

West Nile Virus and Blood Safety, United States, 2002-2005

**Theresa L. Smith, MD, MPH
Arboviral Diseases Branch
DVBID, NCID, CDC**



Acknowledgements

HHS

Jennifer Brown
Roy Campbell
Mary Chamberland
Margaret Collins
Nicholas Crall
Jay Epstein
Jesse Goodman
Roselyn Hochbein
Krista Kniss
Olga Kosoy
Matt Kuehnert
Stephanie Kuhn
Rob Lanciotti
Amy Lambert
Jennifer Lehman
Tony Marfin
Denise Martin

Susan Montgomery
Hira Nakhasi
Amanda Noga
Lisa Pealer
Lyle Petersen
Maria Rios

Blood banking partners

Armed Services Blood Program
Celso Bianco
Mike Busch
Sally Caglioti
Roger Dodd
Steve Kleinman
Jeff Linnen
Larry Pietrelli
Sue Stramer
Mike Strong



West Nile Virus (WNV)

- **Flavivirus related to hepatitis C virus**
 - First seen in the United States in 1999
 - 70-80% asymptomatic
 - 20-30% West Nile Fever (WNF)
 - <1% West Nile neuroinvasive disease (WNND)
- **Potential for blood-borne transmission**
 - Peak viremia before illness onset
 - Duration of viremia estimated median 6.5 days



WNV Transfusion-Associated Transmission (TAT), 2002

- **17 confirmed WNV TAT infections***
 - 15 developed WNND; 2 developed WNF
- **16 infectious units donated 7/22-10/6**
 - 9 donors symptomatic near donation
 - RBCs, plasma, & platelets implicated
 - No WNV IgM or neutralizing antibody
- **2002 WNV transmission via organ transplant probably due to TAT**

*NEJM 9/25/03



WNV Blood Screening, 2003

- **Commercial screening tests**
 - Nucleic acid amplification tests (NAT)
 - Minipool format (same as HCV and HIV)
 - FDA investigational new drug (IND)
- **Rapid implementation in summer 2003**
- **Effectiveness measures**
 - Potentially infectious donations interdicted
 - Breakthrough transmission



IND WNV Blood Screening Algorithm

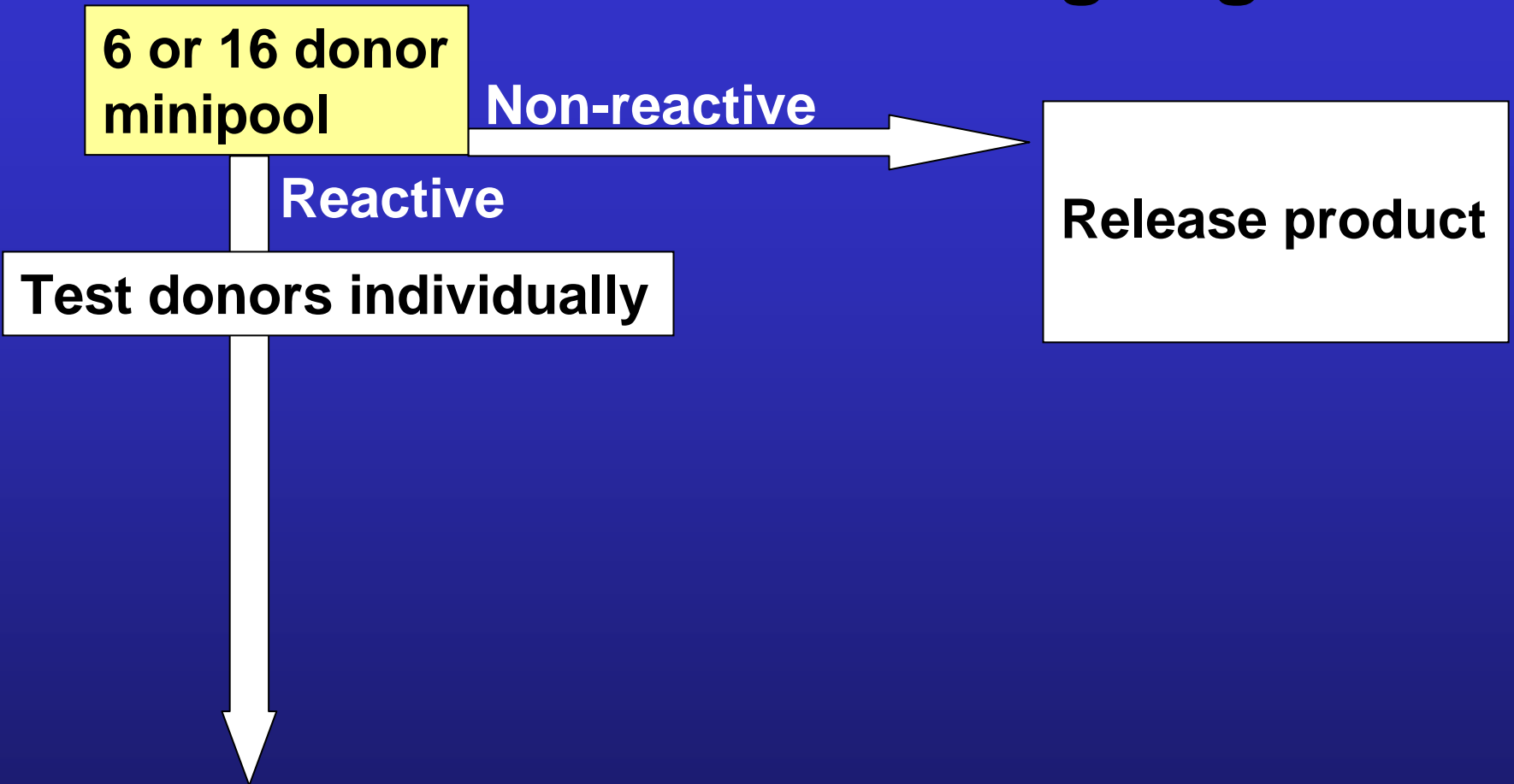
6 or 16 donor
minipool

Non-reactive

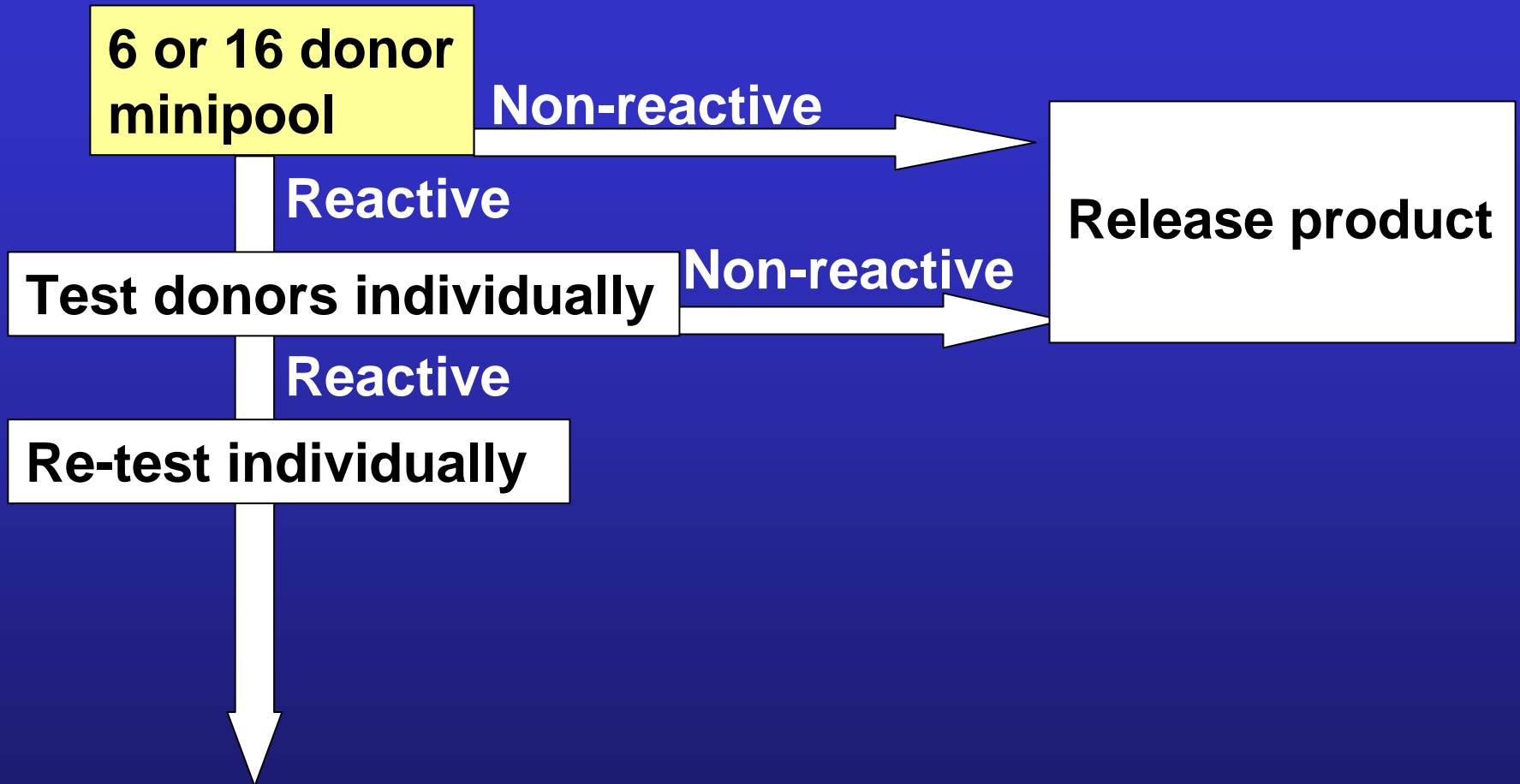
Reactive

Test donors individually

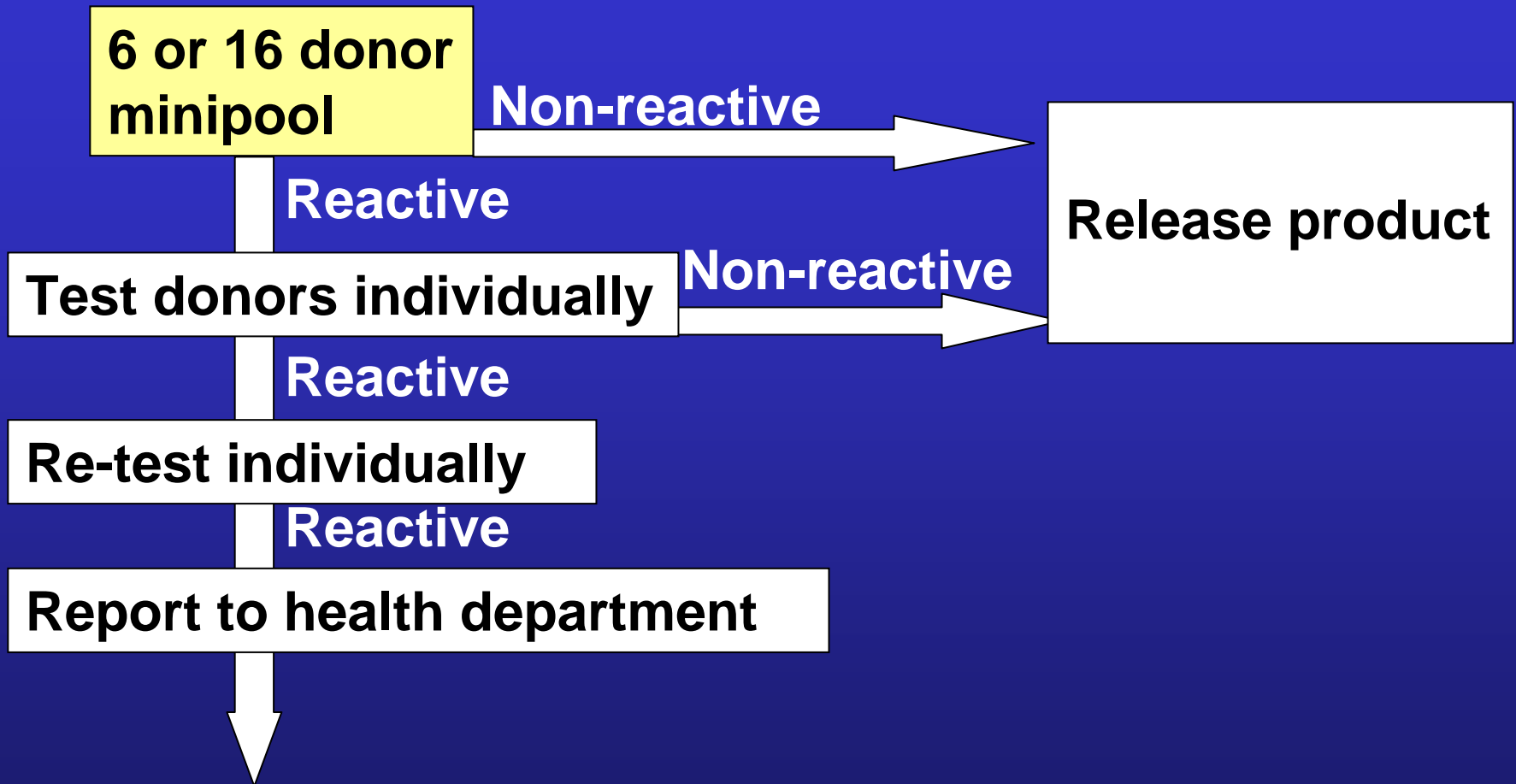
Release product



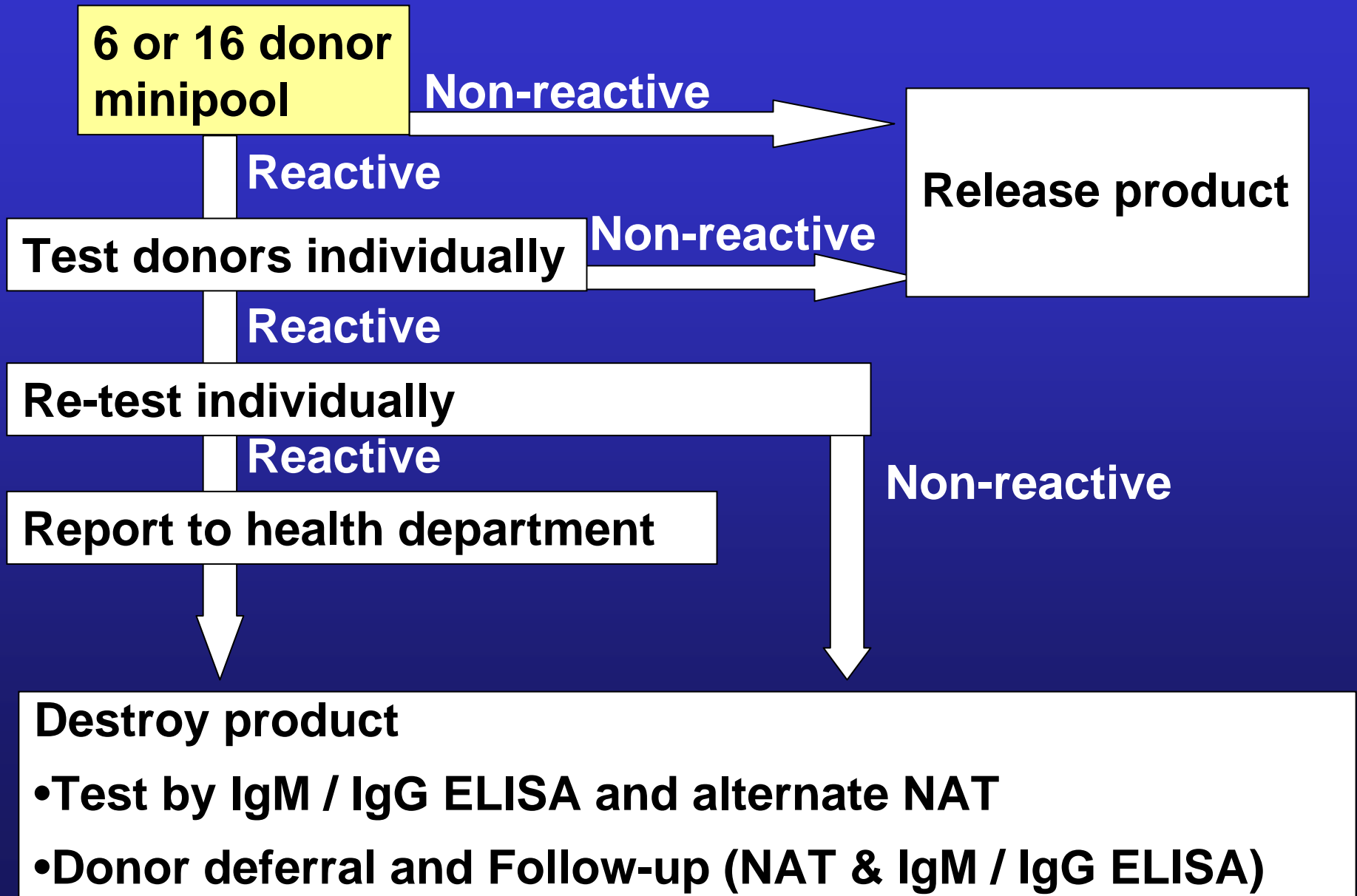
IND WNV Blood Screening Algorithm



IND WNV Blood Screening Algorithm



IND WNV Blood Screening Algorithm



ArboNET-National Electronic Arbovirus Surveillance

- **Ecologic data-mosquito, bird, mammal**
- **Human data**
 - **Disease cases: fever or neuroinvasive**
 - **Presumptively viremic donors (PVDs)**
 - **Blood banks report to public health departments**
 - Gender, age, residence by ZIP code, donation date
 - **Public health departments report to ArboNET**
 - Demographics and clinical follow-up
 - Blood donors or recipients who become ill



“AlterNET”

- **Weekly AABB conference call includes FDA, AABB, DoD, CDC**
 - AABB accounts for 90-95% of U.S. donations
- **Discuss recent PVD activity**
 - Number of units screened & PVDs found
 - Identify risks at level of blood collection sites



2003 PVDs Reported

ArboNET*

- 812 PVDs
 - 1% develop WNND
 - 15% develop WNF
 - 84% asymptomatic

AlterNET**

- Over 6.2 million donations screened
- 1,027 PVDs

*Reported as of 2/9/2004

**Represents 90-95% of donors



Screening Effectiveness Measured by TAT Cases

- Investigations defined as probable, confirmed, non-case or inconclusive
 - Probable has evidence of WNV in donor and infection in recipient
 - Confirmed case has more evidence
 - Non-case shows no infection in donor
 - Inconclusive case lacks samples



WNV TAT Cases, 2003

- **33 case investigations**
 - 5 probable or confirmed cases
 - 14 non-cases
 - 14 inconclusive
- **Donations July 29-September 18**
- **Recipient median age 63 years**
- **Median 7 donations transfused**
- **WNND onsets August 7– October 1**



WNV Blood Screening Conclusions, 2003

- **WNV blood screening success**
 - Rapid implementation
 - Over 1,000 potential infections prevented
- **2003 WNV TAT infectious donation viral load lower than 2002 cases**
- **Sensitivity could be improved**
 - Use PVD “density” as triggers to switch to individual donation testing



2004 PVDs Reported

ArboNET*

- **223 PVDs**
 - 1% develop WNND
 - 29% develop WNF
 - 70% asymptomatic

AlterNET**

- **Over 8.2 million donations screened**
- **206 PVDs**

- ***Reported as of 4/29/2005**
- **** Represents 90-95% of donors**



WNV TAT Cases, 2004

- **14 case investigations**
 - 1 probable case
 - 8 non-cases
 - 5 inconclusive
- **Donation June 2004**
- **Recipient aged 43 years**
- **Received two RBC transfusions**
- **Developed WNND July 2004**



Compare 2003 to 2004

- **2003**

- 5 TAT with a viral load ~ 0.11 pfu/mL
- 821 PVDs reported in ArboNET vs 1,026 reported in AlterNET
- 1 TAT:205 AlterNET PVDs

- **2004**

- 1 TAT with a viral load ~ 0.12 pfu/mL
- 223 PVDs reported in ArboNET vs 206 reported in AlterNET
- 1 TAT: 206 AlterNET PVDs



WNV Blood Screening Conclusions, 2004

- **WNV blood screening success**
 - Fewer TAT investigations and cases
 - Fewer PVDs
- **2004 WNV TAT infectious donation viral load almost identical to 2003 cases**
- **Was sensitivity improved by triggers?**
 - Ratio of TAT to PVDs almost identical



ArboNET versus AlterNET, US, 2003-2004

•2003

- Fewer PVDs reported to ArboNet
 - Encouraged proper reporting
- Learned of PVDs sooner in AlterNET

•2004

- More PVDs in ArboNET than AlterNET
- Learned of PVDs sooner in AlterNET



Surveillance Limitations

- **Multiplicity in surveillance elements**
 - Test manufacturers
 - Blood collection agencies
 - Blood collection sites
 - State health department
- **Experimental screening test variations**
 - Different protocols per manufacturer
 - Used slightly differently each year



Surveillance Limitations

- **Problems investigating possible TATs**
 - Sample availability
 - Loss to follow-up
- **TAT recognition is clinician dependent**
 - May be so insensitive as to yield tertiary cases through organ transplantation



Surveillance Benefits

- **Two systems allows critical data be shared quickly between blood banks and DHHS**
- **Information on asymptomatic human illness may be gained through PVDs as case ascertainment method**
- **Blood bank screening evaluation linked to surveillance can improve screening methods**
- **Improving blood safety can improve transplant safety**

