

# Recent Analyses of Hepatitis B Viral Infections in Children

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# Hepatitis B: Burden of Disease United States, 2002

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- ~80,000 new infections
- 1 of 20 persons have been infected with HBV during their lifetime (about 12.5 million)
- 1 of 200 persons have chronic (lifelong) infection with HBV (about 1.25 million)
- 4-5000 deaths from hepatitis B-related chronic liver disease (cirrhosis, liver cancer)

# Strategy to Eliminate Hepatitis B Virus Transmission in the United States

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## *ACIP Recommendations*

- Prevent perinatal HBV transmission
- Universal infant vaccination
- Universal adolescent vaccination
- Vaccination of adults in high risk groups

# Key Elements of Perinatal Hepatitis B Prevention Programs

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- Testing all pregnant women for HBsAg
- Reporting of HBsAg-positive women
- Case-management and tracking to assure:
  - HBI G and hepatitis B vaccine at birth
  - completion of 3 dose vaccine series by 6 months of age

## Estimated Births to HBsAg-Positive Mothers United States, 1997

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Race/Ethnicity	1997	<u>CDC Estimate</u>		<u>Pooled Estimate*</u>	
	Births	% positive	N	% positive	N
White	2,358,989	0.13	3,067	0.09	2,123
African American	578,099	0.50	2,890	0.53	3,064
Asian/Pacific Islander	165,776	7.50	12,433	5.74	9,515
Hispanic	701,339	0.12	841	0.20	1,403
Other	87,291	0.50	436	0.29	253
Total	3,891,494		19,668		16,358
(95% CI)			(14,906 – 31,861)		(16,056 – 16,897)

\*prevalence studies among pregnant women in 18 states since 1990

## Evaluations of HBsAg Screening of Pregnant Women, 1991-2001

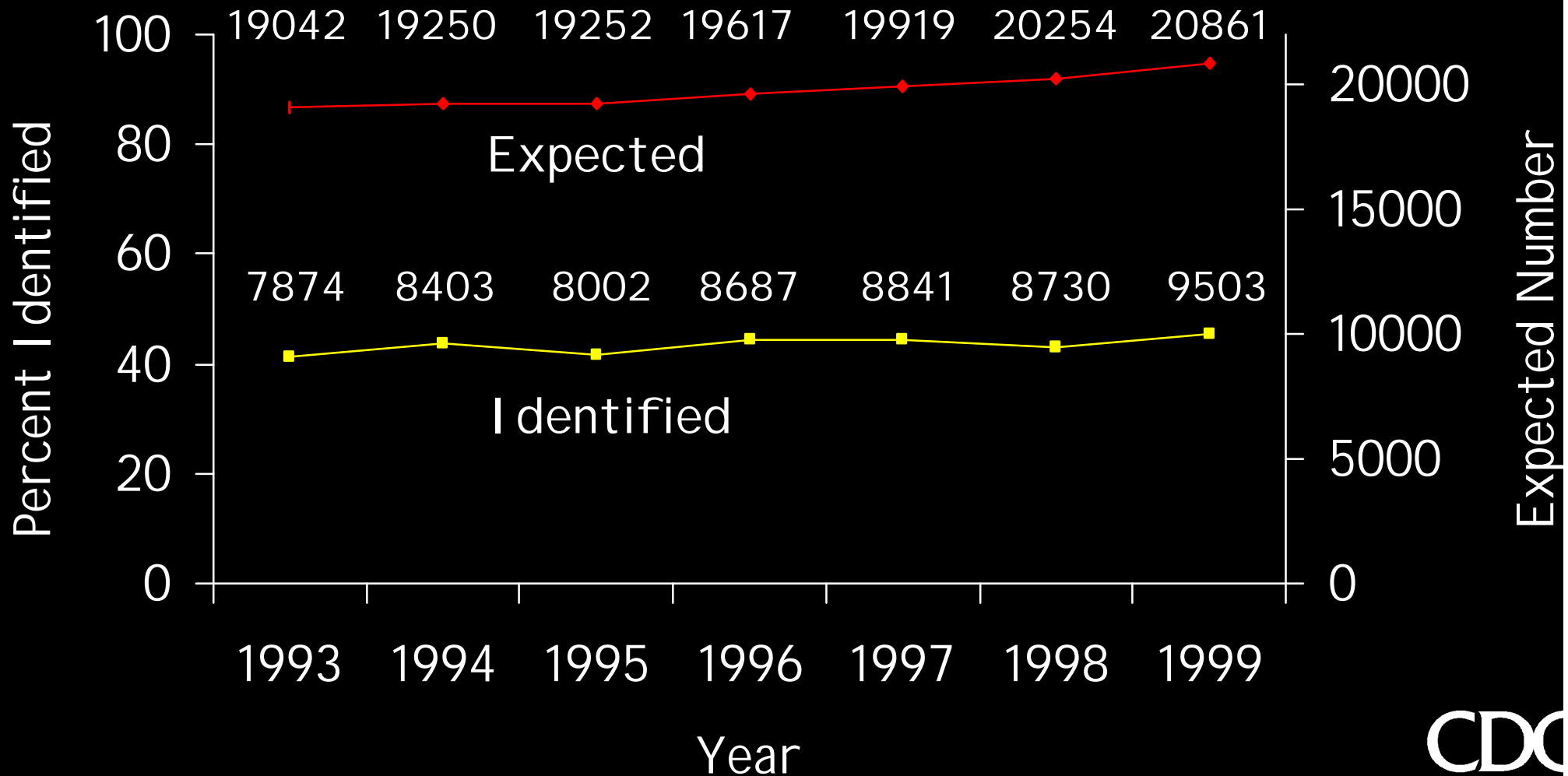
Study	Year	Births Reviewed, No.	Mothers Screened, (%)
New York	1991	607	(96)
Kansas	1992	412	(84)
National	1993	3,982	(84)
Washington	1994	4,031	(96)
Ohio	1994	394	(96)
Illinois	1994-5	1,361	(91)
California	1995	5,414	(96)
Florida	1995	365	(88)
North Carolina	1997-98	4726	(92)
Delaware	1999	N/A	(91)
8 states (EID sites)	2001	5135	(96.5)

# Perinatal Hepatitis B Prevention Gaps

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- Less than 50% of expected infants born to HBsAg-positive mothers reported
- Infants born to mothers with unknown HBsAg status often not managed appropriately
- Errors in tracking infants born to known HBsAg-positive mothers

# Identified and Expected Births to HBsAg-Positive Mothers United States, 1993-1999



## HBsAg Prevalence among Pregnant Women by Prenatal Screening Status, Philadelphia, 1991

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Prenatal Screening	No. of Women Tested	HBsAg-positive No. (%)
Yes	1555	12 (0.8)
No	208	14 (6.7)

Source: JAMA 1991;266:2852-5

# Hepatitis B Vaccination at Birth, by Mother's HBsAg Status

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Vaccinated at Birth, No., (%)  
Mother's HBsAg Status

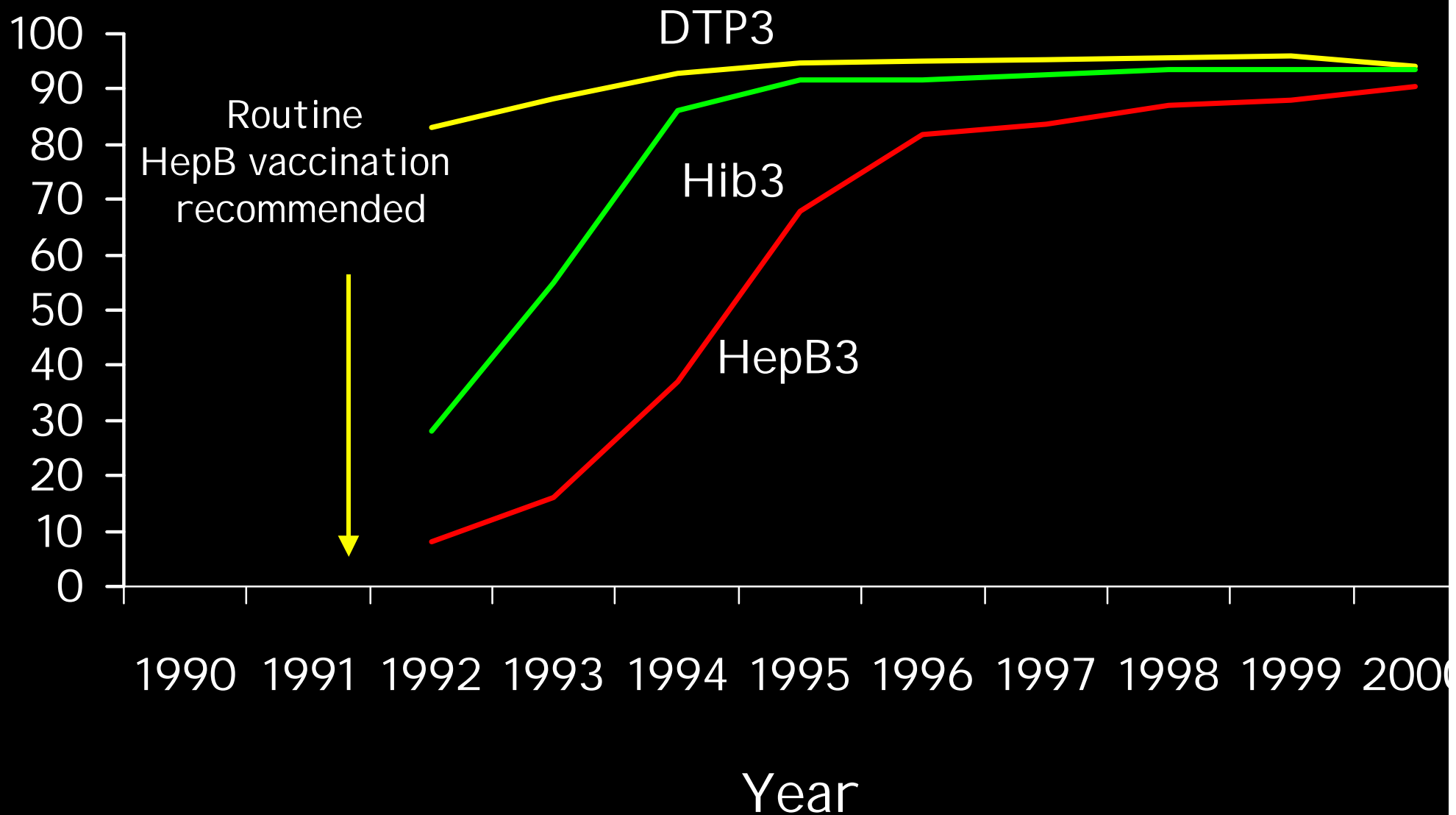
<u>Study</u>	<u>Year</u>	<u>Unknown</u>		<u>Negative</u>	
Nat'l	1993	640	(22)	3,982	(36)
WA	1994	125	(53)	3,860	(64)
CA	1995	200	(20)	6	(26)
FL	1995	38	(29)	311	(26)
OH	1995	35	(66)	266	(89)

# Perinatal Hepatitis B Death - Michigan

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- Baby girl; DOB: 9/99
- Died: 12/99; Cause: fulminant hepatitis B
- Mother tested HBsAg-positive during pregnancy
- **Prenatal care provider**
  - Made a transcription error and reported mother as “hepatitis negative” to the hospital
  - Used prenatal record form from 1966
  - Did not report HBsAg-positive test (Michigan law)
- **Hospital staff**
  - Relied on written record from prenatal provider
  - Did not have a copy of mother’s laboratory result
  - Had suspended administration of hepatitis B vaccine birth dose for all newborns because of thimerosal concern

# HepB3, DTP3, and Hib3 Coverage, Among 19-35 Month-Old Children, 1992-2000

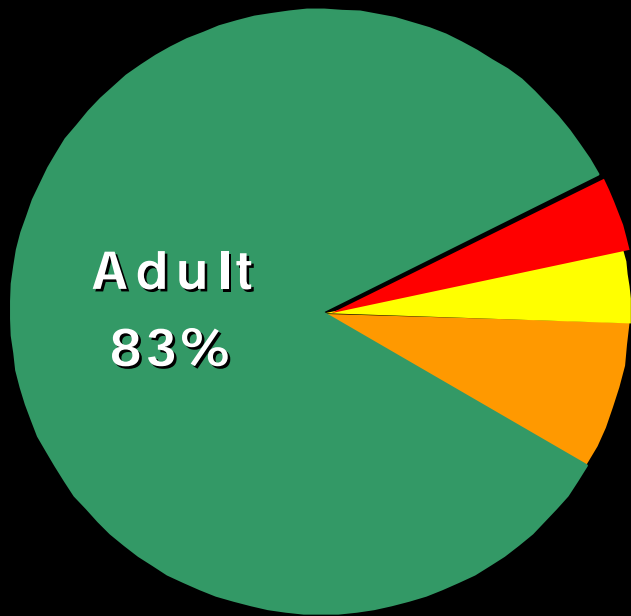


# Estimated Childhood HBV Infections in the United States Before Routine Infant Hepatitis B Immunization

Armstrong GL, Mast EE, Wojczynski M, Margolis HS.  
Pediatrics 2001;108:1123-8.

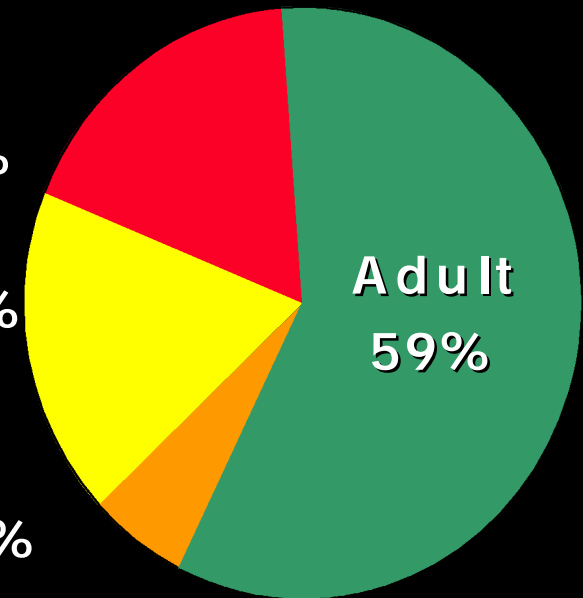
# Age at Acquisition of Acute and Chronic HBV Infection United States, 1989 Estimates

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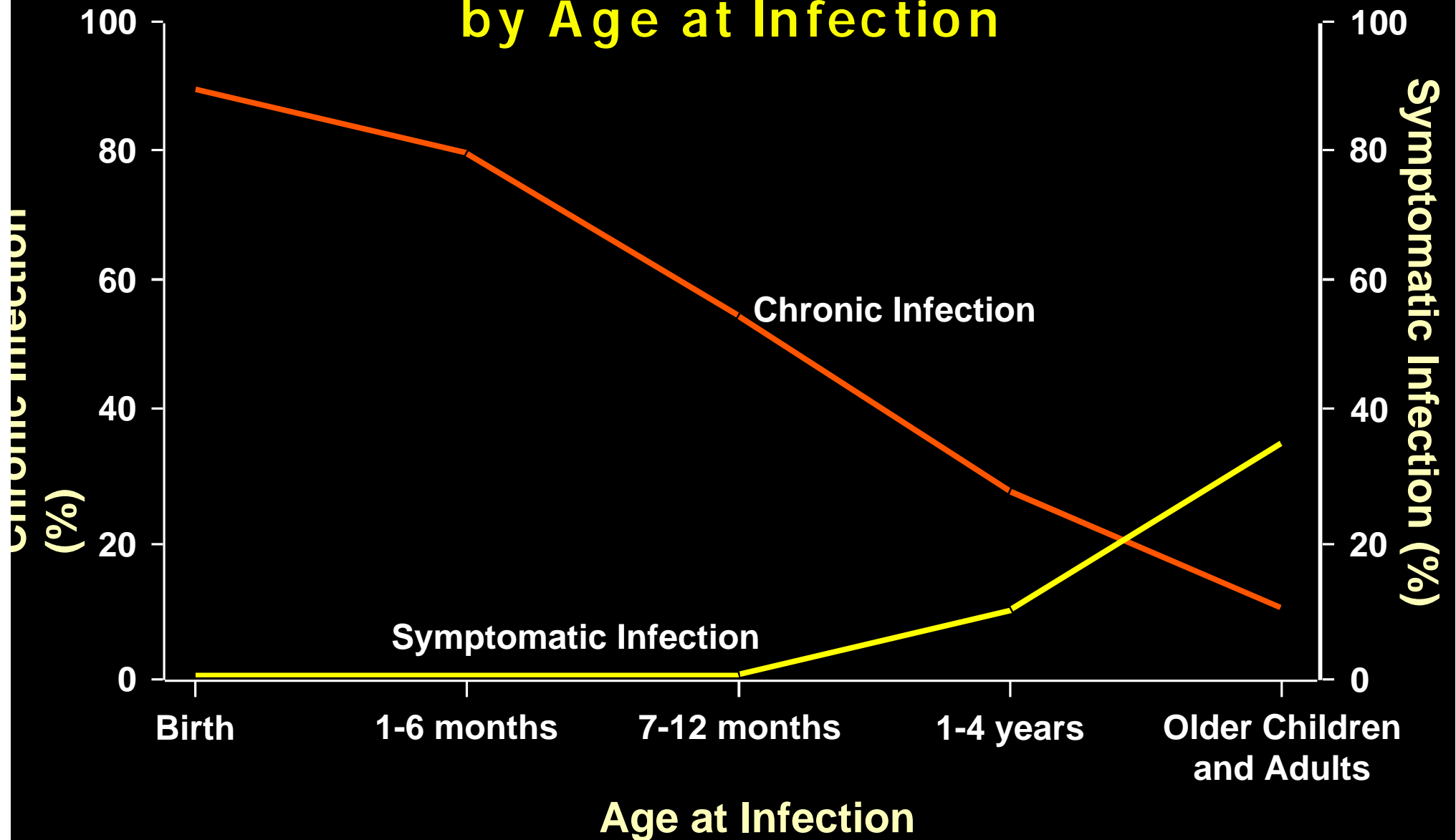
Acute HBV Infections

4%	Perinatal	18%
4%	Children (1-10 yrs)	18%
8%	Adolescent	6%



Chronic HBV Infection

# Outcome of Hepatitis B Virus Infection by Age at Infection



## Methods

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- Incidence of childhood HBV infection estimated from published and unpublished sources of age-specific seroprevalence data
- Perinatal HBV infections excluded:
  - Directly (maternal HBsAg testing)
  - Indirectly (estimated rate of perinatal HBV transmission)
- Race/ethnicity-specific HBV infection rates applied to 1991 US population data to calculate annual number of non-perinatal HBV in children <10 years of age

## Data Sources

Study	Ethnic groups	No.	Ages, yrs
NHANES II, III	Whites, Blacks	4793	2-11
Wisconsin/ Louisiana	US-born children of SE Asian immigrants	823	1-12
New York	US-born children of Chinese immigrants	541	4-12
Honolulu	Hawaiian natives	3312	6-17

# Chronic HBV Infections among US Born Children (0-11 y) of SE Asian Immigrants By Maternal HBsAg Status

Study (years)	Mother's HBsAg Status			
	Negative		Positive	
	Tested	Infected No. (%)	Tested	Infected No. (%)
Wisconsin (1984-1989)	360	15 (4)	69	11 (16)
Louisiana (1991)	596	17 (3)	60	11 (18)

**Overall, 59% (32/54) of chronic infections were among infants born to HBsAg-negative mothers**

## Estimated Non-Perinatal HBV Infections Among Children <10 Years of Age United States, 1991

Racial/Ethnic Group	Population (millions)	Incidence Per 100,000 (95% CI)	Annual Infections, No. (95% CI)
Non-Asian	36.6	24 (9-62)	8,677 (3,310-22,770)
Asian	1.2	605 (471-783)	7,276 (5,670-9,420)
Total	37.8	42 (24-85)	15,953 (8,980-32,190)

Source: Armstrong, et al. Pediatrics 2001; 108:1123-8.

# Limitations

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- Estimates of HBV infections in non-Asians are less precise than for Asians
  - Relatively small sample size from 2 NHANES surveys yielded wide 95% confidence limits
  - Rate of perinatal infection in non-Asians estimated from external data sources
- Not able to directly determine proportion of childhood infections among children born to HBsAg-positive and HBsAg-negative mothers in non-Asians.

# Mechanisms of Child-to-Child HBV Transmission

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- Contact of non-intact skin, or mucous membranes with:
  - blood, skin lesion secretions, or saliva (possible)
  - contaminated inanimate objects, e.g., toothbrushes, towels, bed sheets\*
- Biting

\*HBV survives  $\geq 7$  days outside the body

HBV has been found in high titers on inanimate objects in homes of chronically infected persons in the absence of visible blood

# Conclusions

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- Thousands of US children infected with HBV each year before infant hepatitis B immunization implemented (non-perinatal)
  - ~1/6 of HBV-related chronic liver disease burden
- Routine infant immunization needed to prevent these infections:
  - >50% in infants born to HBsAg-negative mothers
  - >50% in non-Asians
- Birth dose is a “safety net” to prevent perinatal HBV infections:
  - Assures appropriate management infants born to mothers with unknown HBsAg status
  - Prevents infections in infants born to HBsAg-positive mothers if there are errors in tracking these infants