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
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

<table>
<thead>
<tr>
<th>Definition Name</th>
<th>NPDS Query Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>Human exposure to arsenic (pesticide or excluding pesticide) with caller reported symptoms of hypotension, abdominal pain, diarrhea, and either nausea or vomiting</td>
</tr>
<tr>
<td>Botulism</td>
<td>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</td>
</tr>
<tr>
<td>Ciguatera</td>
<td>Human exposure to ciguatera</td>
</tr>
<tr>
<td>Cyanide</td>
<td>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</td>
</tr>
<tr>
<td>Nerve Agents</td>
<td>Human exposure with caller reporting symptoms of excess secretions, diaphoresis, or lacrimation, as well as either diarrhea or fecal incontinence</td>
</tr>
<tr>
<td>Ricin</td>
<td>Human exposure with caller reporting symptoms of vomiting and diarrhea and one of the following symptoms of abdominal pain, AST, ALT&gt;1,000, or AST, ALT&gt;100&lt;=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</td>
</tr>
</tbody>
</table>
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

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


Acknowledgements

- CDC
  - Amy Wolkin
  - Cristina Cooper
  - Josh Schier
  - Adrianne Holmes
  - Lauren Lewis

- AAPCC
  - James Hirt
  - Stuart Heard
  - Alvin Bronstein
  - Sandy Giffin
  - Toxicosurveillance Team
Thank you!

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AUQ4@CDC.GOV
770-488-1468
NPDS Application

• Investigate anomalies
• Create definitions
• View Reports
National Clinical Effects Anomaly Email

From: Anomaly_Detected@NIPDS.US
To: Alvin Bronstein, MD (CDC/nipds.org); Walkey, Amy Funk (CDC/CCEHP/NCEH); Cooper, Cristina G. (CDC/CCEHP/NCEH) (CTR); Schier, Joshua (CDC/CCEHP/NCEH) (CTR); Martin, Colleen (CDC/CCEHP/NCEH); Cooper, Cristina G. (CDC/CCEHP/NCEH) (CTR); TESS Alerts (CDC)
Cc: 
Subject: CE Alert 1229222: ARPCP NATIONAL CE MONITOR: 0000 - 2400 H

CE ANOMALY
National = Yes
Anomaly ID = 122922
Detected = 4/28/2009 4:01:53 AM

CLINICAL EFFECTS
Anorexia (N = 18, M = 7.867, 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 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.

Ratio For Log Graph = Value on Date of Interest / Mean

Anomaly Value = Ratio For Log Graph - (Mean + 2 * Standard Deviation) / Mean

<table>
<thead>
<tr>
<th>Clinical Effect Name</th>
<th>Case Count</th>
<th>(x0)</th>
<th>Historical Baseline Mean (µh)</th>
<th>Standard Deviation (σh)</th>
<th>Log (x0/µh)</th>
<th>Log(x0/µh) &gt; log(1 + 2 * (σh/µh))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polypusia</td>
<td>4</td>
<td>1.547619104</td>
<td>1.073542333</td>
<td></td>
<td>0.412395909</td>
<td>0.03448025</td>
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<tr>
<td>Fecal incontinence</td>
<td>2</td>
<td>0.333333343</td>
<td>0.563436151</td>
<td></td>
<td>0.778151237</td>
<td>0.13661973</td>
</tr>
<tr>
<td>Constipation</td>
<td>6</td>
<td>1.833333373</td>
<td>1.850568295</td>
<td></td>
<td>0.514909806</td>
<td>0.035075216</td>
</tr>
<tr>
<td>Anorexia</td>
<td>16</td>
<td>7.666666508</td>
<td>2.933116913</td>
<td></td>
<td>0.31951341</td>
<td>0.072279099</td>
</tr>
</tbody>
</table>
Clinical Effects by System

Gastrointestinal

- Abdominal Pain
- Anorexia
- Blood per rectum (other)
- Constipation
- Dehydration
- Diarrhea
- Dysphagia
- Esophageal injury
- Esophageal stricture
- Fecal incontinence
- Gastric burns
- Hematemesis
- Ileus/no bowel sounds
- Melena
- Nausea
- Oral burns (incl. lips)
- Oral irritation
- Oropharyngeal edema
- Throat irritation
- Vomiting
Investigating Anomalies

National Poison Data System

User Names:
Password:
Logon

About DR. Certmatch

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 1-800-222-1222

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

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Inside NPDS

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.
Anomaly Monitor: Analyze

Definition Summary

- AnomalyID: 122922
- Definition ID: 206
- Description: AAPCC NATIONAL CE MONITOR: 0000 - 2400
- Surveillance Start Date/Time: 4/27/2009 12:00:00 AM
- Surveillance End Date/Time: 4/28/2009 12:00:00 AM
- Upper Deviation Threshold: 2
- Lower Deviation Threshold: 10
- Minimum Count: 0
- Mean: 25.31
- Standard Deviation: 5.56

Case Count: 38
Definition End Date: 2/14/2013 9:11:01 PM

Clinical Effects

<table>
<thead>
<tr>
<th>Clinical Effects Name</th>
<th>Count Mean</th>
<th>Standard Deviation</th>
<th>Upper Threshold</th>
<th>Lower Threshold</th>
<th>Case Count</th>
<th>Count Outside Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anorexia</td>
<td>7.47</td>
<td>2.92</td>
<td>2</td>
<td>10</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Constipation</td>
<td>1.52</td>
<td>1.58</td>
<td>2</td>
<td>10</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Fecal incontinence</td>
<td>0.32</td>
<td>0.56</td>
<td>2</td>
<td>10</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Polyuria</td>
<td>1.55</td>
<td>1.07</td>
<td>2</td>
<td>10</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

Case List
Anomaly Mapping
Anomaly Analysis Complete Email

From: Anomaly/Analyst@npds.us
To: Avin Bronstein, MD (CDC/npds.us); Wolinsky, Alan (CDC/npds.us); Funk, Amy (CDC/npds.us); Cooper, Cristina G. (CDC/npds.us); Schier, Joshua (CDC/npds.us); Martin, Colleen (CDC/npds.us); Cooper, Cristina G. (CDC/npds.us); TESS Alerts (CDC); Avin Bronstein, MD (CDC/npds.us)

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
Cases = 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

Toxicosurveillance - Add Case Based Definition

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: supplement selenium

* Status: Active

Comment: Identifying calls with exposure to Product #22 or match case definition
NPDS Application

• Investigate anomalies/alerts
• Create case-based definitions
• Run reports
Enterprise Reports

AAPCC - American Association of Poison Control Centers
National Poison Data System

Welcome: Colleen Martin - CDC
Reports
Toxicosurveillance
Anomaly Monitor

Reports

Administration
Case Summary

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

Exposure
Free Area

Name:
Description:
Parameters:

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