptoms of dysphagia or muscle weakness
Ciguatera	Human exposure to ciguatera
Cyanide	Human exposure with caller reporting symptoms of being agitated/irritable, coma, confusion, or drowsiness/lethargy, as well as acidosis and hypotension, where the exposure reported is not a known product of adult, pediatric, or unknown formulation and is not lithium, ethylene glycol, or methanol, and the call is not related to a suspected suicide
Nerve Agents	Human exposure with caller reporting symptoms of excess secretions, diaphoresis, or lacrimation, as well as either diarrhea or fecal incontinence
Ricin	Human exposure with caller reporting symptoms of vomiting and diarrhea and one of the following symptoms of abdominal pain, AST, ALT>1,000, or AST, ALT>100<=1,000, as well as one of the following symptoms of hypotension, ematemesis, renal failure, or oliguria/anuria where the exposure reported is not a known product of adult, pediatric, or unknown formulation





Anomaly Characterization

- Anomalies reviewed by AAPCC toxicosurveillance team and NCEH
- Cluster characterization
 - Number of reports
 - Geographic dispersion
 - Magnitude above the threshold
 - Illness severity
 - Evidence of a shared exposure
- Individual cases
 - Lab data
 - Information from clinical care providers, PH officials
- Regional poison centers contacted as required
- Confirmed PH issues communicated to state PH and NCEH



NPDS Functionality

- User defined surveillance definitions
- Automated anomaly identification and notification via email to definition subscribers
- Anomaly line lists, access to individual call records, and tracking of anomaly findings
- National maps of callers meeting surveillance definitions
- Interactive reports with data export capability



Case Studies: Cluster Detection

- Anomaly: statistically significant increase in callers' reported clinical effects nationally during the previous 24 hours
- Retrospective analysis of anomalies identified 12/01/08 to 12/31/08
- PH significance classified by AAPCC surveillance team at time of the anomaly as yes, no, or unknown



Case Studies: Cluster Detection

- Anomalies on 268 of 366 (73%) days
- Median # anomalies per day=1.4 (range 1 to 7)
- Most common CEs
 - Multiple chemical sensitivities (6.7%)
 - Asystole (5.4%)
 - Hemolysis (3.7%)
- AAPCC classification
 - 250 (93.3%) of no PH significance
 - 4 (1.5%) of unknown PH significance
 - 14 (5.2%) of PH significance



Case Studies: Cluster Detection

- 4 anomalies of unknown importance
 - Miscoding of a single caller's CEs
 - Exposures to pool algicide, pesticides, and possible food poisoning
- 14 anomalies of importance
 - 3 (21%) school malodorous odors
 - 2 (14%) chemical accidents
 - 2 (14%) food poisonings
 - 2 (14%) building construction dust exposures
 - 1 (7%) family exposed to mold
 - 1 (7%) narcotic overdose
 - 1 (7%) possible TB outbreak in a prison
 - 1 (7%) carbon monoxide exposure
 - 1 (7%) aflatoxin exposure in cows



Use of NPDS for Outbreak Response

- Conduct national surveillance
 - Identify new potential cases
 - Track temporal and spatial distribution
 - Characterize illness symptoms and severity
- Engage individual PCs through AAPCC to
 - Identify calls associated with the event
 - Provide case management and toxicological expertise
 - Assist with surge capacity and triage calls
 - Report potential cases to state HD





Selenosis Outbreak

- March 2008: FDA began receiving reports of clusters of illness associated with a dietary supplement product
 - Hair loss
 - Gastrointestinal problems
 - Joint pain
 - Nausea
- FDA contacted NCEH to determine if NPDS was identifying related reports from PCs



Selenosis Outbreak

- AAPCC developed temporary product code
- Sent product alert to all regional PCs
- NCEH implemented case-based definition 3/25/08
- Human + exposure + Code #22

AAPCC Product Alert

Total Body Formula - Essential Nutrition

26 March 2008

Total Body Formula - Essential Nutrition

Please use AAPCC Temporary Code 22 for this product. This product will be added to the next edition of Poisindex.

AAPCC TEMPORARY CODE: 6540664

GENERIC CODE: 077900 – Other Non-Drug Substances

AAPCC Rapid Coding Team



Selenosis Outbreak

- NPDS used to track temporal and geographic distribution
- 3/11/08 to 6/4/08: 170 human exposures in 8 states
 - 136 (80%) reported clinical effects
 - Generalized pain (25.3%)
 - Diarrhea (24.1%)
 - Nausea (12.4%).
- PCs provided treatment and case management guidelines and reported potential cases to state HDs
- Collaboration between state HDs, PCs, FDA, and CDC



Hurricane Ike

- Landfall 9/13/08 in Galveston, TX
- CDC Emergency Operations Center (EOC) activated
- Surveillance activities included use of NPDS to identify calls to TX PCs regarding carbon monoxide (CO) exposure



Hurricane Ike

- 9/13/08 to 9/30/08: 97 unintentional CO exposure calls to TX (66%), KY (26%), and LA (8%) PCs
- Most commonly reported symptoms headache (60%), nausea (45%), and vomiting (25%)
- Daily aggregate data integrated with other CO surveillance data from across CDC and reported to the CDC Air Pollution and Respiratory Health Branch, CDC EOC, state HD to support public health action



Salmonella Typhimurium Outbreak

- Epidemiologic assessment of cluster of *S. typhimurium* with same pulsed field gel electrophoresis pattern began November 25, 2008
- Hundreds of cases identified, >100 hospitalizations, contributed to at least 8 deaths
- Illness onset dates September 1 forward
- Epidemiologic and laboratory investigation identified source of exposure as peanut butter and peanut paste used in a variety of food products from a single plant
- Widespread food recalls



Salmonella Typhimurium Outbreak

- AAPCC created temporary product code and communicated to regional PCs to assist in capturing peanut product exposures in NPDS
- NPDS reports used to identify persons reporting exposure, January and February 2009
 - 1427 calls to NPDS from all 50 states
 - 1020 (71%) reported clinical effects
 - Diarrhea (41%), vomiting (34%), nausea (26%), abdominal pain (23%)
- Aggregate state call data reported daily to CDC Enteric Diseases Epidemiology Branch to assist in spatial tracking of the outbreak



Conclusions

- NPDS provides near real-time capability for identifying illness clusters and potential cases in time and space during an outbreak
- Real events provide opportunities for using the system and augmenting relationships between CDC, other agencies, state HDs, and PCs
- PCs provide expertise to the public and healthcare providers routinely and during an event
- AAPCC surveillance team provides a link between NCEH and the regional PCs



Further Information

- AAPCC Annual Report available at:
<http://www.aapcc.org/Annual%20Reports/06Report/2006%20Annual%20Report%20Final.pdf>
- Wolkin AF, et al. Early detection of illness associated with poisonings of public health significance. Annals of Emergency Medicine. 2006;47(2):170-6.



Acknowledgements

- CDC
 - Amy Wolkin
 - Cristina Cooper
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- AAPCC
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 - Stuart Heard
 - Alvin Bronstein
 - Sandy Giffin
 - Toxicosurveillance Team



Thank you!

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770-488-1468



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NPDS Screen Shots



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NPDS Application

- Investigate anomalies
- Create definitions
- View Reports



National Clinical Effects Anomaly Email

From: Anomaly_Detected@NPDS.US Sent: Tue 4/28/2009 4:08 AM

To: Alvin Bronstein, AB, MD (CDC rmpdc.org); Wolkin, Amy Funk (CDC/CCEHIP/NCEH); Cooper, Cristina G. (CDC/CCEHIP/NCEH) (CTR); Schier, Joshua (CDC/CCEHIP/NCEH); Martin, Colleen (CDC/CCEHIP/NCEH); Cooper, Cristina G. (CDC/CCEHIP/NCEH) (CTR); TESS Alerts (CDC)

Cc:

Subject: CE Alert 122922: AAPCC NATIONAL CE MONITOR: 0000 - 2400 H

Attachments:  Figure1_122922.xls (265 KB)

CE ANOMALY
National = Yes

Anomaly ID = 122922
Detected = 4/28/2009 4:01:53 AM

CLINICAL EFFECTS
Anorexia (N = 16, M = 7.667, SD = 2.933)
Constipation (N = 6, M = 1.833, SD = 1.851)
Fecal incontinence (N = 2, M = 0.333, SD = 0.563)
Polyuria (N = 4, M = 1.548, SD = 1.074)

[Click here to analyze](#)

DEFINITION OVERVIEW
Definition ID = 206
USD = 2
LSD = 10
Min Ct = 0
Definition Period = 24 H
Definition Run Frequency = 24 H
Prior Year/s Baseline = 3
Days Before = 7
Days After = 6
Latency = 4 H

DEFINITION MESSAGE
National Clinical Effect Alert USD=2 LSD=10 Min=0 Run Daily at 1200



Figure 1

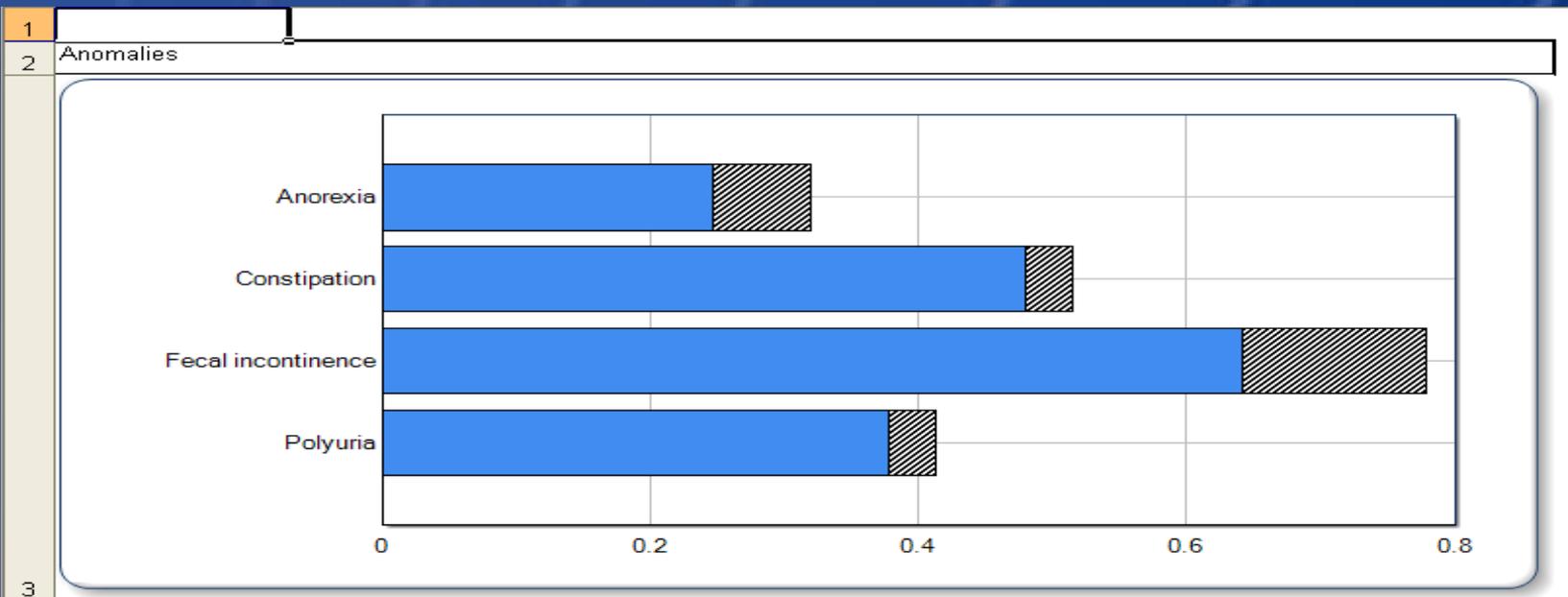


Figure 1 is created in the manner of the figure in MMWR, which is calculated at 2 SD above the historic mean. If you choose to use another cutpoint, the figure will not match the relationship between your case counts and historical means. If this is the case, you may use the formulas presented beneath the figure to create a customized figure.

$$\text{Ratio For Log Graph} = \text{Value on Date Of Interest} / \text{Mean}$$

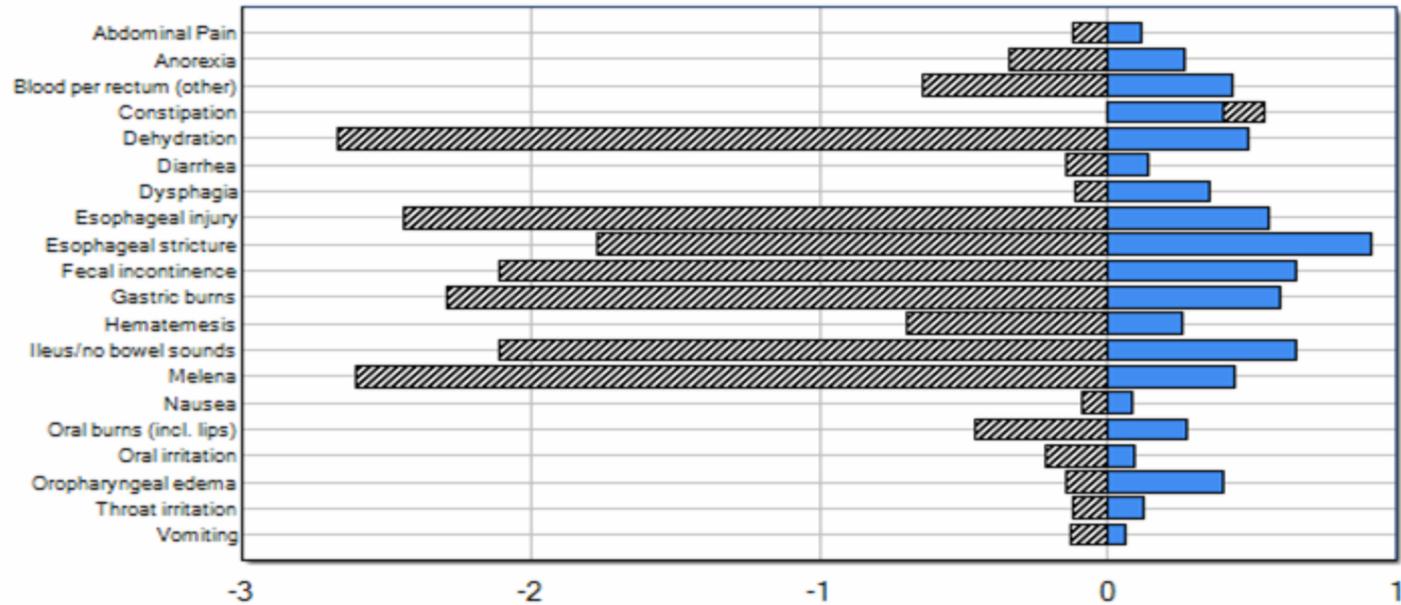
$$\text{Anomaly Value} = \text{Ratio For Log Graph} - ((\text{Mean} + 2 * \text{Standard Deviation}) / \text{Mean})$$

Clinical Effect Name	Case Count (x0)	Historical Baseline Mean (μh)	Standard Deviation (σh)	Log (x0/μh)	$\log(x0/\mu h) > \log(1 + (2 * (\sigma h/\mu h)))$
Polyuria	4	1.547619104	1.073542833	0.412395909	0.03448025
Fecal incontinence	2	0.333333343	0.563436151	0.778151237	0.136615973
Constipation	6	1.833333373	1.850568295	0.514909806	0.035075216
Anorexia	16	7.666666508	2.933116913	0.31951341	0.072729099



Clinical Effects by System

Gastrointestinal



Investigating Anomalies

National Poison Data System
<http://www.npds.us/>

National Poison
Data System



Poison center personnel include medical toxicologists, clinical toxicologists and specialists in poison information.

User Name:

Password:

[About SSL Certificates](#)

Since 1953, poison centers have been making a positive contribution to public health in the United States.

The goal of poison centers is to reduce morbidity and mortality due to poisoning.

It is clear that poison centers accomplish this goal while simultaneously decreasing the cost of health care.

If you have a poisoning emergency, call

**POISON
Help**
1-800-222-1222

If the victim has collapsed or is not breathing, call 911.

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TM

Inside NPDS



Build Version: [NPDS 1.2.2](#)

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National Poison Data System



Welcome: Amy Wolkin - CDC

Reports

Toxicosurveillance

Anomaly Monitor

Fatality

Search

Anomaly Monitor



National Poison Data System

The American Association of Poison Control Centers (AAPCC) has launched a nationwide number for access to the 61 US poison control centers. The number, 1-800-222-1222, is routed to the local poison center serving the caller, based on the area code and exchange of the caller. The number is functional 24-hours a day in the 50 states, the District of Columbia, the US Virgin Islands, and Puerto Rico.

While there is no charge imposed for the use of the 1-800-222-1222 number on product labels, there are important guidelines governing its use. It is important that companies comply with these guidelines to optimize emergency response recommendations and treatment.



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Anomaly Monitor: Search

	Build Version: NPDS 1.2.12	Home Help Contact Toxicosurveillance Email Change password Logout & close	 1-800-222-1222
AAPCC - American Association of Poison Control Centers		National Poison Data System	
Welcome: Colleen Martin - CDC	Reports	Toxicosurveillance	Anomaly Monitor
Anomaly Monitor - Search			
Definition Type :	<input type="text" value="--Select--"/> Total Call Volume Human Exposure Call Volume Clinical Effect Case Based	Definition ID : <input type="text"/>	Anomaly ID : <input type="text"/>
Start Date Time :	<input type="text" value="4/28/2009"/> <input type="text" value="00"/> Hrs.	Analysis Status :	<input type="checkbox"/> Complete <input checked="" type="checkbox"/> Incomplete
End Date Time :	<input type="text" value="4/29/2009"/> <input type="text" value="00"/> Hrs.		
<input type="button" value="Search"/>			



Anomaly Monitor: Analyze



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National Poison Data System



**POISON
Help**
1-800-222-1222

Welcome: Colleen Martin - CDC
Reports
Toxicosurveillance
Anomaly Monitor

Anomaly Monitor - Analyze * Mandatory

Definition Summary

AnomalyID : 122922	Surveillance Start Date/Time : 4/27/2009 12:00:00 AM
Definition ID : 206	Surveillance End Date/Time : 4/28/2009 12:00:00 AM
Description : AAPCC NATIONAL CE MONITOR: 0000 - 2400	
Description : H	
Region : <input type="text"/>	Occurrence Date/Time : 4/28/2009 4:01:53 AM
State : <input type="text"/>	Upper Deviation Threshold : 2
Location : <input type="text"/>	Lower Deviation Threshold : 10
National : Yes	Minimum Count : 0
Case Count : 28	Mean : 25.31
Definition End Date : 2/14/2013 9:11:01 PM	Standard Deviation : 5.56

[Back](#)

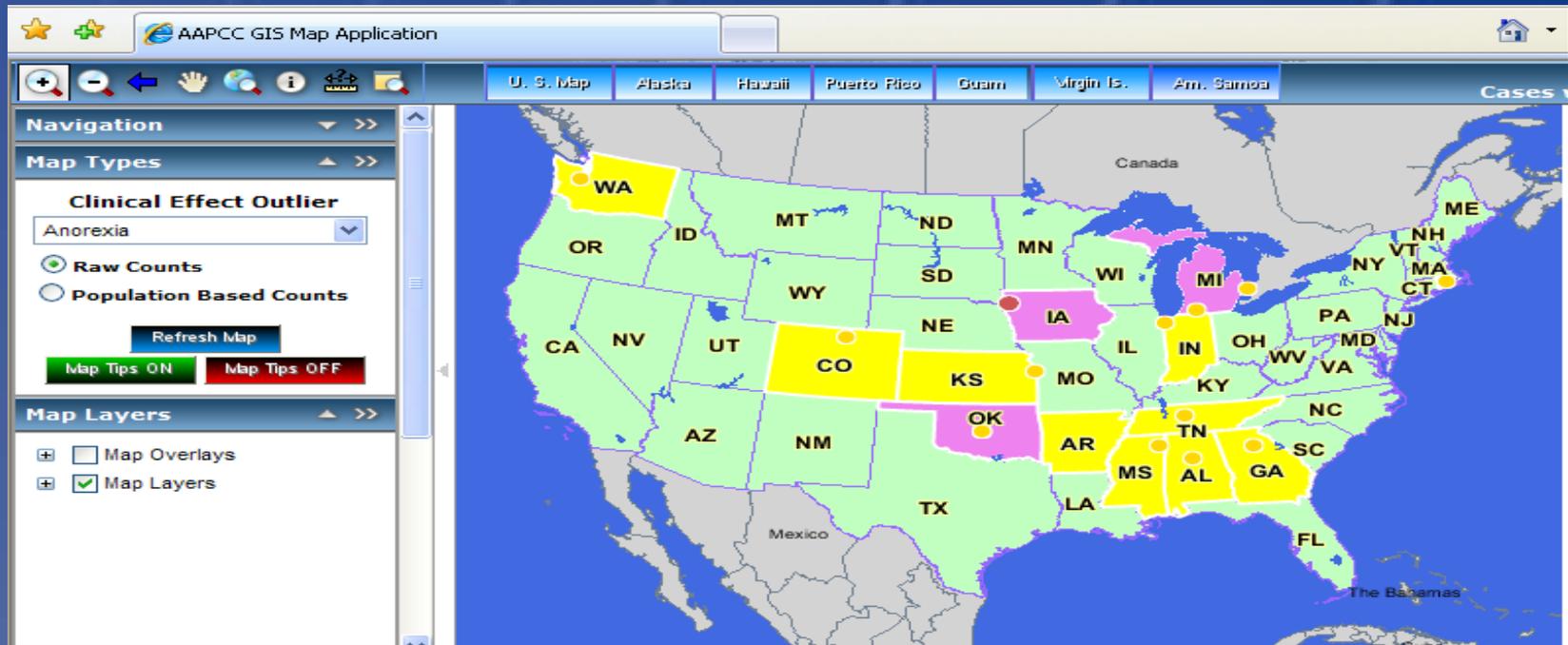
Figure 1

Clinical Effects

	Clinical Effects Name	Count Mean	Standard Deviation	Upper Threshold	Lower Threshold	Case Count	Count Outside Threshold	Select
1	Anorexia	7.67	2.93	2	10	16	2.47	<input type="checkbox"/>
2	Constipation	1.83	1.85	2	10	6	0.47	<input type="checkbox"/>
3	Fecal incontinence	0.33	0.56	2	10	2	0.55	<input type="checkbox"/>
4	Polyuria	1.55	1.07	2	10	4	0.31	<input type="checkbox"/>

Case List

Anomaly Mapping



Anomaly Analysis Complete Email

From: AnomalyAnalysis@npds.us

Sent: Tue 4/28/2009 10:33 AM

To: Alvin Bronstein, AB, MD (CDC rmpdc.org); Wolkin, Amy Funk (CDC/CCEHIP/NCEH); Cooper, Cristina G. (CDC/CCEHIP/NCEH) (CTR); Schier, Joshua (CDC/CCEHIP/NCEH); Martin, Colleen (CDC/CCEHIP/NCEH); Cooper, Cristina G. (CDC/CCEHIP/NCEH) (CTR); TESS Alerts (CDC); Alvin Bronstein, AB, MD (CDC rmpdc.org)

Cc:

Subject: CE Analysis Complete 122922: AAPCC NATIONAL CE MONITOR: 0000 - 2400 H

CE ANOMALY OVERVIEW

National = Yes

Definition ID = 206

Anomaly ID = 122922

Detected = 4/28/2009 4:01:53 AM

FINDINGS

PHS = No

Reason = No Unusual Pattern

Case/s = 28

Anorexia (N = 16, M = 7.667, SD = 2.933)

CE Notes = No Unusual Pattern

Constipation (N = 6, M = 1.833, SD = 1.851)

CE Notes = No Unusual Pattern.

Fecal incontinence (N = 2, M = 0.333, SD = 0.563)

CE Notes = No Unusual Pattern.

Polyuria (N = 4, M = 1.548, SD = 1.074)

CE Notes = No Unusual Pattern.

[Click here to view Findings](#)

ANOMALY NOTES

No Unusual Pattern. Richard Thomas, PharmD, C: 602-616-2327

Please do not reply to this automatically generated NPDS email



NPDS Application

- Investigate anomalies/alerts
- **Create case-based definitions**
- Run reports



Case-Based Definitions



Build Version: [NPDS 1.2.2](#)

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National Poison Data System



Welcome: Amy Wolkin - CDC

Reports

Toxicosurveillance

Anomaly Monitor

Fatality

Toxicosurveillance - Add Case Based Definition * Mandatory Fields

Instructions for Creating a Definition (page 1)

1. Provide a Definition Name.
2. Select the checkbox if this is a National Definition.
3. For regional definitions, highlight the Regional Center.
4. If needed, select specific State and Location Codes.
Note: Although these geographic selections will not appear on the next page, they will be included as part of the Boolean expression.
5. Enter an email message you would prefer to receive when an anomaly occurs.
6. Add Notes for a description of the Definition.
7. Click the Continue button.

Definition Name

* Description :

National

Comment :

* Status : Active Inactive



NPDS Application

- Investigate anomalies/alerts
- Create case-based definitions
- Run reports



Enterprise Reports

The screenshot shows the user interface of the National Poison Data System. At the top left is the AAPCC logo (a skull and telephone handset) and the text "AAPCC - American Association of Poison Control Centers". To the right of the logo is the "Build Version: NPDS 1.2.12" and a navigation menu with links for Home, Help, Contact, Toxicosurveillance Email, Change password, and Logout & close. Further right is the "National Poison Data System" logo and the "POISON Help" logo with the phone number 1-800-222-1222. Below the header is a navigation bar with "Welcome: Colleen Martin - CDC" and three tabs: "Reports", "Toxicosurveillance", and "Anomaly Monitor".

The main content area is titled "Reports" and contains a sidebar menu on the left and a main report configuration area on the right. The sidebar menu includes "Administration", "Case Summary", "Exposure", and "Free Area". The "Case Summary" section is expanded to show a table of report options:

Report Name	Preview	Generate
Case Detail	Preview	Generate
Case Log	Preview	Generate
Case Log for Generic Codes	Preview	Generate
Case Log for Substances	Preview	Generate
Case Status	Preview	Generate
Fatality Abstract (External Use)	Preview	Generate
Fatality Abstract (AAPCC Internal Use Only)	Preview	Generate

The main report configuration area on the right has input fields for "Name:", "Description:", and "Parameters:". Below these fields is a large blue area containing two callout boxes:

- Select the Preview button to view a report
- Select the Generate button to run the report

