

Traveler's malaria, locally-transmitted malaria, and transfusion-transmitted malaria in the United States

Monica E. Parise, MD
Centers for Disease Control and Prevention

The findings and conclusions in this report are those of the author and do not necessarily represent the views of the Centers for Disease Control and Prevention



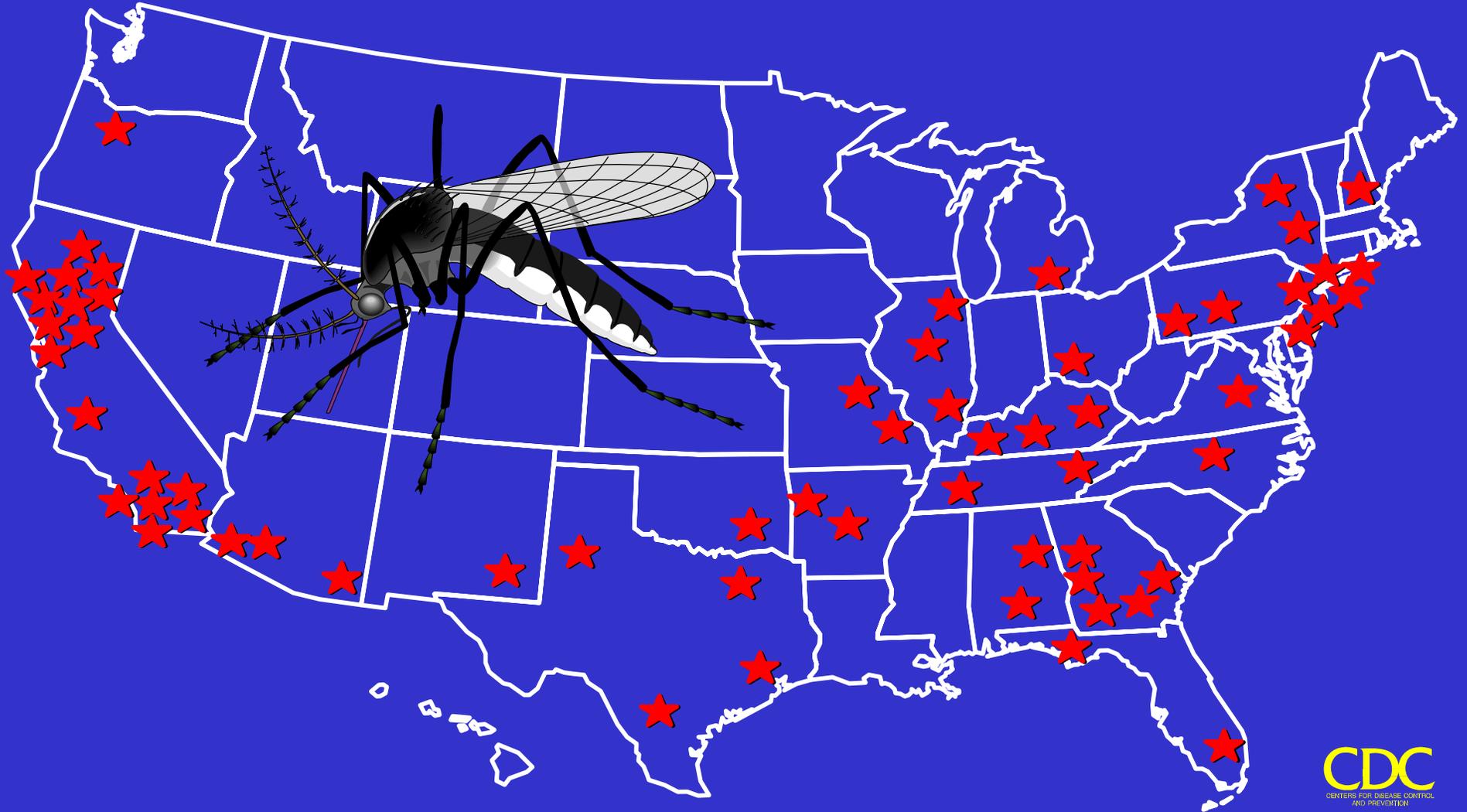
Malaria in the United States

- Approximately 1,000-1,500 cases reported annually
 - Imported – 99%
 - Locally acquired (up to about 10 cases/year)

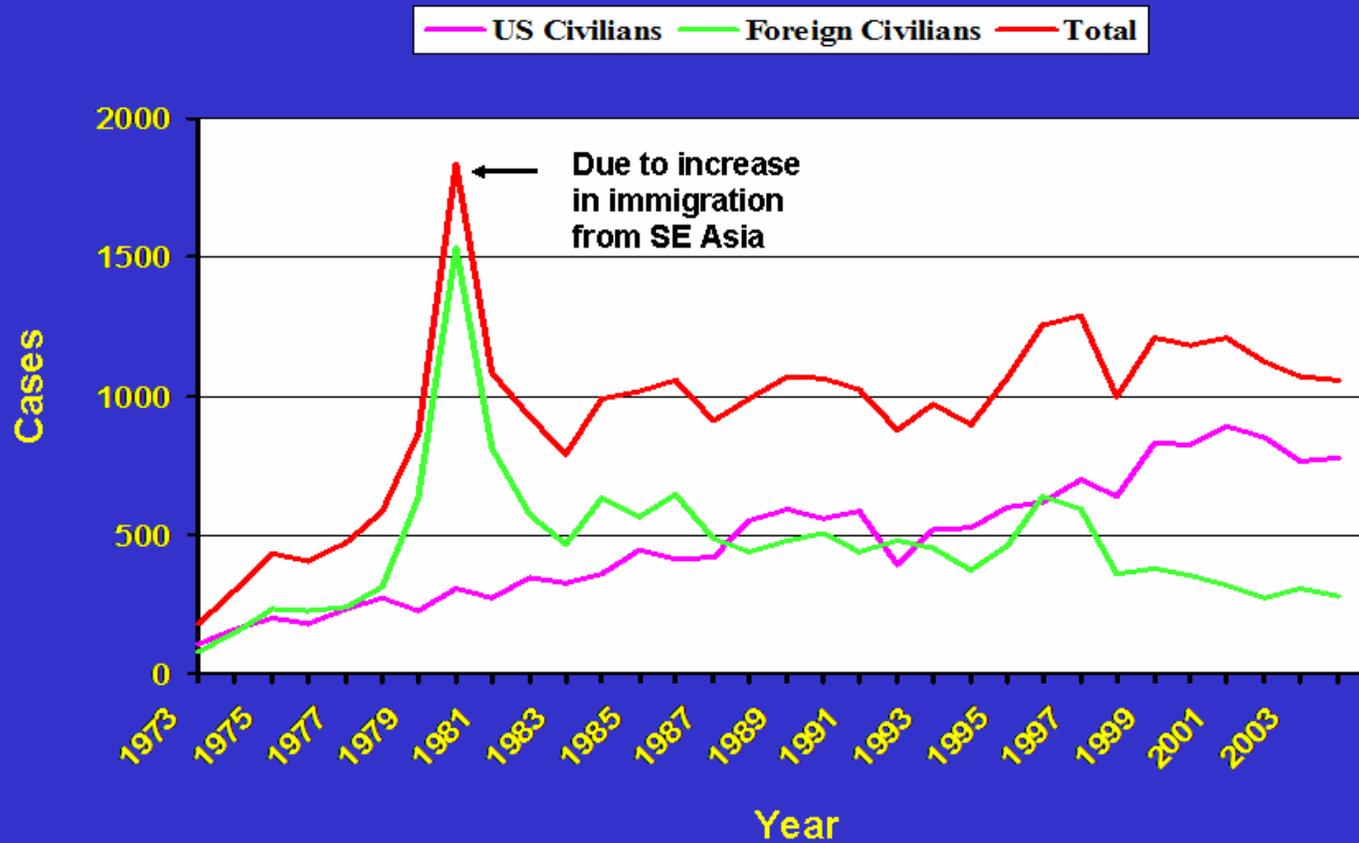
Locally-acquired malaria

- Induced by blood transfusion or organ transplantation, needle-stick, intravenous drug use, nosocomial transmission (errors)
- Congenital
- Local mosquito-borne transmission occasionally occurs...

Local Mosquito-borne Transmission United States, 1957-2005



Number of malaria cases among U.S. and foreign residents, by year — United States,* 1973–2004

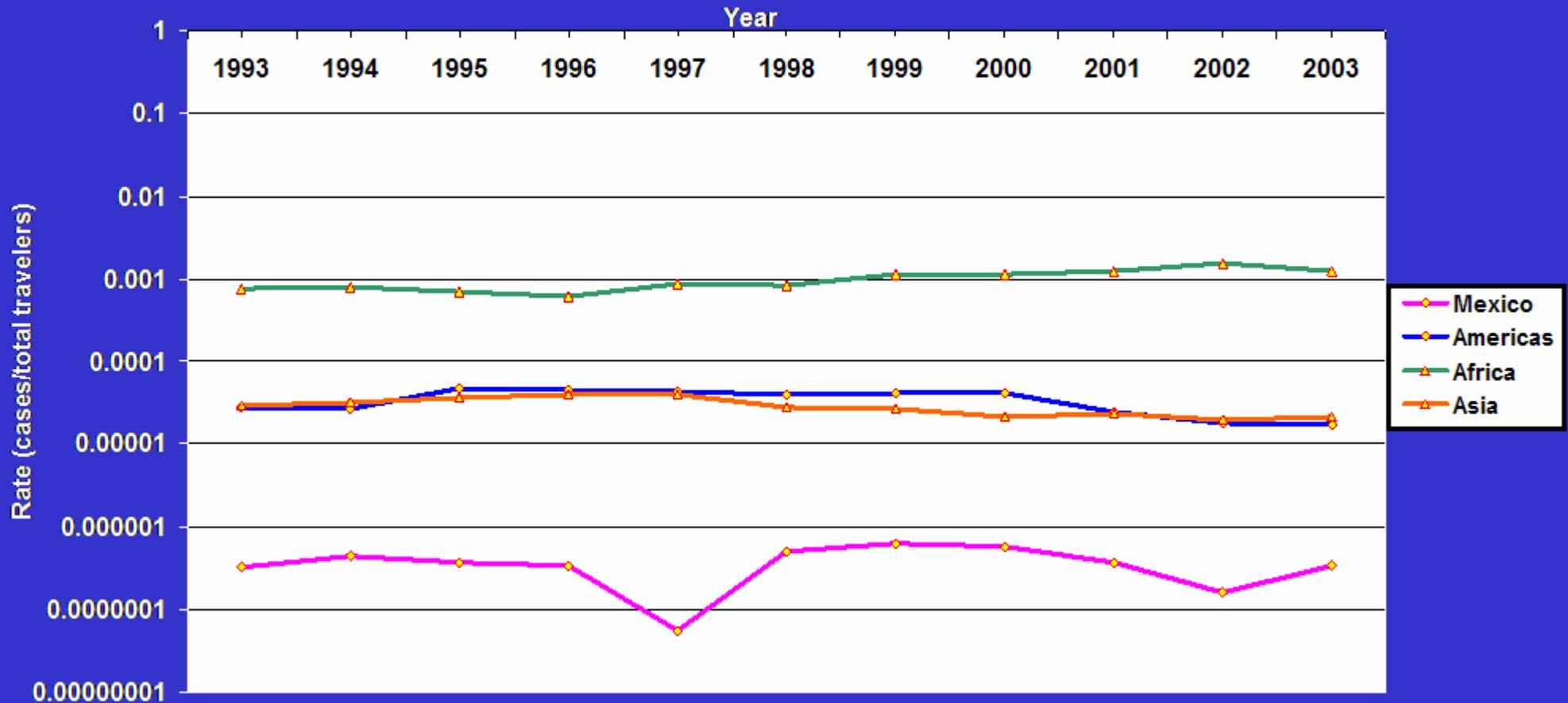


Number of immigrants to the United States, 1820-2003



Source: Office of Immigration Statistics,
US Department of Homeland Security: Yearbook of Immigration Statistics 2003

Rates among U.S. travelers abroad, 1993-2003*



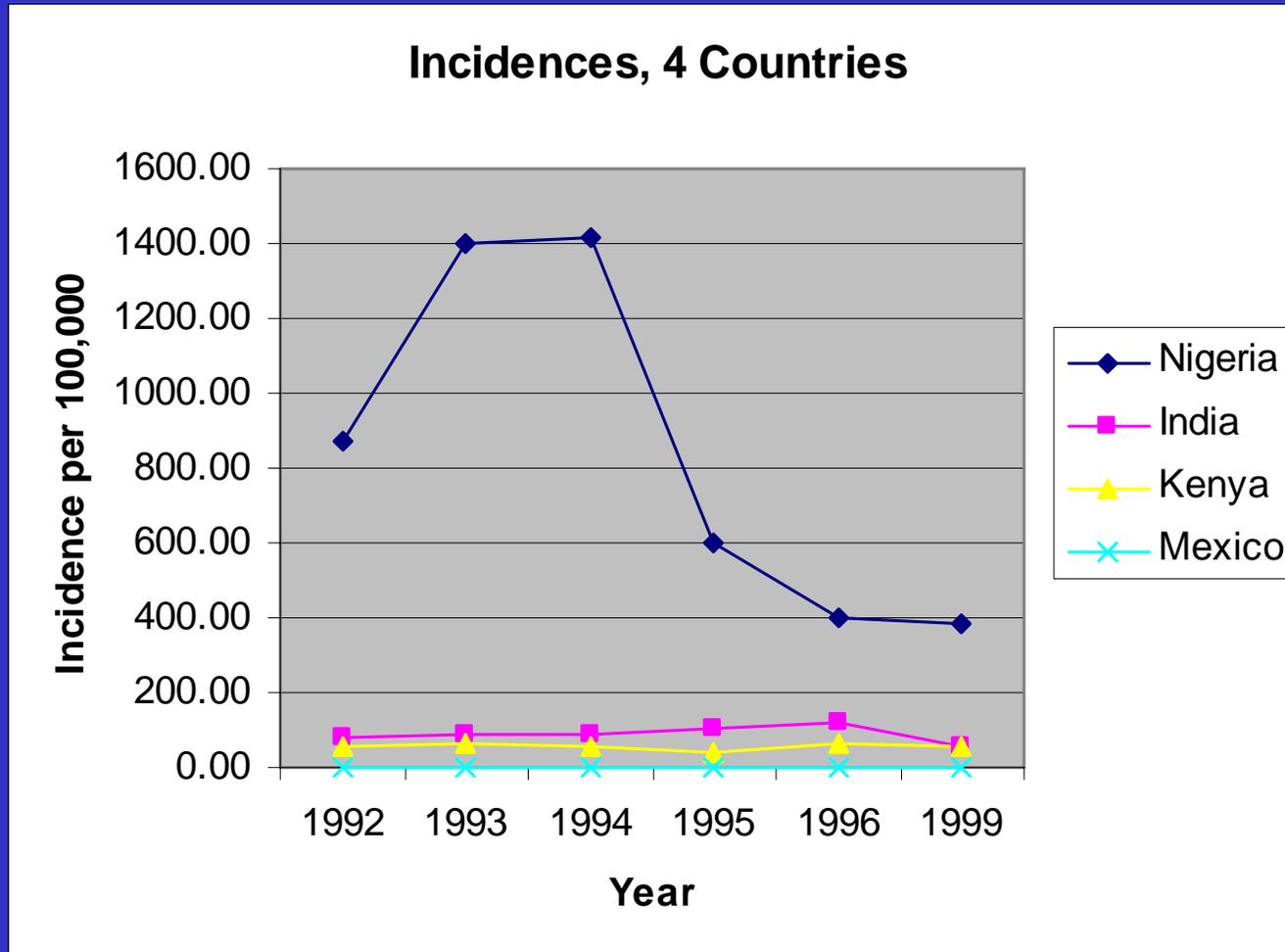
* Data on numbers of travelers from Office of Travel and Tourism Industries

1999 Incidence, by Region

Region	Immigrants, Refugees & Asylees*	Travelers*
Africa	196.96	82.19
Americas	19.08	0.59
Asia	16.41	4.22
Europe	0.00	0.35
Oceania	0.00	210.55
All Regions	33.88	2.95

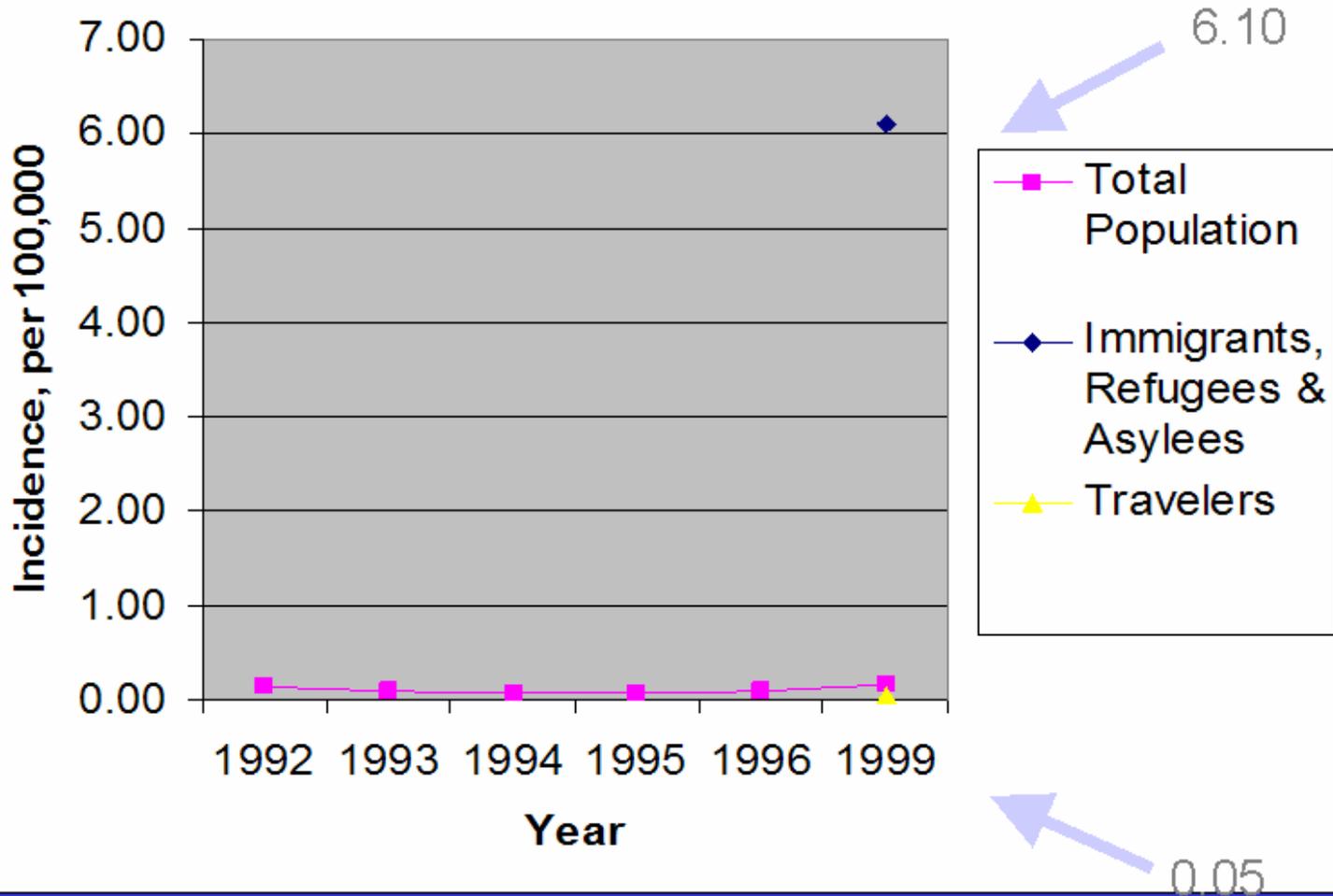
* Incidence per 100,000 persons

Incidence of malaria in US travelers, immigrants, refugees, and asylees



Rates calculated using traveler data from World Tourism Organization and figures for immigrants, refugees, and asylees from INS.

Incidences of Malaria Imported from Mexico



Rates calculated using traveler data from World Tourism Organization and figures for immigrants, refugees, and asylees from INS.

What about the resorts? Risk is so low.
Can't you all just give us those?

- Risk is in the resorts in rural areas except La Altagracia Province, DR
- We hear arguments about what is a rural vs urban resort...we have some evidence that there were cases from a resort town that is argued to be big/urban
- Highlights need for best evidence-based recommendations possible

What about the resorts? (II)

- These are areas where CDC considers risk high enough to recommend prophylaxis for travelers (although possible will go to standby treatment for very low risk situations in future)...would seem risky to not defer blood donors
- Raises some interesting questions/issues:
 - Base recommendations on the endemic situation (conservative approach) vs traveler (or TTM) data?
 - Given the micro-epidemiology of malaria, if base on traveler data, must remember that assumptions based on the average traveler may not hold for all
 - What would be an acceptable level of risk?

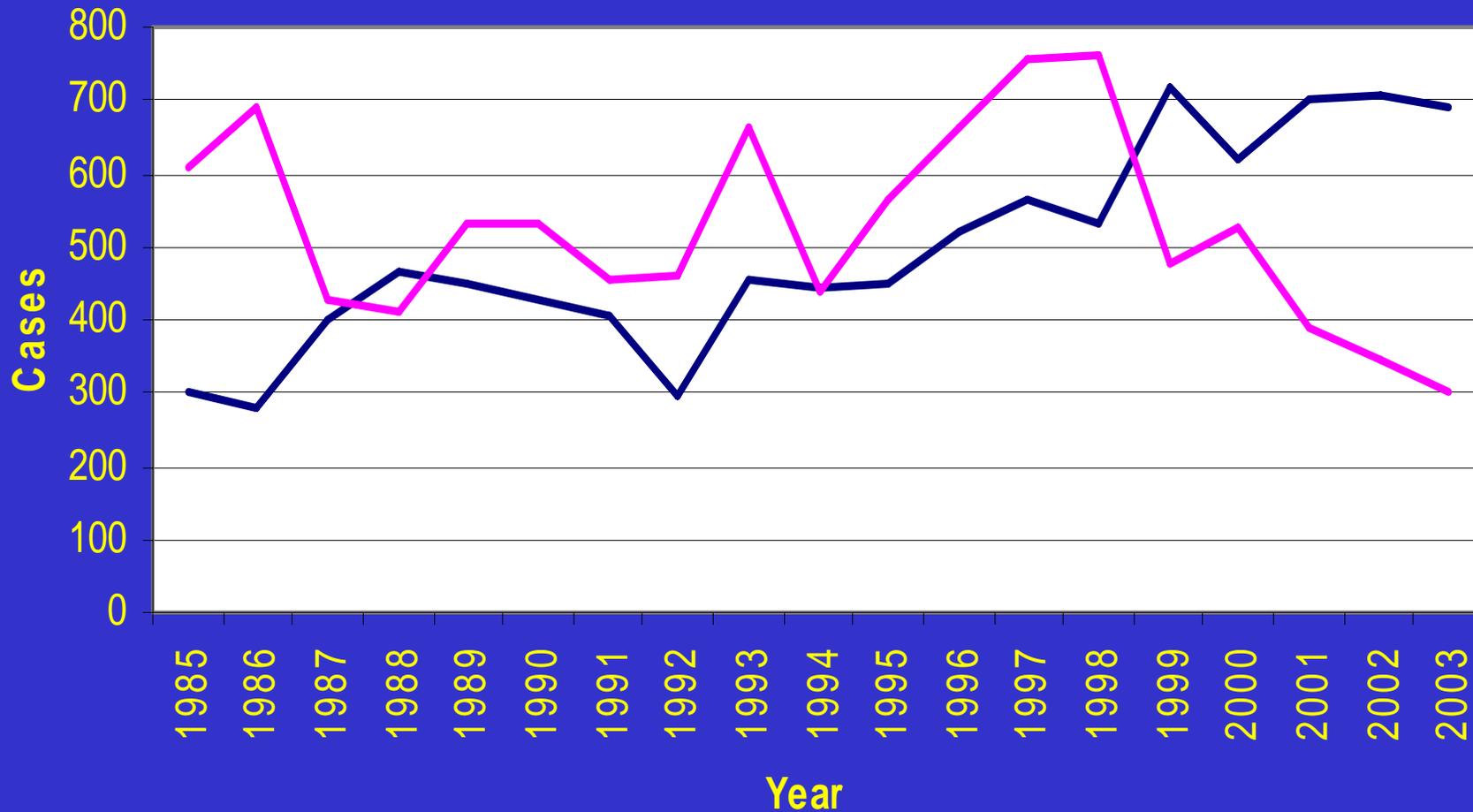
Number of malaria cases, by *Plasmodium* species — United States, 2002-2004

TABLE 2. Number of malaria cases, by *Plasmodium* species — United States, 2002, 2003, and 2004

<i>Plasmodium</i> Species	2002		2003		2004	
	No.	(%)	No.	(%)	No.	(%)
<i>P. falciparum</i>	699	(52.3)	682	(53.4)	656	(49.6)
<i>P. vivax</i>	339	(25.4)	293	(22.9)	315	(23.8)
<i>P. malariae</i>	38	(2.8)	46	(3.6)	47	(3.6)
<i>P. ovale</i>	37	(2.8)	33	(2.6)	27	(2.0)
Mixed	11	(0.8)	12	(0.9)	17	(1.3)
Undetermined	213	(15.9)	212	(16.6)	262	(19.8)
Total	1,337	(100.0)	1,278	(100.0)	1,324	(100.0)

Trend in Species from 1985-2003

— *P. falciparum* — *P. vivax*



Region of acquisition of malaria cases — United States, 2004

TABLE 5. Number of imported malaria cases among U.S. and foreign civilians, by region of acquisition — United States, 2004*

Area or region	United States		Foreign		Total	
	No.	(%)	No.	(%)	No.	(%)
Africa	548	(70.7)	177	(62.8)	725	(68.6)
Asia	91	(11.7)	53	(18.8)	144	(13.6)
Central America and the Caribbean	73	(9.4)	35	(12.4)	108	(10.2)
South America	24	(3.1)	3	(1.1)	27	(2.6)
North America	6	(0.8)	11	(3.9)	17	(1.6)
Oceania	28	(3.6)	1	(0.4)	29	(2.7)
Europe/Newly Independent States	0	(0)	0	(0)	0	(0)
Unknown†	5	(0.7)	2	(0.7)	7	(0.7)
Total	775	(100.0)	282	(100.0)	1,057	(100.0)

*Persons for whom U.S. or foreign status is not known are excluded.

†Region of acquisition is unknown.

Malaria acquired in Africa, 2003

- Travel to Africa accounts for only 0.6% of U.S. travel in 2003
- Yet 66.2% of all malaria infections and 85.9% of all *P. falciparum* infections were acquired in Africa in 2003
- From 1985-2002, 93% of all malaria deaths in US travelers due to *Pf* – 73% of those were acquired in sub-Saharan Africa

Malaria acquired in the Americas, 2004: US surveillance data

Region	Pf	Pv	Pm	Po
Central America	15	49	4	1
Caribbean	26	0	2	0
Mexico	0	12	1	0
South America	8	17	1	0

Species data from the Americas

- PAHO (2004)
 - Reports *P. malariae* in Americas – most cases from Guyana and Suriname. Also from Venezuela, Colombia, Belize
 - No mention of *P. ovale*
- Review article on *P. ovale* (Collins WE, 2005)
 - No *P. ovale* mentioned from Americas

VFR travel

- Purpose of travel in 44% of the 26 million trips made in 2002 (excluding Canada and Mexico)
- GeoSentinel: VFR travelers have 8 times higher risk of acquiring malaria than tourists (Leder CID 2004)

VFR = immigrant who returns to homeland to visit friends and relatives

Results: Characteristics of 96 Cases 1963-2005

Age > 40 years (%)	67
Male (%)	57
Fatal outcome (%)	10
Implicated blood product (%)	
Whole blood	62
PRBCs	32
Platelets	6
Number of donors/case	1-192 (median=7)
Time from symptom onset to diagnosis (days)	1-180 (median =9)

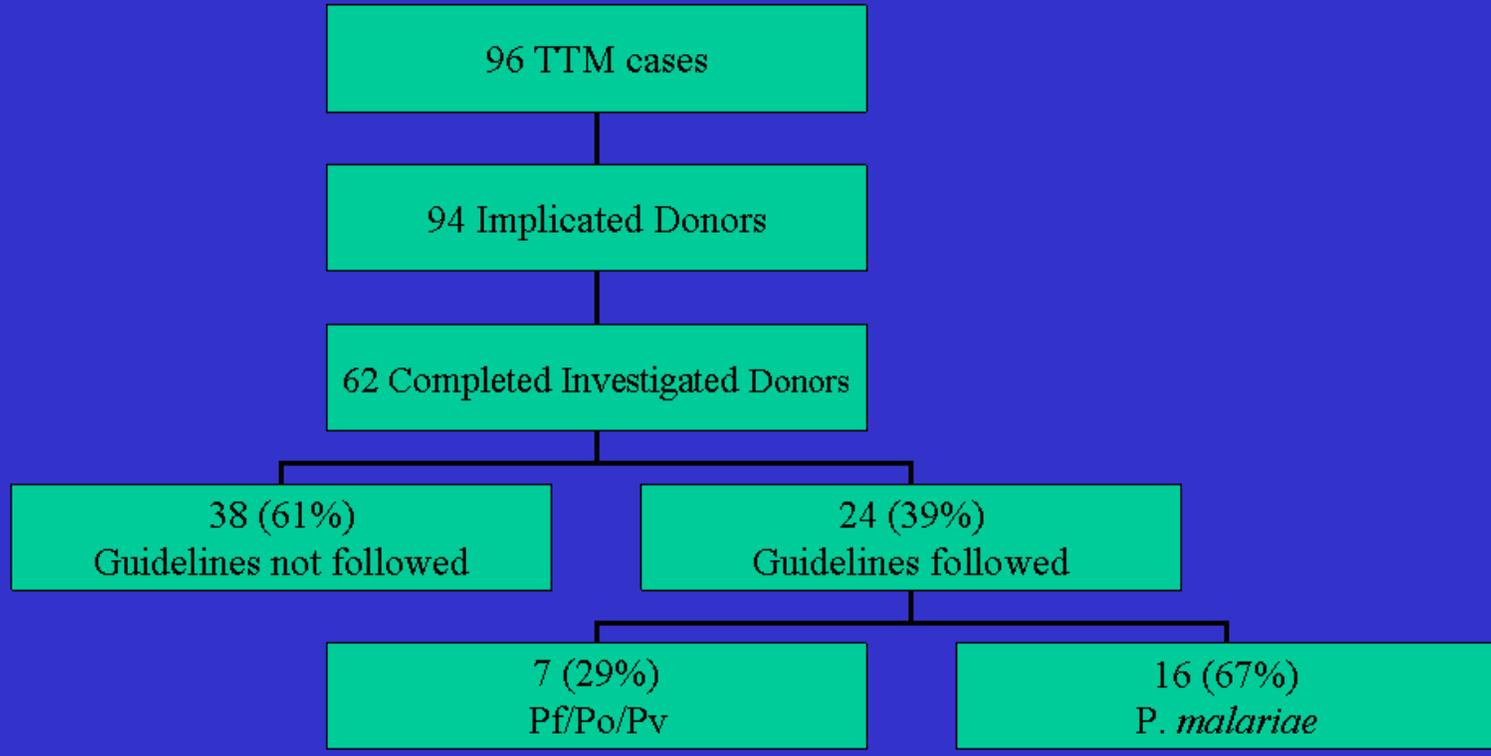
Characteristics Of 69 Implicated Donors 1963-2005

Age	Range 17-59 years 74% between 21-40 years
Male (%)	90
Foreign-born (%)	61
Area of acquisition of infection (%)	
Africa	48
Asia	34
Americas	10

Implicated Donors

- For 62 implicated donors where the epidemiologic investigation was complete:
 - 61% should have been excluded if the donor deferral guidelines had been correctly applied
 - 39% would not have been excluded; of these, 2/3 had *Plasmodium malariae*

Implicated Donors



0.09 cases/million units transfused where guidelines were followed

Prior Residents of Endemic Areas

Persons who return home to visit friends and relatives (n = 8):

- Correct time limit for donor deferral?
- Five cases arose within 1 year
- Two of the others were *Pm* and > 3 yrs
- Only one case (*Pf* at 29 months) would have been prevented with change from 1-year to 3-year exclusion

Malaria Species Involved

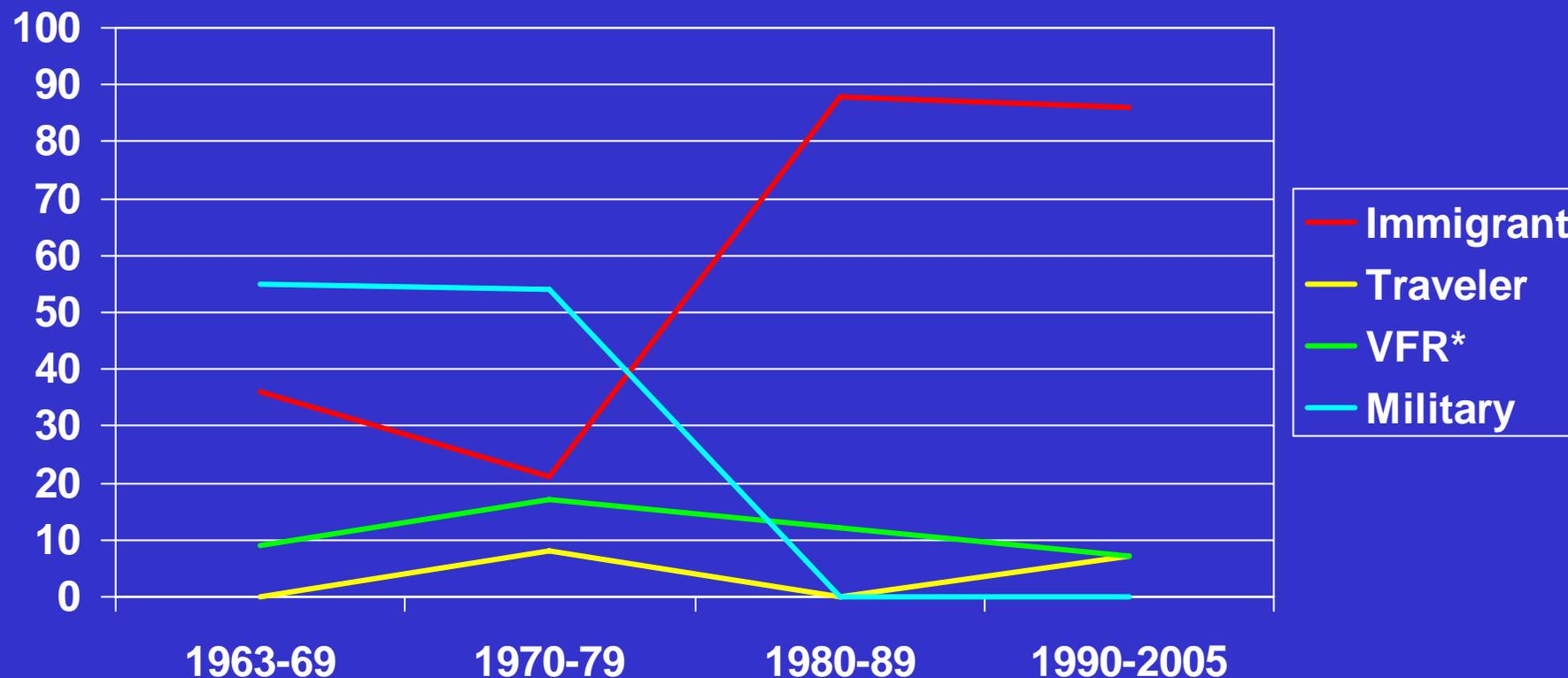
Species (%)	All cases* N=94	Guidelines not followed n= 38	Guidelines followed n= 24
<i>P. falciparum</i>	36	61	17
<i>P. vivax</i>	27	26	8
<i>P. malariae</i>	28	8	67
<i>P. ovale</i>	5	5	4
Mixed	3	-	4

* 2 cases were unknown species

Species involved in TTM cases by region, 1963-2005

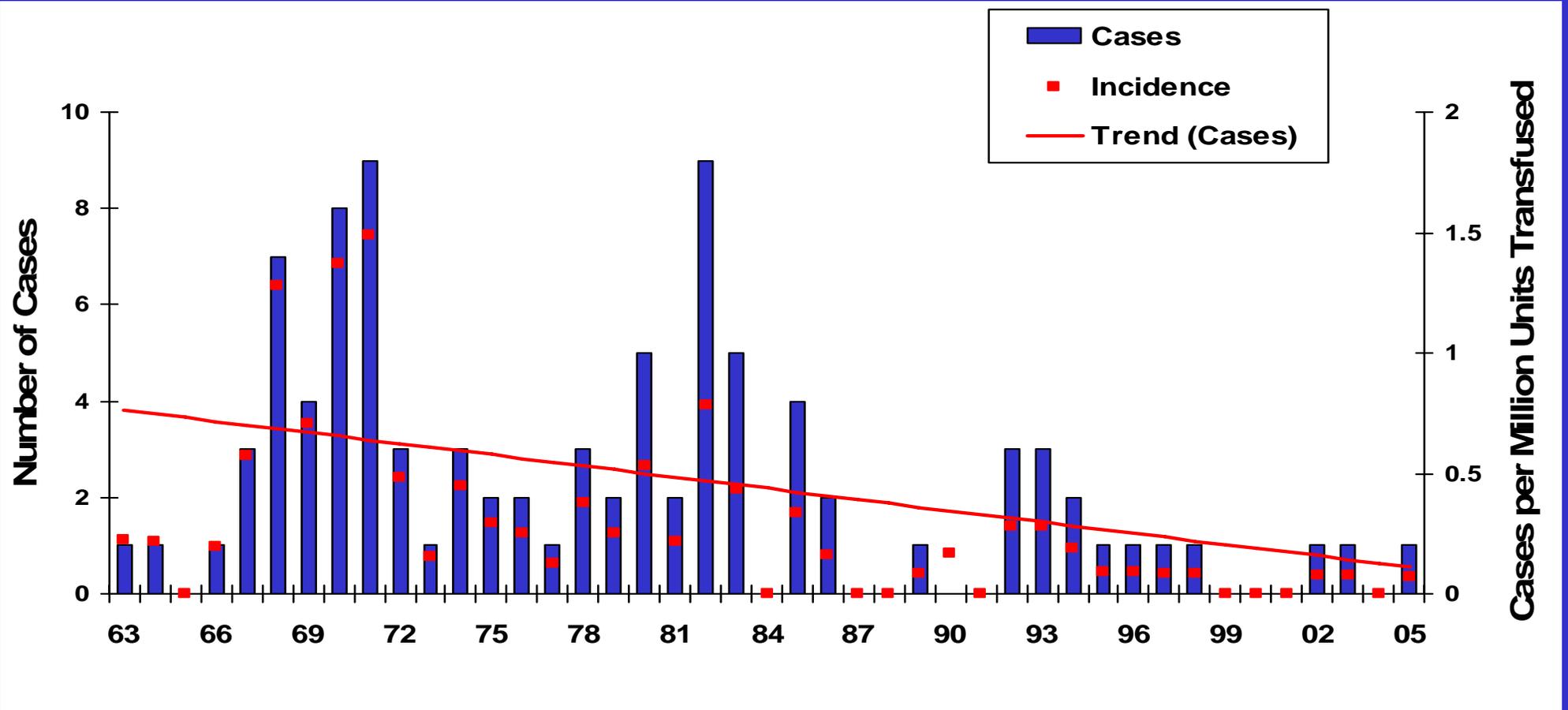
Region	Pf	Pv	Pm	Po
Africa	17	2	8	5
Asia	10	8	5	0
Americas	1	3	3	0
Other	0	0	4	0

Implicated donors, by decade



* VFR = Persons who previously lived in an endemic area, now live in the US, and return to their country of origin to visit friends/relatives

Incidence of Transfusion- Transmitted Malaria, 1963-2005



TTM...the last 15 years (1990-2005)

- 16 cases (donor implicated in 14)
 - 12 – immigrants; two persons born in US but who lived long-term overseas grouped into this category
 - 1 – US traveler (Kenya)
 - 1 – VFR (Africa)
- 12/14 (86%) acquired in sub-Saharan Africa (2 in China due to *Pm*)
- 71% due to *Plasmodium falciparum*
 - 21% *P. malariae* – China; 7% *P. ovale*
- Failure of screening process in 71%

Summary

- Low incidence TTM with current guidelines
 - Incidence 0.23 cases/ million units transfused
 - 0.09 cases/ million units transfused where guidelines were followed
- Highest risk
 - Immigrants
 - Exposure in Africa

Acknowledgements

- Sonja Mali
- Lou Katz
- Heather Wachtel