Cancer Incidence and Mortality among Children and Adolescents in the United States, 2001-2003

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Background

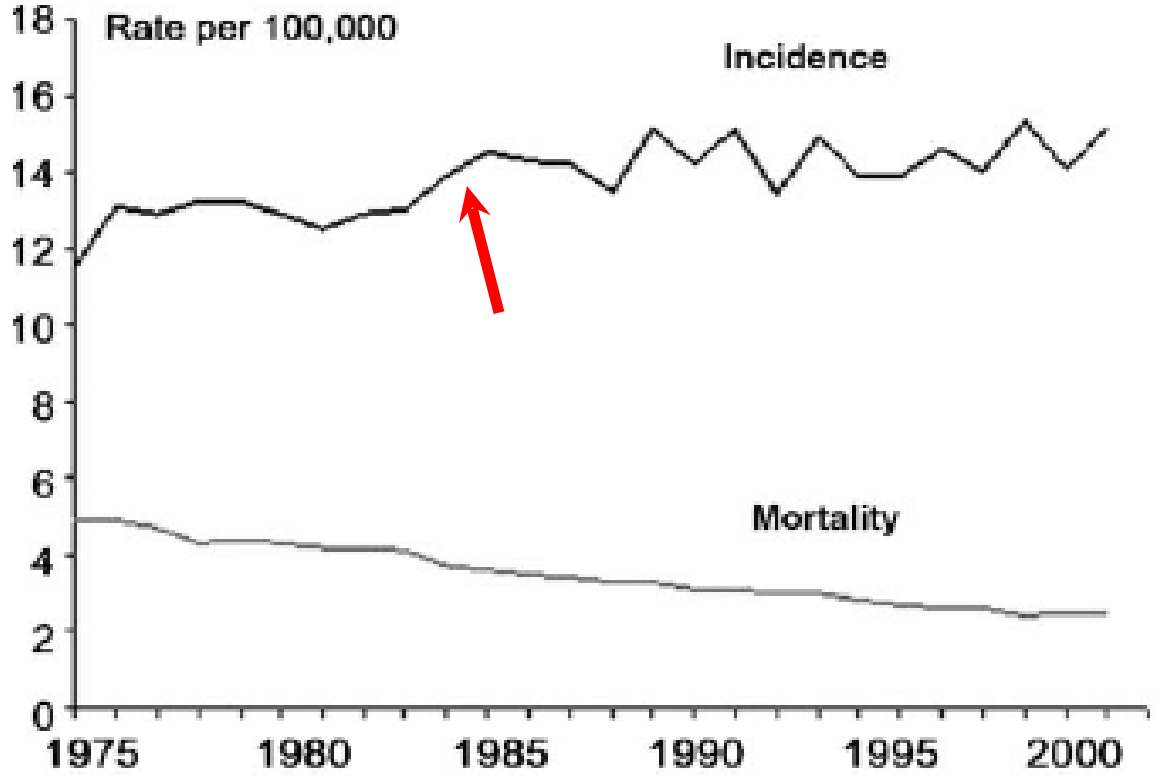
- Childhood (0-19 years) cancer accounts for 1% of the total cancer cases in U.S.
- Most common disease-related cause of death among youth aged 1-19 years
- 2007 estimates [1]
  - 10,400 new cases
  - 1,500 deaths

[1] Cancer Facts & Figure 2007

Background

- More meaningfully grouped by morphology using International Classification of Childhood Cancer (ICCC)
- ICCC based on International Classification of Diseases for Oncology (ICD-O)
- ICD-O-3, issued in 2000, became effective in 2001.

Background



*Age-adjusted to the 2000 Standard population.
Source: Surveillance, Epidemiology, and Results Program, 1975-2000, Division of Cancer Control and Population Sciences, National Cancer Institute,2003.

SEER: Surveillance, Epidemiology, and End Results

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Background

- Incidence rates not well described after using ICD-O-3
- Recent cancer death rates not well characterized
- Geographic differences in cancer incidence and mortality not well elucidated

Objectives

- Describe recent cancer incidence and mortality rates
- Identify demographic and geographic variations in cancer incidence and mortality

Methods---Incidence

- Cancer incidence data from National Program of Cancer Registry (NPCR) and SEER
- Cover 43 states and the District of Columbia, representing 90% of U.S. population
- Cases definition:

  Children (0-14 years) and adolescents (15-19 years) diagnosed with a primary malignant neoplasm

Methods---Incidence

- Cancers stratified by sex, age, race, ethnicity, and U.S. Census region
- Age-adjusted incidence rates (per million), rate ratios, and 95% CI estimated by SEER-Stat
- p-values < 0.05 for significance except for racial and regional analyses

Methods---Incidence

- In racial and regional analyses
  - White and the Northeast as reference groups
  - Bonferroni correction was applied
  - Cut-point of p-value was 0.0167
- Multivariate analyses
  - Negative binomial modeling
  - Adjust for sex, age, race, ethnicity, region, and year

Methods---Mortality

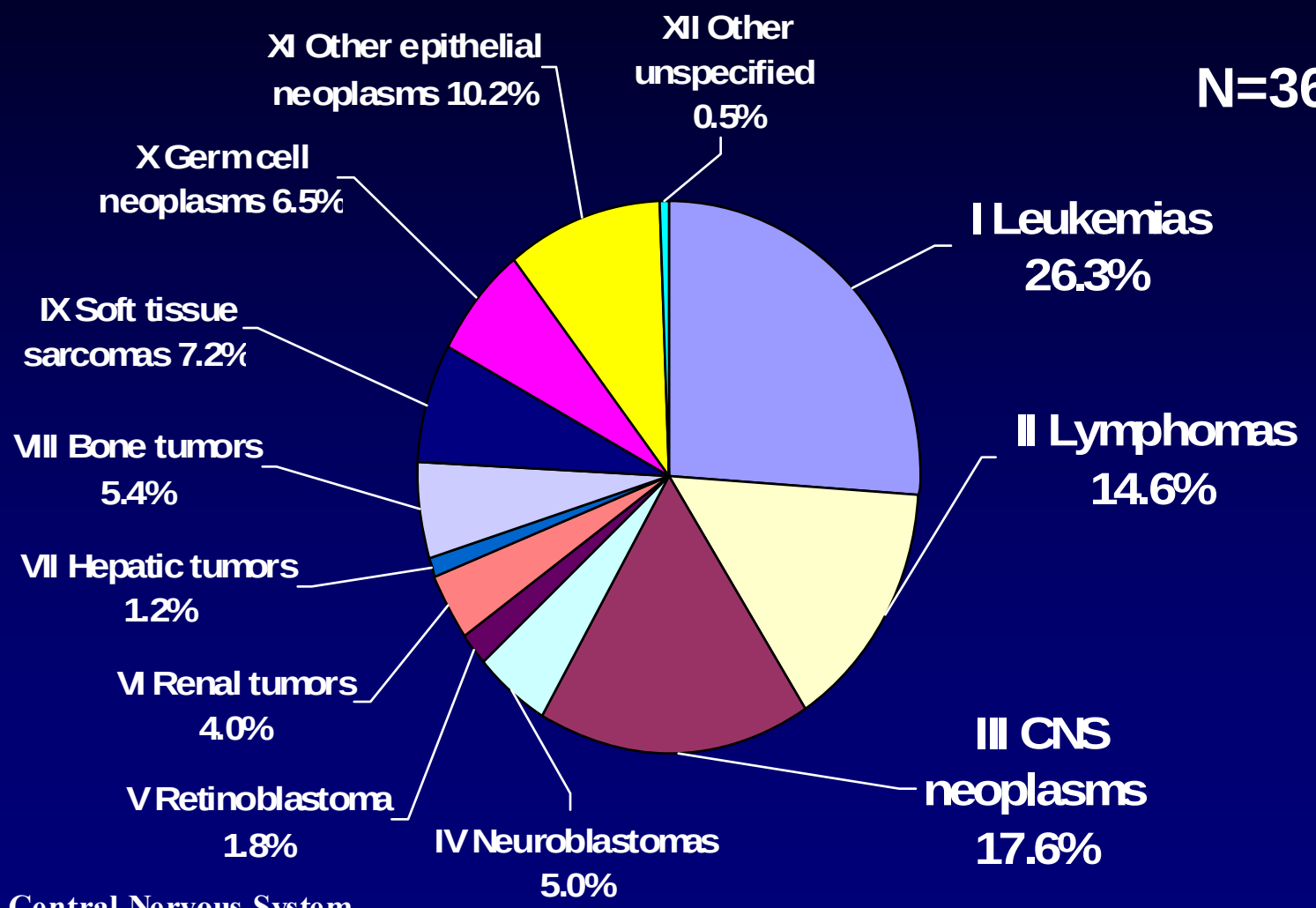
- Mortality data from NCHS
- Cover 50 states and the District of Columbia, representing 100% of U.S. population
- Stratified analyses for cancer mortality same as incidence

Results

I Cancer Incidence
- Stratify analysis
- Multivariate modeling

II Cancer Mortality
- Stratify analysis

Distribution of Childhood Cancer Incidence by ICCC-3 Groups, U.S., 2001-2003



CNS: Central Nervous System

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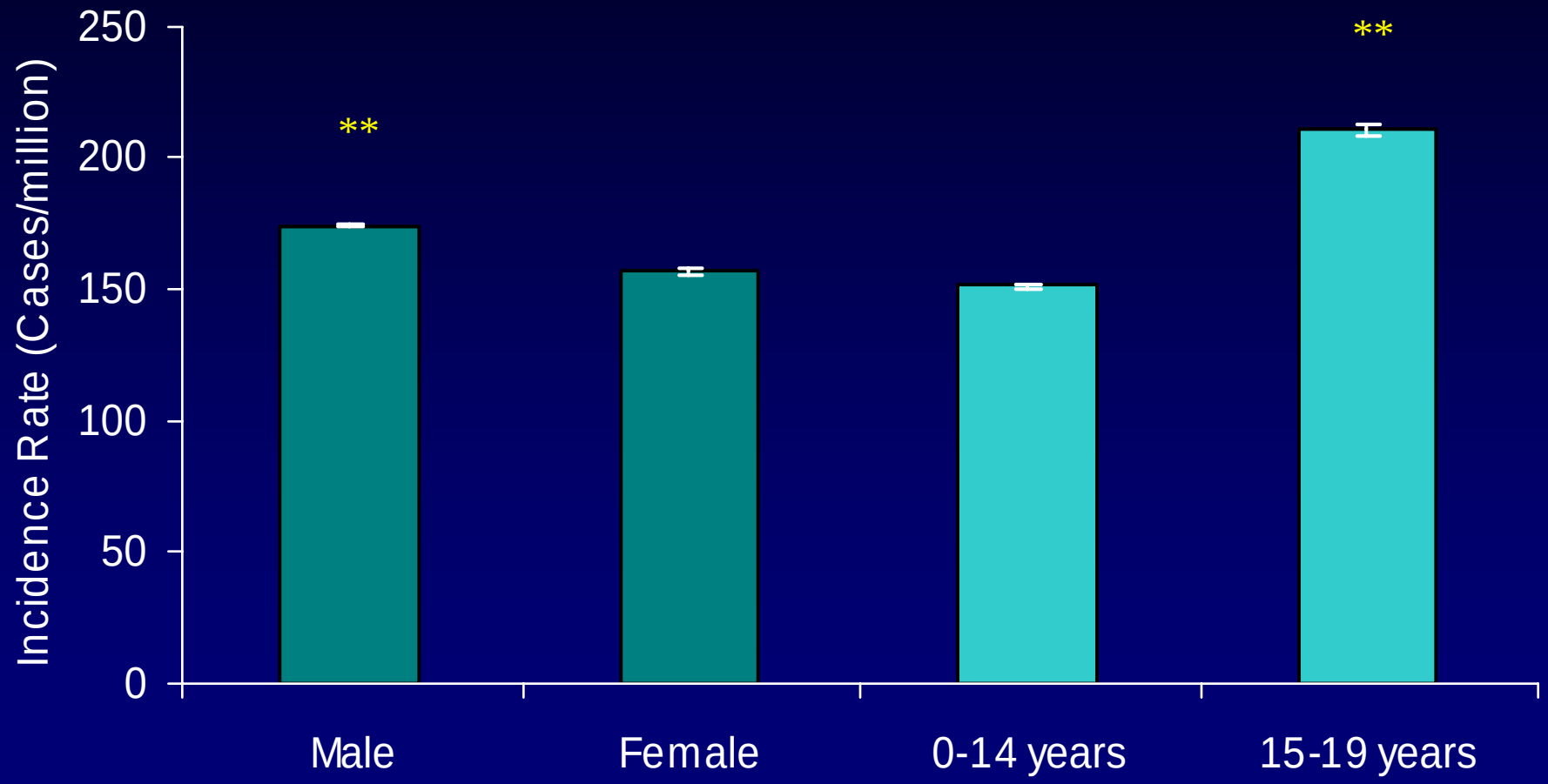
Incidence Rate of All Cancers Combined by Sex and Age, 2001-2003



**P<0.05

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Incidence Rate of All Cancers Combined by Race, Ethnicity, and Region, 2001-2003

Category	Cases	Rate	(95% CI)	
White (ref)	29,934	173.2	(171.3 - 175.2)	
Black	4,004	117.9	(114.2 - 121.6)	**
API	1,328	131.4	(124.5 - 138.7)	**
AIAN	273	97.3	(86.1 - 109.8)	**
Hispanic	6,729	163.8	(159.9 - 167.8)	
Non-Hispanic	29,717	166.3	(164.4 - 168.2)	
Northeast (ref)	7,676	179.1	(175.1 - 183.2)	
Midwest	9,011	165.5	(162.1 - 168.9)	**
South	1,1082	158.7	(155.7 - 161.6)	**
West	8,677	165.3	(161.8 - 168.8)	**

**Rate is significantly different from the rate of reference groups: white or the Northeast. P<0.0167

ref: reference group

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Multivariate Modeling* for All ICCC-3 Groups Combined, 2001-2003

Characteristic	$\chi 2$	*P*	RR	95% CI
Sex	34.88	<.0001		
Male vs. Female			1.11	1.07-1.14
Age	148.65	<.0001		
15-19 vs. 0-14			1.35	1.31-1.40
Race	288.74	<.0001		
Black vs. White			0.66	0.63-0.69
API vs. White			0.73	0.69-0.78
AI/AN vs. White			0.55	0.48-0.62

*Adjusting for sex, age, race, ethnicity, region and year
Underlining denotes reference group

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Multivariate Modeling* for All ICCC-3 Groups Combined, 2001-2003

Characteristic	$\chi 2$	*P*	RR	95% CI
Ethnicity	27.6	<.0001		
Hispanic vs. Non-Hispanic			0.9	0.87-0.94
Region	8.36	0.0391		
Midwest vs. Northeast			0.93	0.89-0.98
South vs. Northeast			0.95	0.91-1.00
West vs. Northeast			0.96	0.92-1.01

*Adjusting for sex, age, race, ethnicity, region and year
Underlining denotes reference group

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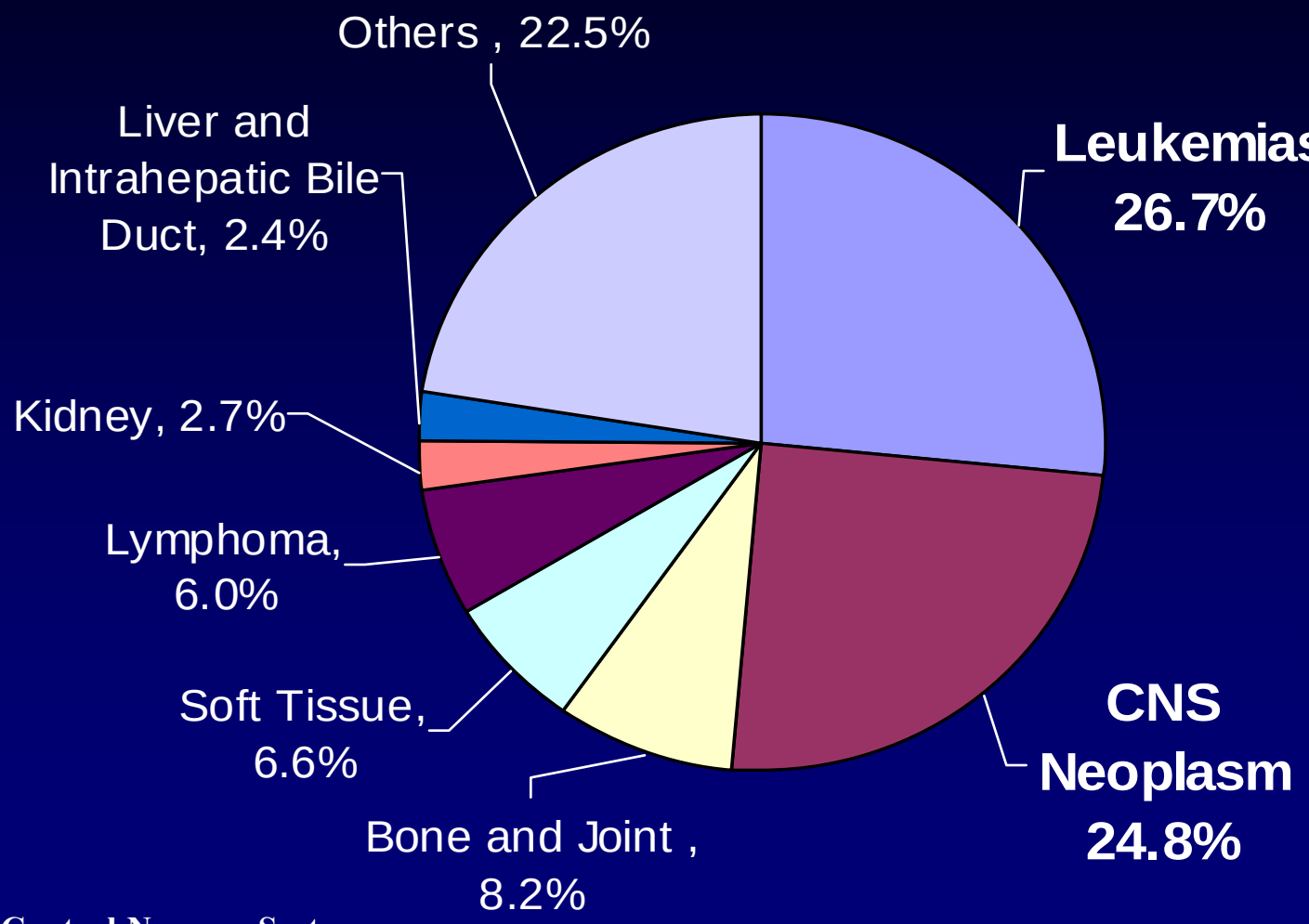
Distribution of Childhood Cancer Deaths, U.S., 2001-2003

N=6,730



CNS: Central Nervous System

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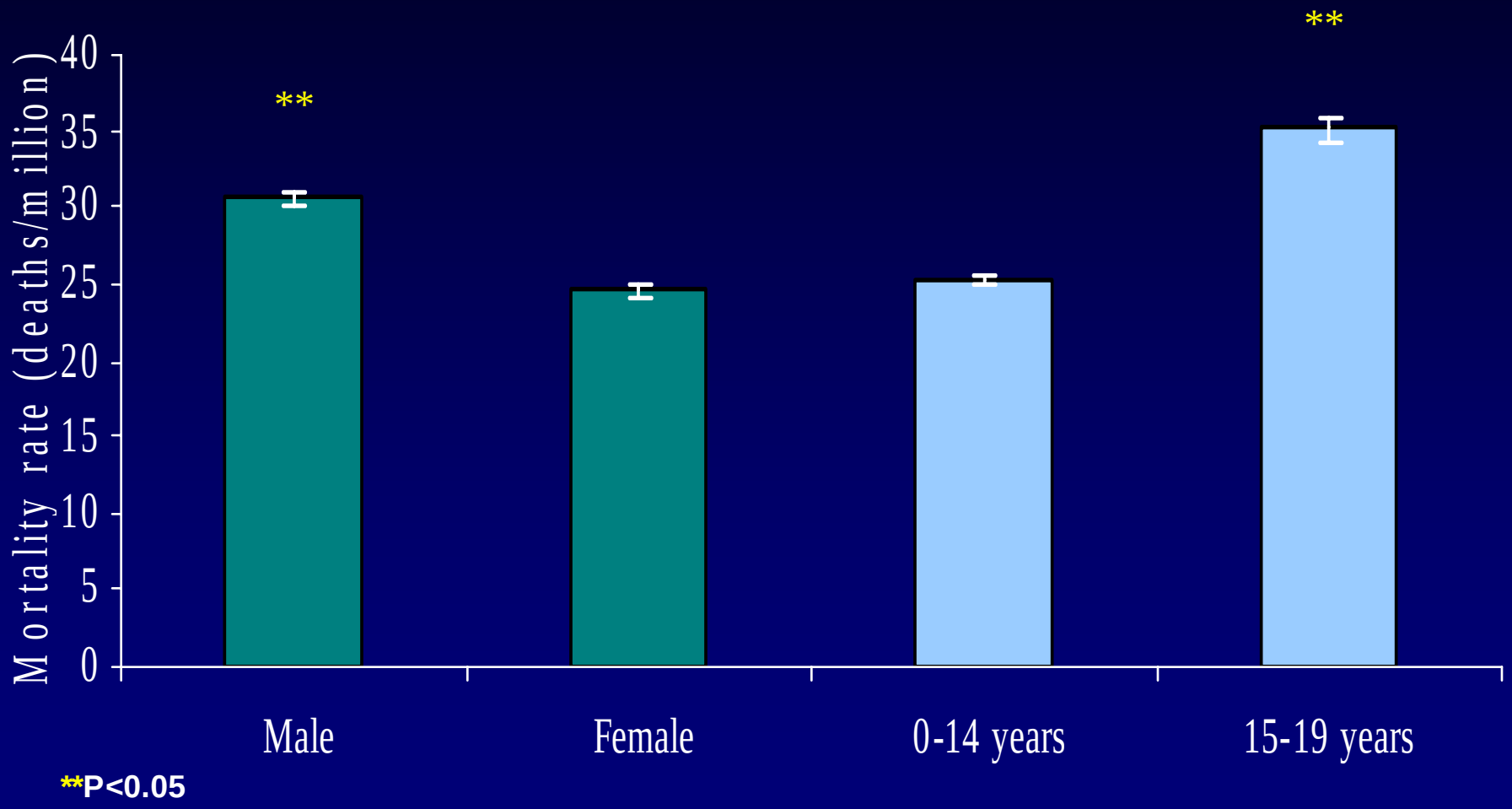
Death Rate of All Cancers Combined by Sex and Age, 2001-2003



**P<0.05

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Death Rate of All Cancers Combined by Race, Ethnicity, and Region, 2001-2003

Category	Cases	Rate	(95% CI)
White (ref)	5,353	28.3	(27.5 - 29.0)
Black	1,047	26.6	(25.0 - 28.3)
API	259	24.2	(21.3 - 27.3) **
AIAN	71	21.2	(16.6 - 26.9) **
Hispanic (ref)	1,291	30.2	(28.6 - 31.9)
Non-Hispanic	5,421	27.1	(26.4 - 27.9) **
West (ref)	1,772	30.7	(29.3 - 32.2)
Northeast	1,099	25.6	(24.1 - 27.1) **
Midwest	1,453	26.4	(25.1 - 27.8) **
South	2,406	27.6	(26.5 - 28.7) **

**Rate is significantly different from the rate of reference groups. P<0.0167
ref: reference group

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Conclusions

- Incidence and death rates varied by sex, age, race, and ethnicity.

- Incidence rates significantly higher for
  - Boys
  - Adolescents (15-19 years)
  - Whites
  - Non-Hispanics
  - Northeast Census region

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Conclusions

- Death rates significantly higher for
  - Boys
  - Adolescents (15-19 years)
  - Hispanics
  - West Census region

- Compared with Non-Hispanics, Hispanics had significantly lower incidence rate, but higher death rate.

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Conclusions

- Northeast: highest incidence rate, lowest death rate

  West: highest death rate, second lowest incidence rate

- Compared with rates between 1995 and 1999 [1]
  - Incidence rate slightly increased
  - Death rate slightly decreased

[1] Cancer. 2002 May 15;94(10):2766-92

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Strengths

- First study to describe cancer incidence using data representing 90% of U.S. population
- Describe cancer incidence rate with new ICCC
- Addressed geographic variation in childhood cancer incidence and mortality

Limitations

- Small cancer case number limits ability to study the geographic variation at state and county level
- Underestimation of API, AI/AN, and Hispanics

Recommendations

- Maintain surveillance systems to track and understand changes in incidence and mortality
- Need survival study to address the geographic and ethnic discordance between incidence and mortality

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