Rabies in Animals
Rabies in Wyoming

- Wyoming has the bat and skunk strains of rabies
Distribution of major rabies virus variants among reservoirs in the United States and Puerto Rico, 2007 to 2011
Rabies in Wyoming

- Animals positive for rabies in Wyoming from 1/1/2000 through 12/31/2013
  - 219 skunks
  - 107 bats
  - 6 cats
  - 5 horses
  - 5 cows
  - 2 dogs
  - 1 squirrel
  - 1 fox

346 animals diagnosed with rabies
Rabies in Wyoming

2013  Annual  Previous 12yr Mean

Year

Percent Rabies Positive

Rabies Positive Wild and Domestic Animals in Wyoming, 2000-2013

<table>
<thead>
<tr>
<th>COUNTY</th>
<th>Bats</th>
<th>Cats</th>
<th>Cows</th>
<th>Dogs</th>
<th>Foxes</th>
<th>Horses</th>
<th>Skunks</th>
<th>Squirrels</th>
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<td>Sublette</td>
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<td>Teton</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
Rabies Positive Wild and Domestic Animals in Wyoming, 2000-2013

*the animal symbols do not necessarily represent the number of that species reported as rabies positive.
Possible Rabies Exposures

Categories of Exposure:

1. Bite
   - any penetration of the skin by the teeth
   ***bat bites are small and often missed

2. Non-bite
   - scratch, abrasion, open wounds, or mucus membranes contaminated with saliva, CSF, or brain tissue

• Both are considered as a possible exposure to rabies virus and administration of PEP should be discussed
Animal Bite Surveillance in WY

- Data from WRVPHC Program and Mandatory Disease/Condition Reporting
- “Bite” = highly subjective
  - Must have physical contact and include harm
- Total of 3637 incidents reported (2009-2013)
  - 131 other exposures (avg. 26/year)
  - 3506 bite incidents (avg. 701/year)
    - Of those (bite incidents),
      - 2728 (78%) dog related (avg. 546/yr)
      - 626 (18%) cat related (avg. 125/yr)
      - 188 (3%) other species related
Animal-to-Human Bite Incidents in WY

Number of Incidents

Month Occurred or Reported

2013
Previous 5yr Mean
Animal-to-Human Bite Incidents in WY

- 2013
- Previous 5yr Mean
- 2010-2013 Combined Number of Rabies Positive animals

Number of Incidents

Month Occurred or Reported

JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC

0  10  20  30  40  50  60  70  80  90  100  110
Selected incident characteristics and circumstances

VICTIM CHARACTERISTICS
(bite only data from 2009-2013; n is the number of incidents where information was known)

<table>
<thead>
<tr>
<th>Demographic</th>
<th>All Bite Incidents (n=2951)</th>
<th>Dog Related Bite Incidents (n=2299)</th>
<th>Cat Related Bite Incidents (n=531)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
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<td></td>
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</tr>
<tr>
<td>Female</td>
<td>52%</td>
<td>49%</td>
<td>64%</td>
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<tr>
<td>Male</td>
<td>48%</td>
<td>51%</td>
<td>36%</td>
</tr>
<tr>
<td>Age Category</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>children (0-18)</td>
<td>37%</td>
<td>42%</td>
<td>16%</td>
</tr>
<tr>
<td>adults (&gt;18)</td>
<td>63%</td>
<td>58%</td>
<td>84%</td>
</tr>
</tbody>
</table>

- Most often reported body location of injury = upper extremities
  (all incidents: 55%; dog related: 48%; cat related: 83%)
## Selected incident characteristics and circumstances

### OFFENDING ANIMAL CHARACTERISTICS
(bite only data from 2009-2013; n is the number of incidents where information was known)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Bite Incidents (n=2232)</th>
<th>Dog Related Bite Incidents (n=1629)</th>
<th>Cat Related Bite Incidents (n=319)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccination Status</td>
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<tr>
<td>vaccinated</td>
<td>72%</td>
<td>72%</td>
<td>52%</td>
</tr>
<tr>
<td>unvaccinated/not current</td>
<td>28%</td>
<td>28%</td>
<td>48%</td>
</tr>
<tr>
<td>Ultimate Disposition</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>quarantined</td>
<td>74%</td>
<td>78%</td>
<td>61%</td>
</tr>
<tr>
<td>not quarantined</td>
<td>26%</td>
<td>22%</td>
<td>39%</td>
</tr>
<tr>
<td>[LTF]</td>
<td>[10%]</td>
<td>[7%]</td>
<td>[14%]</td>
</tr>
<tr>
<td>[died/euthanized]</td>
<td>[13%]</td>
<td>[10%]</td>
<td>[23%]</td>
</tr>
<tr>
<td>[released/not a risk]</td>
<td>[4%]</td>
<td>[6%]</td>
<td>[2%]</td>
</tr>
</tbody>
</table>
### Selected incident characteristics and circumstances

#### OFFENDING ANIMAL CHARACTERISTICS

(bite only data from 2009-2013; n is the number of incidents where information was known)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Bite Incidents (n=2635)</th>
<th>Dog Related Bite Incidents (n=2063)</th>
<th>Cat Related Bite Incidents (n=540)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Acquaintance's pet</td>
<td>19%</td>
<td>22%</td>
<td>7%</td>
</tr>
<tr>
<td>Family member’s pet</td>
<td>14%</td>
<td>16%</td>
<td>8%</td>
</tr>
<tr>
<td>Friend’s pet</td>
<td>8%</td>
<td>9%</td>
<td>4%</td>
</tr>
<tr>
<td>Stranger’s pet</td>
<td>21%</td>
<td>25%</td>
<td>4%</td>
</tr>
<tr>
<td>Stray animal</td>
<td>12%</td>
<td>5%</td>
<td>37%</td>
</tr>
<tr>
<td>Victim’s pet</td>
<td>27%</td>
<td>23%</td>
<td>40%</td>
</tr>
</tbody>
</table>

- 61% of dog bites offending animal owned by known individual*
- 42% of cat bites offending animal owned by unknown individual*

*excluding incidents where victim = owner
Selected incident characteristics and circumstances

BITE CIRCUMSTANCES

• **Human: depends on species**
  - Dog bites = victim breaking up a fight (18%)
  - Cat bites = victim touching animal (42%)
  - All bites = victim approaching/touching animal (18% each)

• **Animal: running at large**
  - 60% all bites, 60% dog bites, 66% cat bites

• **Location: depends on species**
  - Dog bites = owner’s property (50%)
  - Cat bites = victim’s property (48%)
  - All bites = owner’s property (45%)
BRFSS Dog and Cat Bite Question

• How many times in the past year have you been bitten by a dog (2007) cat (2008) severely enough that it punctured the skin?

• Answer options: #, none, don’t know/not sure, refused.
Number of Individuals Bitten by a Dog

- 2.6% x 2007 WY population of 397,465 = 10,334
- 95% Confidence intervals around 2.6% of 1.7-3.9
- 10334 [6757,15501]
- Total number of bites: 14,597 (7,585-21,610)
Number of individuals Bitten by a Cat

- 4.3% x 2008 WY population of 404,211 = 17,381
- 95% Confidence intervals around 4.3% of 3.1-6.1
- 17,381 [12,530, 24,657]
- Total number of bites: 111,717
  (40,351-183,082)
Prevention and Management of Rabies Exposures
Management of Animal Bites

- Thorough washing of the wound with soap and water.
- Use iodine solution if available.
- Notify WDH
- Consider PEP
Animal Bites – domestic animal

• If a healthy dog, cat or ferret bites a person, animal should be quarantined for?
  – 10 days to watch for signs of rabies
• If animal unavailable obtain the location, circumstance an behavior of animal and human
• If you have questions about administering PEP call WDH at 1-877-996-9000
Management of Wild Animal Bites

• Wild animal bites (carnivores/bats)
  – Rabies testing or PEP only options (no observation period)
  – Regard as rabid unless proven negative by laboratory tests
  – If animal is not available for testing, rabies post-exposure should begin ASAP

• Small rodents and rabbits
  – Rarely require testing or PEP
  – Consider each case individually
Rabies and Bats

• Rabid bats have been documented in Wyoming
  – Average of 13 a year

• Recent data suggests human transmission of rabies virus from bats can occur from
  – Minor bites, scratches or mucous membrane exposure
  – Unrecognized bites
  – Seemingly unimportant contact
<table>
<thead>
<tr>
<th>Type</th>
<th>Name</th>
<th>Route</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Diploid Cell Vaccine (HDCV)</td>
<td>Imovax® Rabies</td>
<td>Intramuscular</td>
<td>Preexposure or Postexposure</td>
</tr>
<tr>
<td>Purified Chick Embryo Cell Vaccine (PCEC)</td>
<td>RabAvert®</td>
<td>Intramuscular</td>
<td>Preexposure or Postexposure</td>
</tr>
<tr>
<td>Human Rabies Immune Globulin</td>
<td>Imogam® Rabies-HT</td>
<td>Local infusion at wound site, with additional amount intramuscular at site distant from vaccine</td>
<td>Postexposure</td>
</tr>
<tr>
<td>Human Rabies Immune Globulin</td>
<td>HyperRab TMS/D</td>
<td>Local infusion at wound site, with additional amount intramuscular at site distant from vaccine</td>
<td>Postexposure</td>
</tr>
</tbody>
</table>

Grifols/Talecris 919-316-3600
Novartis 800-244-7668
Sanofi Pasteur 800-822-2463
Postexposure Prophylaxis (PEP) Details

- HRIG 20 IU/kg on day 0, **plus** 4 rabies vaccinations (1ml via IM) on days 0, 3, 7, 14 days after the first vaccination
- Previously vaccinated: 2 rabies vaccinations on days 0 and 3; **no** HRIG
- Medical urgency not emergency
- PEP can be given regardless of time lapse since exposure
Rabies PEP Logic Tree

- Is the animal available for observation or testing?
- Is it safe to wait for test results or the 10 day observation period before starting PEP?
- What other facts of the case should be considered?
Factors

- Species of the animal
- Can the animal be located
- Indoor or outdoor pet
- Type of exposure
  - Bite or non-bite
- Circumstances of the bite
- Ownership of the animal
- Vaccination status of the biting animal
Factors, continued

- **Location of the bite**
  - Facial bite vs. bite to extremity
  - Bites to areas with greater innervation, closer to CNS more urgent

- **Severity of the wound**
  - Regardless of location, the deeper and more serious the wound, the greater the urgency for rabies PEP
• Sunday 7/4 Calf fine
• 7/5 calf ran away at feeding time
• No interest in eating /drinking
• Staggered, wobbly
• Died 7/6
• 2 other calves euthanized
4 people get rabies shots
Sheridan County, Rabid Cow, 2010

- Evening of 3/28
- Cow found down, unable to get up
- Coughing, very vocal
- Acted like something caught in throat
- 3 people get rabies shots, 1 DVM a booster
• **Rabies Vaccine:**
  – 1 ml IM injection days 0, 3, 7 and 14
  – In the deltoid area of the upper arm or lateral thigh for children; **not in the gluteals**!
  – If previously vaccinated, booster day 0 and 3

• **Steroids, immunosuppressive agents and anti-malarials can interfere with development of active immunity**
PEP: HRIG

• Human Rabies Immune Globulin (HRIG)
  – Administer on Day 0, infiltrate as much into the wound area as possible, rest in muscle away from vaccination site
  – 20 IU/kg
  – Can administer up to 7 days after first rabies vaccination
  – No HRIG if previously vaccinated
• Both vaccines safe and immunogenic
• Promotes acute immune response in 7-10 days that lasts ≥ 2 years
• Both can be used for pre-exposure and postexposure prophylaxis
• Safe in pregnancy
• Same guidelines for children
Pre-Exposure Rabies Vaccinations for Humans

• Recommended for those with high risk of exposure:
  – Veterinarians and animal handlers
  – Animal control officers
  – Laboratorians working with rabies virus
  – Spelunkers
  – Travelers to endemic areas with poor access to appropriate medical care
Pre-Exposure Rabies Vaccinations for Humans

• (3) 1 ml, IM injections on days 0, 7, and 21 or 28
• Site of injection in the deltoid muscle/lateral thigh in children
• Intended to simplify the postexposure prophylaxis
• Not universally effective without postexposure prophylaxis after recognized rabies exposure
Titer Testing After Pre-Exposure Vaccination

- Continuous risk category: Check titer every 6 months
- Frequent risk category: Check titer every 2 years
- Boost with 1 dose rabies vaccine if <1:5
Rabies Specimen Testing

• Only the head or brain of an animal larger than 2 pounds (squirrel) should be submitted
  – Brain tissue to include: Brain Stem, Cerebellum, Hippocampus

• Submitted specimens cannot be returned

• Specimen should be kept refrigerated but not frozen
Type of Baits Distributed

Coated Sachet Baits   Fishmeal Polymer Baits

The outer bait matrix is made from fishmeal (for raccoons and coyotes) or dog food (for gray foxes) combined with a polymer that acts as a binding agent. The vaccine packet, or sachet, resembles a small catsup package but contains about 1.5 ml of vaccine. The sachet is inside the bait matrix and waxed into place.
Human Rabies Cases and Adverse Reactions to Pre/Post Exposure Prophylaxis
### Cases of Rabies in Human Beings in the United States, by Circumstances of Exposure and Rabies Virus Variant, 1995-2011

<table>
<thead>
<tr>
<th>Date of Death</th>
<th>State of Residence</th>
<th>Exposure History*</th>
<th>Rabies Virus Variant?</th>
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</thead>
<tbody>
<tr>
<td>March 15, 1995</td>
<td>WA</td>
<td>Unknown*</td>
<td>Bat, Msp</td>
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<tr>
<td>September 21, 1995</td>
<td>CA</td>
<td>Unknown*</td>
<td>Bat, Tis</td>
</tr>
<tr>
<td>October 2, 1995</td>
<td>CT</td>
<td>Unknown*</td>
<td>Bat, Lv/Ps</td>
</tr>
<tr>
<td>November 9, 1995</td>
<td>CA</td>
<td>Unknown*</td>
<td>Bat, Lv/Ps</td>
</tr>
<tr>
<td>February 8, 1996</td>
<td>FL</td>
<td>Dog bite-Mexico</td>
<td>Dog, Mexico</td>
</tr>
<tr>
<td>August 20, 1996</td>
<td>NH</td>
<td>Dog bite-Nepal</td>
<td>Dog, SE Asia</td>
</tr>
<tr>
<td>October 15, 1995</td>
<td>KY</td>
<td>Unknown*</td>
<td>Bat, Lv/Ps</td>
</tr>
<tr>
<td>December 19, 1995</td>
<td>MT</td>
<td>Unknown*</td>
<td>Bat, Lv/Ps</td>
</tr>
<tr>
<td>January 5, 1997</td>
<td>MT</td>
<td>Unknown*</td>
<td>Bat, Lv/Ps</td>
</tr>
<tr>
<td>January 18, 1997</td>
<td>WA</td>
<td>Unknown*</td>
<td>Bat, El</td>
</tr>
<tr>
<td>October 17, 1997</td>
<td>TX</td>
<td>Unknown*</td>
<td>Bat, Lv/Ps</td>
</tr>
<tr>
<td>October 23, 1997</td>
<td>NJ</td>
<td>Unknown*</td>
<td>Bat, Lv/Ps</td>
</tr>
<tr>
<td>December 31, 1998</td>
<td>VA</td>
<td>Unknown*</td>
<td>Bat, Lv/Ps</td>
</tr>
<tr>
<td>September 20, 2000</td>
<td>CA</td>
<td>Unknown*</td>
<td>Bat, Tis</td>
</tr>
<tr>
<td>October 3, 2000</td>
<td>NY</td>
<td>Dog bite-Ghana</td>
<td>Dog, Africa</td>
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<td>October 10, 2000</td>
<td>CA</td>
<td>Unknown*</td>
<td>Bat, Tis</td>
</tr>
<tr>
<td>October 23, 2000</td>
<td>MN</td>
<td>Bat bite-MN</td>
<td>Bat, Ln/Ps</td>
</tr>
<tr>
<td>November 1, 2000</td>
<td>WI</td>
<td>Unknown*</td>
<td>Bat, Lv/Ps</td>
</tr>
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<td>February 4, 2001</td>
<td>CA</td>
<td>Unknown*</td>
<td>Bat, Ph</td>
</tr>
<tr>
<td>March 31, 2002</td>
<td>CA</td>
<td>Dog bite-Philippines</td>
<td>Dog, Philippines</td>
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<tr>
<td>August 31, 2002</td>
<td>TN</td>
<td>Unknown*</td>
<td>Bat, Tis</td>
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<tr>
<td>September 28, 2003</td>
<td>IA</td>
<td>Unknown*</td>
<td>Bat, Lv/Ps</td>
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<tr>
<td>March 10, 2003</td>
<td>VA</td>
<td>Unknown*</td>
<td>Racoon, Eastern US</td>
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<td>June 5, 2003</td>
<td>PR</td>
<td>Bite</td>
<td>Dog/Mongoose, Puerto Rico</td>
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<td>September 14, 2003</td>
<td>CA</td>
<td>Bite</td>
<td>Bat, Lv/Ps</td>
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<tr>
<td>February 15, 2004</td>
<td>FL</td>
<td>Bite</td>
<td>Dog, Haiti</td>
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<tr>
<td>May 3, 2004</td>
<td>AR</td>
<td>Bite (organ donor)</td>
<td>Bat, Tis</td>
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<tr>
<td>June 7, 2004</td>
<td>OK</td>
<td>Liver transplant recipient</td>
<td>Bat, Tis</td>
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<td>June 3, 2004</td>
<td>TX</td>
<td>Arterial transplant recipient</td>
<td>Bat, Tis</td>
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<tr>
<td>June 21, 2004</td>
<td>TX</td>
<td>Kidney transplant recipient</td>
<td>Bat, Tis</td>
</tr>
<tr>
<td>June 21, 2004</td>
<td>TX</td>
<td>Kidney transplant recipient</td>
<td>Bat, Tis</td>
</tr>
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<td>WI</td>
<td>Unknown*</td>
<td>Bat, Unknown</td>
</tr>
<tr>
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<td>CA</td>
<td>Unknown*</td>
<td>Dog, El Salvador</td>
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<td>September 27, 2005</td>
<td>ME</td>
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<td>Unknown*</td>
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<tr>
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<td>IN</td>
<td>Bite</td>
<td>Bat, Lv/Ps</td>
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<tr>
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<td>CA</td>
<td>Bite</td>
<td>Dog, Philippines</td>
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<td>October 20, 2007</td>
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<td>Bat, Unknown</td>
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<td>Bite-Mexico</td>
<td>Feow, T-b-related</td>
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<td>MO</td>
<td>Bite</td>
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</tr>
<tr>
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<td>Bite</td>
<td>Bat, Unknown</td>
</tr>
<tr>
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<td>IN</td>
<td>Unknown*</td>
<td>Bat, Rs</td>
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<tr>
<td>November 11, 2009</td>
<td>MI</td>
<td>Unknown*</td>
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<td>Bite</td>
<td>Dog, India</td>
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<td>August 21, 2010</td>
<td>LA</td>
<td>Bite</td>
<td>Bat, Mexico, Dz</td>
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<td>Bat, Tis</td>
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<td>NJ</td>
<td>Bite</td>
<td>Dog, Haiti</td>
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<tr>
<td>August 21, 2011</td>
<td>NY</td>
<td>Bite</td>
<td>Dog, Afghanistan</td>
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*Data for exposure history are reported only when the biting animal was available and tested positive for rabies; or when plausible information was reported directly by the patient (if lucid or credible); or when a reliable account of an incident consistent with rabies exposure (e.g., dog bite) was reported by an independent witness and a family member.
Human Rabies Exposure not Recognized

• Mostly bat strain rabies
  • In Texas in 2006 a 16 yr old boy reported waking up from a nap with a bat flying around his face. There were no bite marks or scratches. Neither the boy, his parents or any family friends knew bats could carry rabies and thus he never received PEP. Seven weeks after exposure the boy dies from rabies.
Woman Who Died From Rabies Wasn't Advised That Bats Could Pose Risk

By Bahar Gholipour, Staff Writer
Published: 08/15/2013 02:45 PM EDT on LiveScience
Human Rabies Exposure not Recognized

• Bat Strain, California, 2012
  – 34 y/o male, right arm pain, died in Zurich, friend later noted had observed patient touch bat March 2012 while in California.

• Bat Strain, South Carolina, 2011
  – 46 y/o female, hand tingling, short of breath, died < 24 hours, Family later noted patient had history of bats in home.

• Bat Strain, Michigan, 2009
  – 55 y/o male, numb left hand, neck pain past 10 days, dies after 5 day hospitalization. Relative later remembers bat on arm story.

• Bat Strain, Indiana, 2009
  – 43 y/o male, Oct 5th -fever cough, left arm numb, admitted 2 days later, dies Oct 20th. Friend later remember bats in tarp.
Fourth Rabies Death Reported From a Single Organ Donor

By DENISE GRADY
Published: July 9, 2004

A week after reporting that three patients died of rabies spread by transplants from an infected organ donor, officials at Baylor University Medical Center in Dallas said yesterday that rabies had killed a fourth recipient of tissue from the donor.

All the patients died in June, but the fourth case was not recognized at first because doctors did not know that the patient had received tissue from the infected donor, hospital officials said.

Tests from the Centers for Disease Control and Prevention in Atlanta confirmed yesterday that...
Rabies in Organ Donor Transplant Recipients

• **Arkansas Donor, 2004**
  – Bat strain, donor had mental status change
  – Kidney recipient, Ill after 25 days, died 4 days later
  – Liver recipient, ill after 21 days, died 6 days later
  – Kidney recipient, ill 27 days later, died 10 days later
  – Iliac artery/liver recipient, transplant in May, died month later

• **North Carolina Donor, 2013**
  – Raccoon strain, donor vomited, arm tingling
  – Kidney recipient, died 1 ½ years after transplant
  – 3 other recipients received rabies PEP (never developed rabies)
Symptomology of Clinical Rabies in Humans

1. Prodromal period (days to months): general malaise, chills, fever, headache, photophobia, anorexia, nausea, vomiting, diarrhea, sore throat, cough, musculoskeletal pain, abnormal sensation around bite site (itching, burning, numbness, paresthesia)

2. Acute neurologic phase (2-10 days): nervous system dysfunction, anxiety, agitation, dysphagia, hypersalivation, paralyses (typically flaccid), episodes of delirium, priapism, and

***Hydrophobia is the pathognomonic sign of rabies!!!

3. Coma
Local

NorCal Girl Survives Rabies Without Vaccination
June 13, 2011 6:10 AM

Related Tags: Precious Reynolds, rabies, Sacramento, Willow Creek

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California Girl Only Third in U.S. to Survive Rabies Without Vaccine
June 14, 2011

By KIM CAROLLO, ABC News Medical Unit via GOOD MORNING AMERICA
Recovery of Rabies Patients in the United States

**Wisconsin, 2004**
- 15 y/o female, left hand numb, tingling, bitten by bat 1 month before, blurred vision. Tests for rabies antibodies positive.

**Texas, 2009**
- 17 y/o female, history of recurring headaches and disorientation, never developed severe symptoms. Exposure to bats in Texas cave. Tests for rabies antibodies positive.

**California, 2011**
- 8 y/o female, 1 week history of sore throat and vomiting, then abdominal pain and difficulty swallowing. Respiratory distress. Tests for rabies antibodies positive. Therapeutic coma/Milwaukee protocol. Discharged after 7 weeks, full recovery.
Recovery of a Patient from Clinical Rabies --- Wisconsin, 2004

Rabies is a viral infection of the central nervous system, usually contracted from the bite of an infected animal, and is nearly always fatal without proper postexposure prophylaxis (PEP) (1). In October 2004, a previously healthy female aged 15 years in Fond du Lac County, Wisconsin, received a diagnosis of rabies after being bitten by a bat approximately 1 month before symptom onset. This report summarizes the investigation conducted by the Wisconsin Division of Public Health (WDPH), the public health response in Fond du Lac County, and the patient's clinical course through December 17. This is the first documented recovery from clinical rabies by a patient who had not received either pre- or postexposure prophylaxis for rabies.

While attending a church service in September, the girl picked up a bat after she saw it fall to the floor. She released the bat outside the building; it was not captured for rabies testing, and no one else touched the bat. While handling the bat, she was bitten on her left index finger. The wound was approximately 5 mm in length with some blood present at the margins; it was cleaned with hydrogen peroxide. Medical attention was not sought, and rabies PEP was not administered.

Approximately 1 month after the bat bite, the girl complained of fatigue and tingling and numbness of the left hand. These symptoms persisted, and days later she felt unsteady and developed diplopia (i.e., double vision). On the third day of illness, with continued diplopia and onset of nausea and vomiting, she was examined by her pediatrician and referred to a neurologist. At that time, the patient continued to have blurred vision and also had partial bilateral sixth-nerve palsy. Magnetic resonance imaging (MRI) with and without contrast and magnetic resonance angiography (MRA) studies of her brain were normal, and the patient was sent home.
Milwaukee Protocol, version 4.0 (updated 9/13/2012)

Protocol

1. Do not administer rabies vaccine or immunoglobulin to a patient with rabies.
   - RIG delays development of rabies antibodies in CSF, essential for survival.
   - Preliminary evidence favors detrimental survival after rabies vaccine in bat rabies.
   - We have administered beta-interferon to a few rabies patients with poor prognostic epidemiology, with evidence for a peripheral effect on viral load. This can be considered in particular for dog rabies, where CSF responses are often poor. It appears to “buy” an additional week for serological response to mature.

2. Maintain patient in isolation.
   - There has never been a laboratory-documented case of human-human transmission of rabies other than by transplantation.
   - Patients can be removed from isolation when saliva is negative by RT-PCR on 3 occasions in the presence of serum neutralizing antibodies > 0.5 IU/ml by RFFIT, FAVN or other test for neutralizing antibodies.

3. Transfer patients with laboratory-confirmed rabies to a tertiary care facility capable of critical care including intracranial pressure monitoring.
   - Institutions in developing countries can handle rabies if they treat head trauma and tetanus with critical care facilities.
Evidence of Rabies Virus Exposure among Humans in the Peruvian Amazon

Amy T. Gilbert*,†, Brett W. Petersen†, Sergio Recuenco, Michael Niezgoda, Jorge Gómez, V. Alberto Laguna-Torres and Charles Rupprecht

Author Affiliations

Address correspondence to Amy Gilbert, Centers for Disease Control and Prevention, 1600 Clifton Rd, NE, Mailstop G33, Atlanta, GA 30333. E-mail: fcj6@cdc.gov

*†These authors contributed equally.

Abstract.

In May of 2010, two communities (Truenococha and Santa Marta) reported to be at risk of vampire bat depredation were surveyed in the Province Datem del Marañon in the Loreto Department of Peru. Risk factors for bat exposure included age less than or equal to 75 years and owning animals that had been fed bats before.
I read with interest the recent JAVMA News article\(^1\) on villagers in Peru who had antibodies against rabies virus, despite never having been vaccinated. As a fourth-year veterinary student, my classmates and I were offered an opportunity to enroll in a trial of an experimental rabies vaccine. The experimental protocol involved measuring prevaccination antirabies antibody titers, and I was found to be one of three students in the country with a prevaccination antibody titer. I had no history of being bitten by or in contact with a rabid animal; however, when I was 8 or 9 years old, my father had caught a bat that we kept in a cage until it died. I never touched the bat, but did observe it for prolonged periods.

Several years later, I attended a meeting during which a researcher from the CDC talked about his investigations into the deaths of several spelunkers from rabies. He surmised that bat guano in the caves may have contained the virus and attempted to test his theory by setting out a series of cages containing animals known to develop rabies, such as cats, dogs, skunks, and raccoons. After a waiting period, he discovered that a number of the animals had developed rabies and concluded that the air in a highly contaminated environment might contain the rabies virus.

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*Allen Wolff, DVM*

*Brunswick, Ohio.*

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Laboratory Diagnosis of Rabies

• CDC Recommends:
  – Testing of serum, saliva, CSF and nuchal skin biopsy
    • Viral isolation from CSF or saliva
    • Viral antigen by IFA in nuchal skin biopsy
    • Viral RNA from saliva, tissues (nuchal), other fluids
    • Antibody in CSF or in serum from unvaccinated
Adverse Events
After Rabies Vaccine (n=170)

- Sore Arm ..................... 15-25%
- Headache ...................... 5-8%
- Nausea/malaise .............. 2-5%
- Local Edema .................. < 1%

Adverse Events
After Rabies Vaccine (n=90)

• Redness/Pain.................... 21%
• Headache....................... 7%
• Fever.......................... 3.6%
• Nausea......................... 5%

Adverse Events
For Flu Vaccine (n=5049)

- Sore Arm .................. 33.4%
- Local Redness ............. 18.1%
- Headache ................... 7%
- Fever (sensation) ........... 15.2%

Neurological Reactions After Rabies Vaccine

- Only 5 published reported cases (includes case of Guillain-Barre transient neuroparalytic illness)
- Out of several million doses of rabies vaccine given
- In general population Guillain-Barre type illness occurs in 1/100,000 people/year

Bernard et al., 1982; Boe & Nyland, 1980; Knittel et al., 1989; Tornatore & Richert, 1990; Moulignier et al., 1991
Adverse Reactions (cont.)

- Adverse reactions to HRIG include local pain and low-grade fever
- PEP should not be interrupted or discontinued because of local or mild systemic adverse reactions
- Manage with anti-inflammatory and anti-pyretic medications