

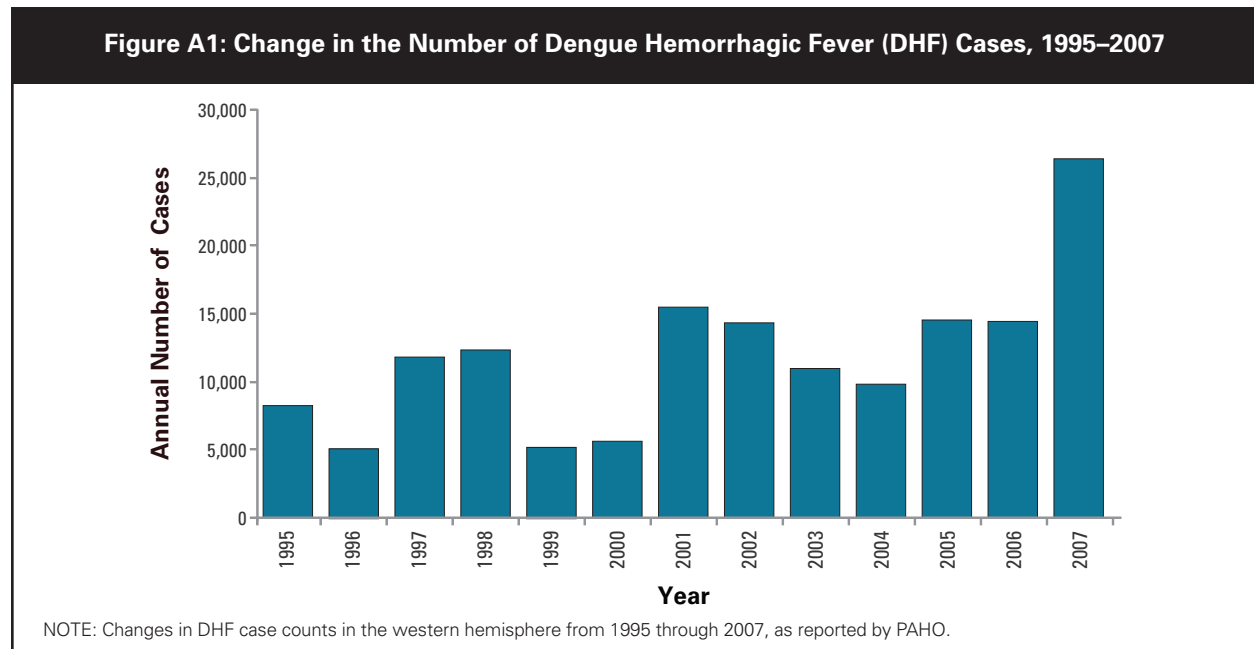
# Online Methodology to the NRDC Report *Fever Pitch: Mosquito-Borne Dengue Fever Threat Spreading in the Americas*

## APPENDIX A

### Methods Used to Map Western Hemisphere Dengue Cases and Vectors in the United States

NRDC used counts of the annual number of cases of dengue fever and dengue hemorrhagic fever for 1995–2007 in the countries of the western hemisphere, obtained from the online data reported to and compiled by the Pan-American Health Organization (PAHO).<sup>1</sup> We chose PAHO data because the information is reviewed and corrected annually. The alternative dengue data source DengueNet, which is collected by the World Health Organization (WHO) and made available online, allows dengue-endemic countries to directly enter their monthly surveillance data, but its annual cross-checking procedures are still being developed. National population data to calculate the rates per 100,000 were taken from the United Nations Populations Statistics website and the Population Reference Bureau.<sup>2</sup>

PAHO data were used to construct the map in Figure 1, which categorizes 2007 dengue incidence rates per 100,000 population as low, medium, or high. This gives a better picture of which nations have experienced the highest rates of reported dengue in recent years.



**Table A1: Hemispheric DHF Cases Reported to PAHO Per Year for 1995–2007**

Number of DHF Cases for 1995–2007													
Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Argentina	N/A	N/A	N/A	N/A	0	0	0	0	0	N/A	0	0	0
Belize	N/A	N/A	N/A	1	0	0	N/A	0	N/A	0	0	0	0
Bolivia	N/A	N/A	N/A	N/A	0	0	0	1	47	25	10	1	109
Brazil	112	69	35	105	70	59	679	2,607	713	77	433	628	1,541
Caribbean	133	20	61	193	74	58	119	303	81	56	154	66	270
Chile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0
Colombia	1,028	1,757	3,950	5,171	1,093	1,819	6,563	5,269	4,878	2,815	4,306	5,379	4,665
Costa Rica	1	N/A	8	N/A	117	4	37	27	69	11	52	72	318
Ecuador	N/A	N/A	N/A	N/A	0	3	55	158	416	64	334	173	334
El Salvador	129	1	N/A	2	70	411	54	405	138	154	207	245	100
Guatemala	1	19	6	2	2	42	4	47	22	39	32	6	21
Hispanic Caribbean	81	41	363	349	63	82	109	111	257	147	103	237	273
Honduras	15	N/A	12	18	69	314	431	863	458	2,345	1,795	636	4,180
Mexico	539	1,456	980	372	220	50	191	1,429	1,419	1,959	4,255	4,477	7,897
Nicaragua	806	49	68	432	749	636	458	157	235	93	177	52	151
Panama	3	N/A	N/A	1	1	3	7	5	0	4	2	7	3
Paraguay	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	55
Peru	N/A	N/A	N/A	N/A	0	0	251	13	15	35	16	4	35
United States	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	N/A	N/A	0	0	0
Uruguay	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0
Venezuela	5,380	1,680	6,300	5,723	2,688	2,186	6,541	2,979	2,246	1,986	2,681	2,476	6,461
<b>Total</b>	<b>8,228</b>	<b>5,092</b>	<b>11,783</b>	<b>12,369</b>	<b>5,216</b>	<b>5,667</b>	<b>15,499</b>	<b>14,374</b>	<b>10,994</b>	<b>9,810</b>	<b>14,557</b>	<b>14,459</b>	<b>26,413</b>

Table 1, also from PAHO data, shows numbers of combined DF plus DHF case counts in 2007 among the various western hemisphere countries. This table gives readers a sense of which nations contribute the greatest number of dengue cases to the overall hemispheric total.

PAHO data were used in mapping Figure 2, which shows the change in incidence rates per 100,000 population for DF and DHF combined, by country, comparing the average for years 2005–2007 versus the average of years 1995–1997. These years were selected to compare the earliest years for which PAHO’s western hemisphere data were centrally collected and made publicly available online (i.e., from 1995), versus the years with the most currently available complete data (through 2007 currently). The rates per 100,000 population are used to account for the effect of population growth and to allow for comparisons across nations with different size populations, but will necessarily underestimate the true rates among locally at-risk populations for a given outbreak.

To look at longer time trends, case data were compiled by WHO’s DengueNet for 1970–1994 and by PAHO for 1995–2007, from combined DF+DHF+DSS cases. The bars in Figure 3 represent seven-year moving averages, tapered at either end. Case counts for 1976 were not available. Western hemisphere countries appear to be using PAHO primarily in the more recent years as the main reporting source for dengue.

Figure A1 shows the changes in DHF cases reported to PAHO between 1995 and 2007. Table A1 lists the numbers of hemispheric DHF cases reported to PAHO per year for 1995–2007 and was used to create Figure A1.

Dengue fever can be carried by two mosquito species that occur in the United States and is potentially transmissible to noninfected local populations from imported and autochthonous (locally transmitted) cases. Therefore, even imported

**Table A2: State-Level Dengue Case Reports Totaled for 1995–2005, and Total Numbers of Counties with Positive Reports for Two Mosquito Vector Species\*\***

State	Total Number of Cases, 1995–2005	Number of Counties with <i>Albopictus</i>	Number of Counties with <i>Aegypti</i>	Number of Counties with Both Species	Sources of Positive Vector Data	
					<i>Albopictus</i>	<i>Aegypti</i>
Alabama	9	40	0	0	Moore (2008), ArboNET	N/A
Alaska	11	N/A	N/A	N/A	N/A	N/A
Arizona	19	0	8	0	N/A	ArboNET
Arkansas	3	20	2	0	ArboNET	Moore (2008), ArboNET
California	35	2	0	0	ArboNET	N/A
Colorado	43	N/A	N/A	N/A	N/A	N/A
Connecticut	6	1	0	0	ArboNET	N/A
Delaware	1	3	0	0	Moore (2008)	N/A
District of Columbia	40	1	1	1	ArboNET	ArboNET
Florida	148	40	27	27	Moore (2008)	Moore (2008), ArboNET
Georgia	84	157	2	2	Moore (2008), ArboNET	ArboNET
Hawaii*	1,782	1	0	0	ArboNET	N/A
Idaho	2	N/A	N/A	N/A	N/A	N/A
Illinois	20	28	0	0	Moore (2008), ArboNET	N/A
Indiana	30	45	0	0	Moore (2008), ArboNET	N/A
Iowa	6	N/A	N/A	N/A	N/A	N/A
Kansas	6	8	0	0	Moore (2008), ArboNET	N/A
Kentucky	2	85	5	5	Moore (2008), ArboNET	ArboNET
Louisiana	5	53	5	5	Moore (2008), ArboNET	Moore (2008), ArboNET
Maine	3	N/A	N/A	N/A	N/A	N/A
Maryland	49	19	4	4	Moore (2008), ArboNET	Moore (2008), ArboNET
Massachusetts	206	1	0	0	ArboNET	N/A
Michigan	28	1	2	0	ArboNET	ArboNET
Minnesota	23	2	0	0	ArboNET	N/A
Mississippi	5	81	1	1	Moore (2008), ArboNET	ArboNET
Missouri	10	28	0	0	Moore (2008), ArboNET	N/A
Montana	15	N/A	N/A	N/A	N/A	N/A
Nebraska	4	3	0	0	Moore (2008)	N/A
Nevada	1	N/A	N/A	N/A	N/A	N/A
New Hampshire	15	3	1	0	ArboNET	ArboNET
New Jersey	6	18	0	0	ArboNET	N/A
New Mexico	12	1	1	0	ArboNET	ArboNET
New York	208	11	0	0	Moore (2008), ArboNET	N/A
North Carolina	50	98	2	2	Moore (2008), ArboNET	ArboNET
North Dakota	1	N/A	N/A	N/A	N/A	N/A
Ohio	21	20	0	0	Moore (2008), ArboNET	N/A
Oklahoma	3	69	0	0	Moore (2008), ArboNET	N/A
Oregon	90	N/A	N/A	N/A	N/A	N/A
Pennsylvania	23	20	1	1	Moore (2008), ArboNET	ArboNET
Rhode Island	12	N/A	N/A	N/A	N/A	N/A
South Carolina	5	46	0	0	Moore (2008), ArboNET	N/A
South Dakota	1	N/A	N/A	N/A	N/A	N/A
Tennessee	4	94	1	1	Moore (2008), ArboNET	ArboNET
Texas*	5,190	80	30	24	Moore (2008), ArboNET	Moore (2008), ArboNET
Utah	7	N/A	N/A	N/A	N/A	N/A
Vermont	15	N/A	N/A	N/A	N/A	N/A
Virginia	7	42	0	0	Moore (2008), ArboNET	N/A
Washington	54	N/A	N/A	N/A	N/A	N/A
West Virginia	0	18	0	0	Moore (2008), ArboNET	N/A
Wisconsin	50	N/A	N/A	N/A	N/A	N/A
Wyoming	2	N/A	N/A	N/A	N/A	N/A

\* Case counts in Texas and Hawaii include some locally transmitted cases.

\*\* See endnotes 43 and 44 of the full issue paper, online at [www.nrdc.org/health/dengue](http://www.nrdc.org/health/dengue).

cases are of potential concern in regions where the vector populations are also found. Figure 4 maps both dengue case counts and dengue vector surveillance data in the United States, showing state boundaries. State-specific cumulative totals for the number of suspected dengue cases (both imported and autochthonous combined) are those reported to the CDC between 1995 and 2005 inclusive, compiled from CDC surveillance. The mosquito vector occurrence reports for species *Aedes aegypti* and *Aedes albopictus* are those for positive occurrences reported in U.S. counties compiled as of 2005 (the most recent year the database was updated) by a national invasive vectors database, and include data from primary state/local reporting sources as well as data through 2006 from the CDC's ArboNET.<sup>3,4</sup> For Hawaii, information about dengue vectors present in recent outbreaks was taken from Effler et al. (2005).<sup>5</sup> Mexican state-specific case surveillance data were compiled from national disease surveillance reports from 1995 to 2005.<sup>6</sup>

Table A2 data, used to create Figure 4, compile state-level dengue case reports and positive reports for the two *Aedes* mosquito vector species from two vector data sources.

Note that there can be discrepancies among the different dengue case reporting data sources, despite appreciable country-level efforts. This highlights the need for additional resources for local, national, and international surveillance, reporting, and coordination. Although there have been 11 suspected travel-associated dengue infections in the state of Alaska, neither of the two mosquito vectors has yet been reported there, and it does not appear on the map.<sup>7</sup> The PAHO data used to construct Figures 1 and 2 include Puerto Rico and the U.S. Virgin Islands in counts for the Hispanic and non-Hispanic Caribbean, respectively; case counts from these areas are not included in Figure 4, but rather in Figures 1 and 2.

# Endnotes

1. PAHO data are available online at: <http://www.paho.org/english/ad/dpc/cd/dengue.htm>.
2. UN medium variant population statistics website for 1995, available at: <http://esa.un.org/unpp/index.asp>; 2007 population estimates from Population Reference Bureau (2008), *World Population Data Sheet*, available at: <http://www.prb.org/Publications/Datasheets/2007/2007WorldPopulationdataSheet.aspx>.
3. Moore, C. (2008), “Exotic mosquitoes in the USA. 27th Biennial State Public Health Vector Control Conference,” available at: <http://www.cdc.gov/ncidod/dvbid/westnile/conf/27thbiennialVectorControl/index.htm>; ArboNET data are through 2006; Note the Moore (2008) data were last updated in 2005.
4. According to a CDC report titled, *Provisional Surveillance Summary of the West Nile Virus Epidemic – United States, January–November 2002* (JAMA 289[3]:293-295), “ArboNET is a web-based surveillance data network comprising 64 state and local public health departments and CDC.”
5. Effler, P.V., et al. (2005), “Dengue fever, Hawaii, 2001-2002,” *Emerg Infect Dis* 11(5):742-749, available at: <http://www.cdc.gov/ncidod/EID/vol11no05/04-1063.htm>
6. Data from Sistema Unico de Información para la Vigilancia Epidemiológica/Dirección General de Epidemiología/SSA <http://www.dgepi.salud.gob.mx/anuario/index.html#>
7. Moore, C., personal communication (December 15, 2008).