

# Measuring Health Disparity

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# This Talk will cover:

- The Definition of Health Disparity
- Basic Measures of Disease Frequency
- Issues in Measuring Health Disparity
- Guidelines for Measurement of Health Disparity

# Healthy People 2010

- Goal 1

- To help individuals of all ages increase life expectancy and improve their quality of life.

- Goal 2

- To eliminate health disparities among segments of the population, including differences according to gender, race or ethnicity, education or income, disability, geographic location or sexual orientation.

# Health Disparity

- “Health disparities are differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific population groups in the United States.” NIH. 2001
- Health Disparity
  - Observed Difference in health status
  - Ethical implication – Inequality
  - Policy implication -- Action

# Health Disparity

The Minority Health and Health Disparities Research and Education Act of 2000

- “A population is a health disparity population if there is a significant disparity in the overall rate of disease incidence, prevalence, morbidity, mortality, or survival rates in the population as compared to the health status of the general population.”

# QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

## Life Expectancy at Birth, by Year — United States, 1970–2003

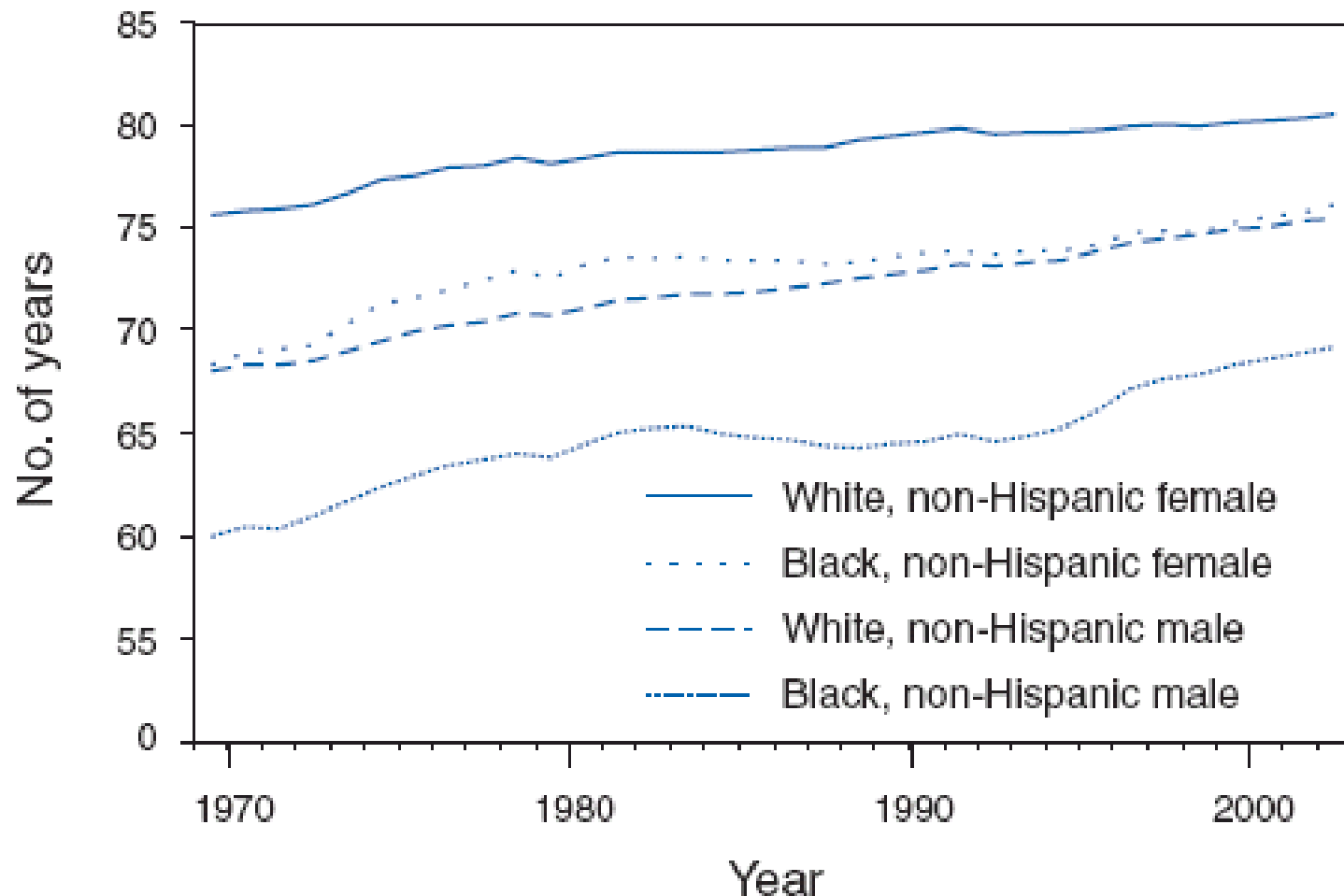
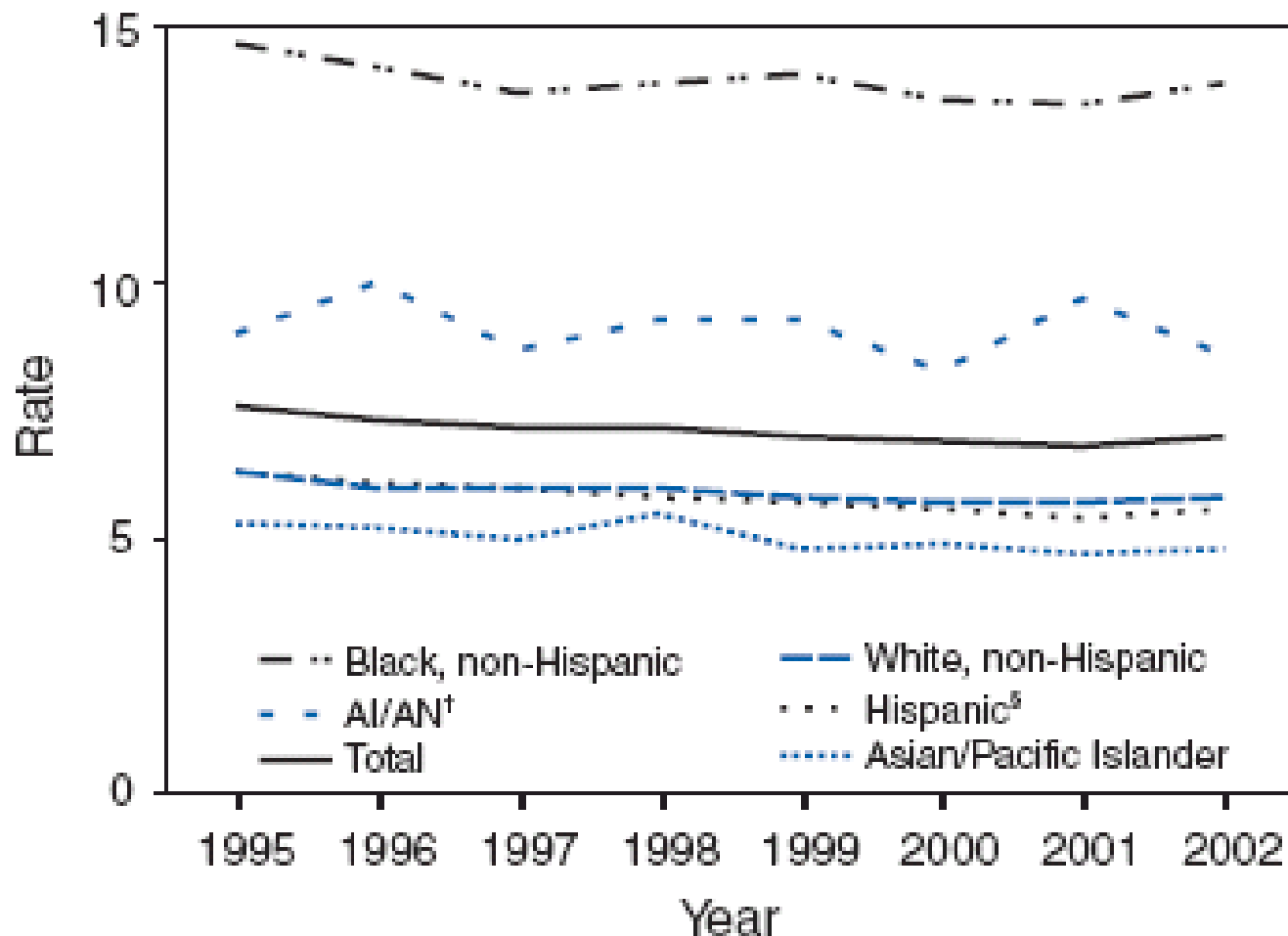


FIGURE. Infant mortality rate\*, by race/ethnicity of mother and year — United States, 1995–2002



\* Per 1,000 live births.

† American Indian/Alaska Native.

§ Hispanic mothers might be of any race.

# Basic Numerical Measures

- Proportion
  - % of smokers among ETSU faculty
- Ratio
  - Sex ratio of ETSU students
- Mean
  - Mean blood pressure of ETSU students

# Basic Measures of Disease Frequency

## ■ Incidence

- *rate at which new cases occur in a population during a specified period.*
- When the population at risk is roughly constant, incidence is measured as:

$$\frac{\text{Number of new cases}}{\text{Population at risk} \times \text{time during which cases were ascertained}}$$

# Basic Measures of Disease Frequency

## ■ Prevalence (Morbidity)

- *the proportion of people with diseases in a population at a point in time.*

$$\frac{\text{Number of cases at a time point}}{\text{Number of people at the time point}}$$

# Basic Measures of Disease Frequency

- Mortality

- the *incidence of death from a disease*

Number of deaths occurred during a period of time

People at risk x Period of time

# Basic Measures of Disease Frequency

- Crude rate
- Specific rate
- Adjusted rate

# Choosing a Reference Point

- The group which has the largest proportion of the population
- The “best” group
- The unweighted mean of all individual groups
- The rate for the total population
- A standard such as Healthy People target

# Choosing a Reference Point

Table A. Differences between infant mortality rates by race and Hispanic origin of mother and selected reference points: United States, 2000

Race and Hispanic origin of mother	Number of infant deaths	Number of live births	Infant mortality rate <sup>1</sup>	Reference point <sup>1</sup>				
				Another group rate (Non-Hispanic white) 5.7	Best group rate (Asian or Pacific Islander) 4.9	Mean of group rates 7.6	Total population rate 6.9	Healthy People 2010 target 4.5
				Difference <sup>1</sup>				
American Indian or Alaska Native . . . . .	346	41,668	8.3	2.6	3.4	0.7	1.4	3.8
Asian or Pacific Islander . . . . .	977	200,544	4.9	-0.8	0.0	-2.7	-2.0	0.4
Hispanic . . . . .	4,564	815,883	5.6	-0.1	0.7	-2.0	-1.3	1.1
Non-Hispanic black . . . . .	8,212	604,367	13.6	7.9	8.7	6.0	6.7	9.1
Non-Hispanic white . . . . .	13,461	2,362,982	5.7	0.0	0.8	-1.9	-1.2	1.2

<sup>1</sup>Infant deaths per 1,000 live births.

SOURCE: National Vital Statistics System, linked birth/infant death data file.

# Choosing a Reference Point

- When disparities are measured, the reference point should be explicitly identified and the rationale for choosing a particular reference point should be provided.
- If comparisons are made between two groups, the more favorable group rate should be used as the reference point. (This would be the lowest rate assuming that rates are expressed in terms of adverse events.)

# Absolute and Relative Term

- Absolute difference
  - Simple difference = rate of interest – reference rate
- Relative difference
  - Relative rate = rate of interest / reference rate
  - Percentage difference

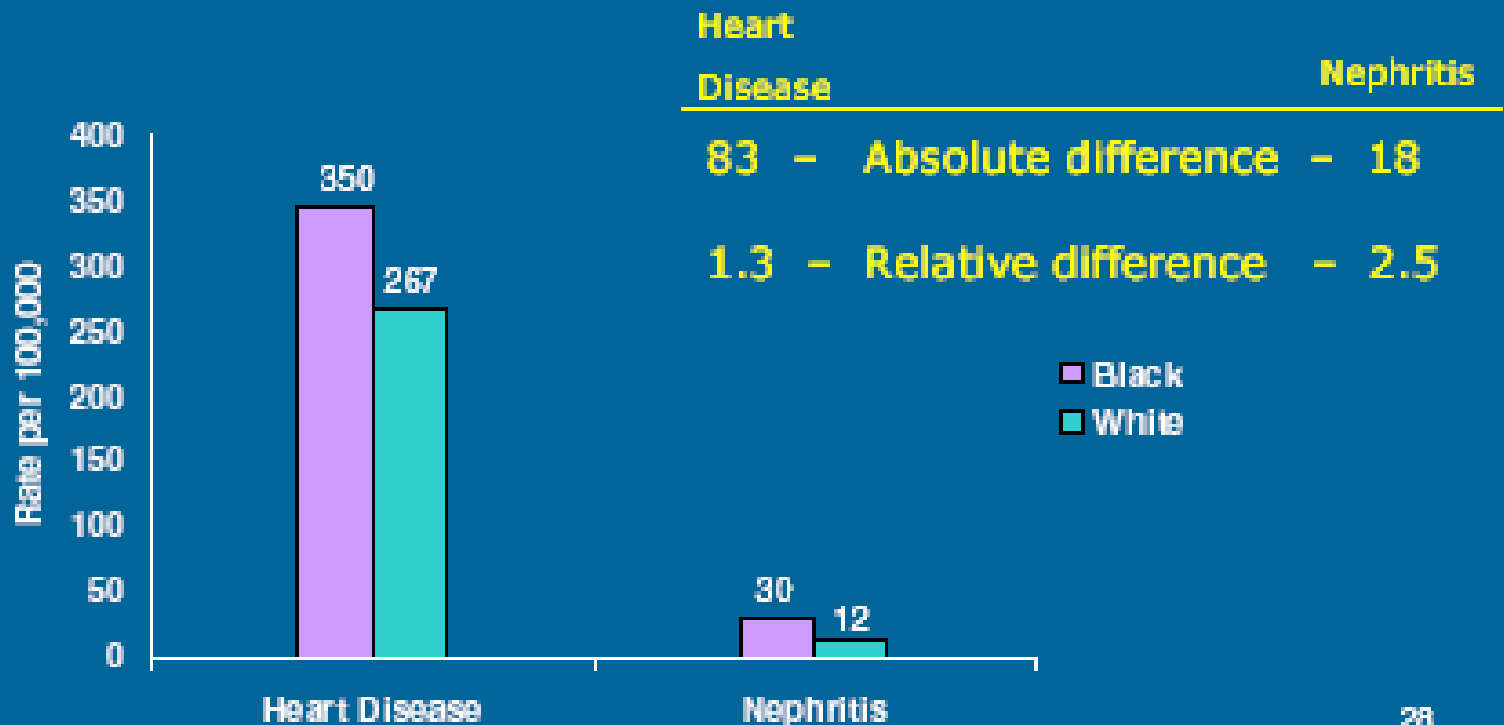
Rate of interest – reference rate

Reference rate

# Absolute and Relative Term

Is the racial disparity in heart disease bigger than the disparity in nephritis?

- It Depends on the Measure



# Absolute and Relative Term

**Table C. Changes in the simple difference and the percentage difference between infant mortality rates for each of four race and Hispanic origin groups and the rate for infants of Asian or Pacific Islander mothers (the best group rate): United States, 1990 and 2000**

Race or origin group	1990		2000		Change 2000–1990 <sup>1</sup>
	Infant mortality rate <sup>1</sup>	Simple difference <sup>1</sup>	Infant mortality rate <sup>1</sup>	Simple difference <sup>1</sup>	
Asian or Pacific Islander <sup>2</sup> . . . . .	6.6	( <sup>2</sup> )	4.9	( <sup>2</sup> )	( <sup>2</sup> )
American Indian or Alaska Native . . . . .	13.1	6.5	8.3	3.4	-3.1
Hispanic . . . . .	7.5	0.9	5.6	0.7	-0.2
Non-Hispanic black . . . . .	16.9	10.3	13.6	8.7	-1.6
Non-Hispanic white . . . . .	7.2	0.6	5.7	0.8	0.2
		Percent difference		Percent difference	Change 2000–1990 <sup>3</sup>
American Indian or Alaska Native . . . . .	13.1	98.5	8.3	69.4	-29.1
Hispanic . . . . .	7.5	13.6	5.6	14.3	0.7
Non-Hispanic black . . . . .	16.9	156.1	13.6	177.6	21.5
Non-Hispanic white . . . . .	7.2	9.1	5.7	16.3	7.2

<sup>1</sup>Infant deaths per 1,000 live births.

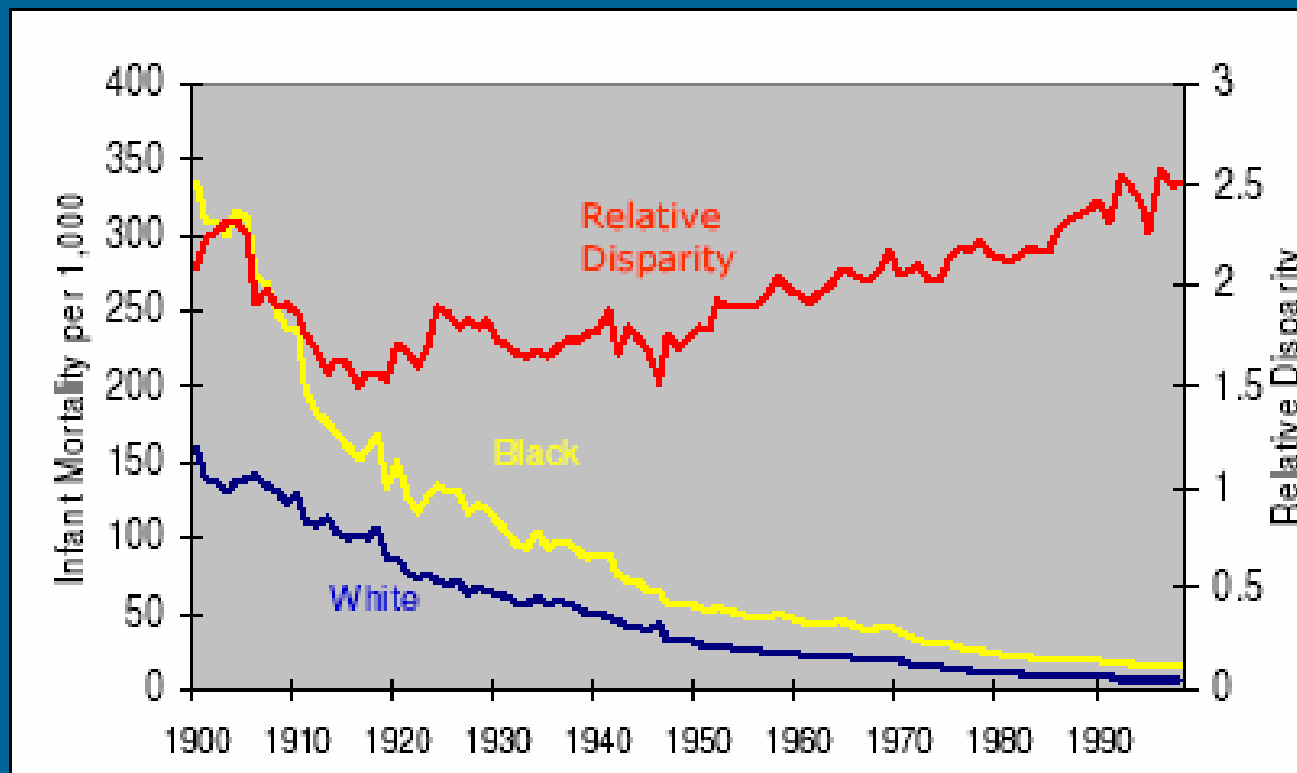
<sup>2</sup>The best group rate was used as the reference point.

<sup>3</sup>Change in percentage points.

SOURCE: National Vital Statistics System, linked birth/infant death data file.

# Absolute and Relative Term

## Black/White Disparity in Infant Mortality over the 20<sup>th</sup> Century (USA)



# Absolute and Relative Term

- Both absolute and relative terms in order to understand their magnitude, especially when making comparisons over time or across geographic areas, populations, or indicators.

# Pair-wise or Summary Fashion

- When a domain has more than two population groups and the focus on disparity is within the domain in addition to group specific disparity, the summary measures for disparity is needed.
- Summary measures (Disparity Index)
  - Mean deviation
  - Relative deviation = mean deviation/reference rate

# Pair-wise or Summary Fashion

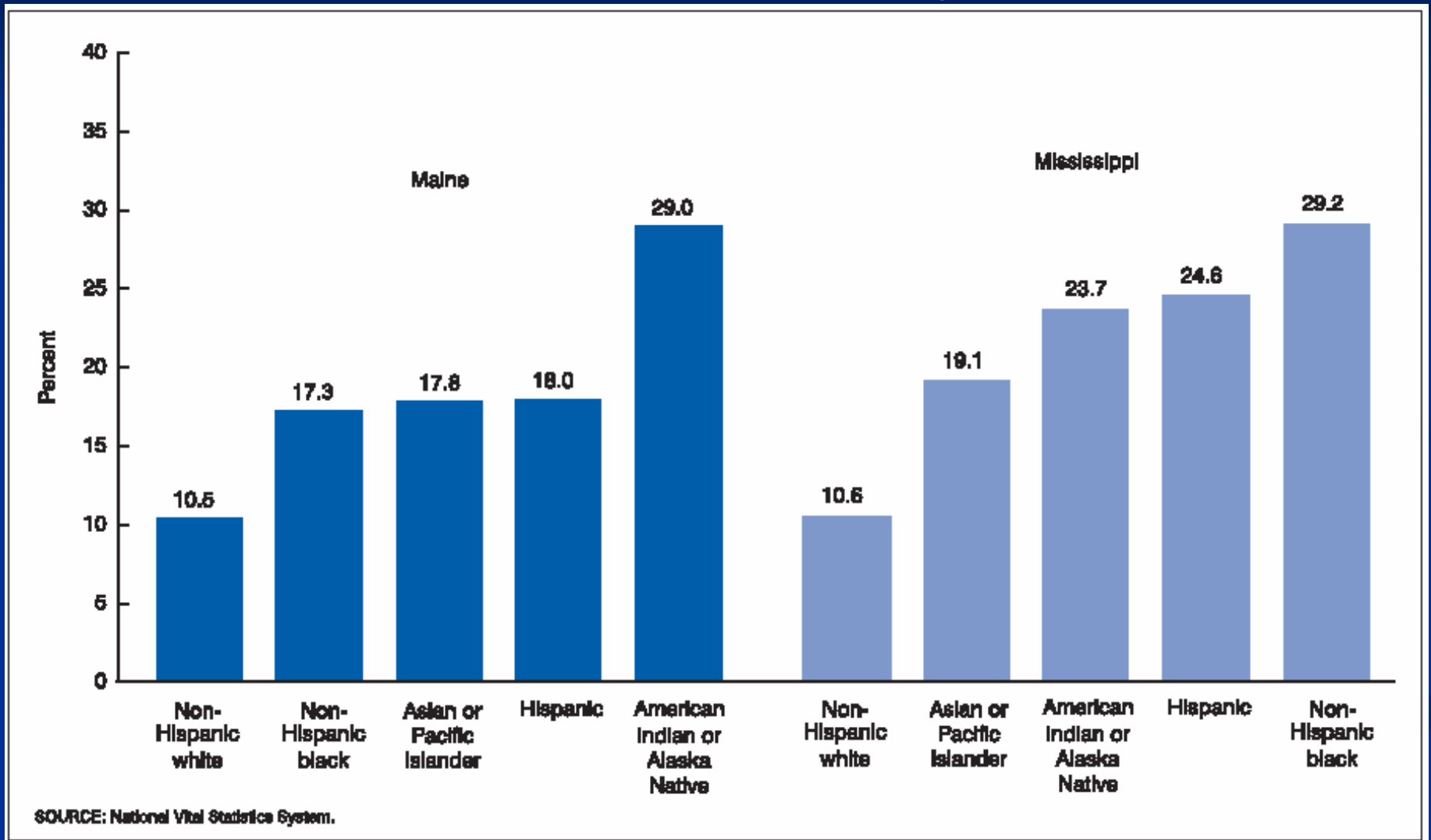


Figure 2. Percentages of mothers with no prenatal care in the first trimester by race and Hispanic origin: Maine and Mississippi, 1997-99

**Table E. Mean deviations from alternative reference points in the percentage of mothers without prenatal care during the first trimester by race and Hispanic origin: Maine and Mississippi, 1997–99**

Alternative values	Best rate		Mean rate		Total rate	
	Maine	Mississippi	Maine	Mississippi	Maine	Mississippi
Reference point . . . . .	10.5	10.6	18.5	21.4	11.0	19.3
Mean deviations						
Absolute . . . . .	8.0	10.8	4.2	5.3	7.7	5.7
Relative . . . . .	76%	102%	23%	25%	70%	30%

SOURCE: National Vital Statistics System.

- Pair-wise comparisons are called for when the objective is to measure disparity for each group in a domain.
- Summary measures can be used to quantify the degree of disparity across all groups composing a domain.
- Conclusions based on summary measures always should be interpreted in conjunction with the group-specific rates on which they are based.

# Weighting ?

- A summary disparity measure across a domain may be obtained through weighting the group values by the proportion of the population they represent.
- Weighting adds a population based perspective – the way the domain is constituted within the overall population is important.

## Comparison of Disparity Across Insurance Status in Prevalence of no Mammogram between County A and B

Health Insurance	Proportion (pro) population	Prevalence of no mammogram	Best rate -reference		Total rate –reference (A .44, B .41)	
			Abs D	Abs D x pro	Abs D	Abs D x pro
<b>County A</b>						
A	.40	.65	.40	.16	.21	.084
B	.20	.40	.15	.03	.04	.008
C	.40	.25	.00	.00	.19	.076
<i>Mean dev</i>			<b>.18</b>	<b>.19</b>	<b>.15</b>	<b>.168</b>
<b>County B</b>						
A	.10	.65	.40	.04	.24	.024
B	.80	.40	.15	.12	.01	.008
C	.10	.25	.00	.00	.16	.016
<i>Mean dev</i>			<b>.18</b>	<b>.16</b>	<b>.12</b>	<b>.048</b>

**Table F. Weighted mean deviations from alternative reference points in the percentage of mothers without prenatal care during the first trimester by race and Hispanic origin: Maine and Mississippi, 1997–99**

Alternative values	Best rate		Mean or total rate	
	Maine	Mississippi	Maine	Mississippi
Reference point . . . . .	10.5	10.6	11.0	19.3
Weighted mean deviations:				
Absolute . . . . .	0.5	8.4	0.9	9.0
Relative . . . . .	5%	80%	9%	47%

SOURCE: National Vital Statistics System.

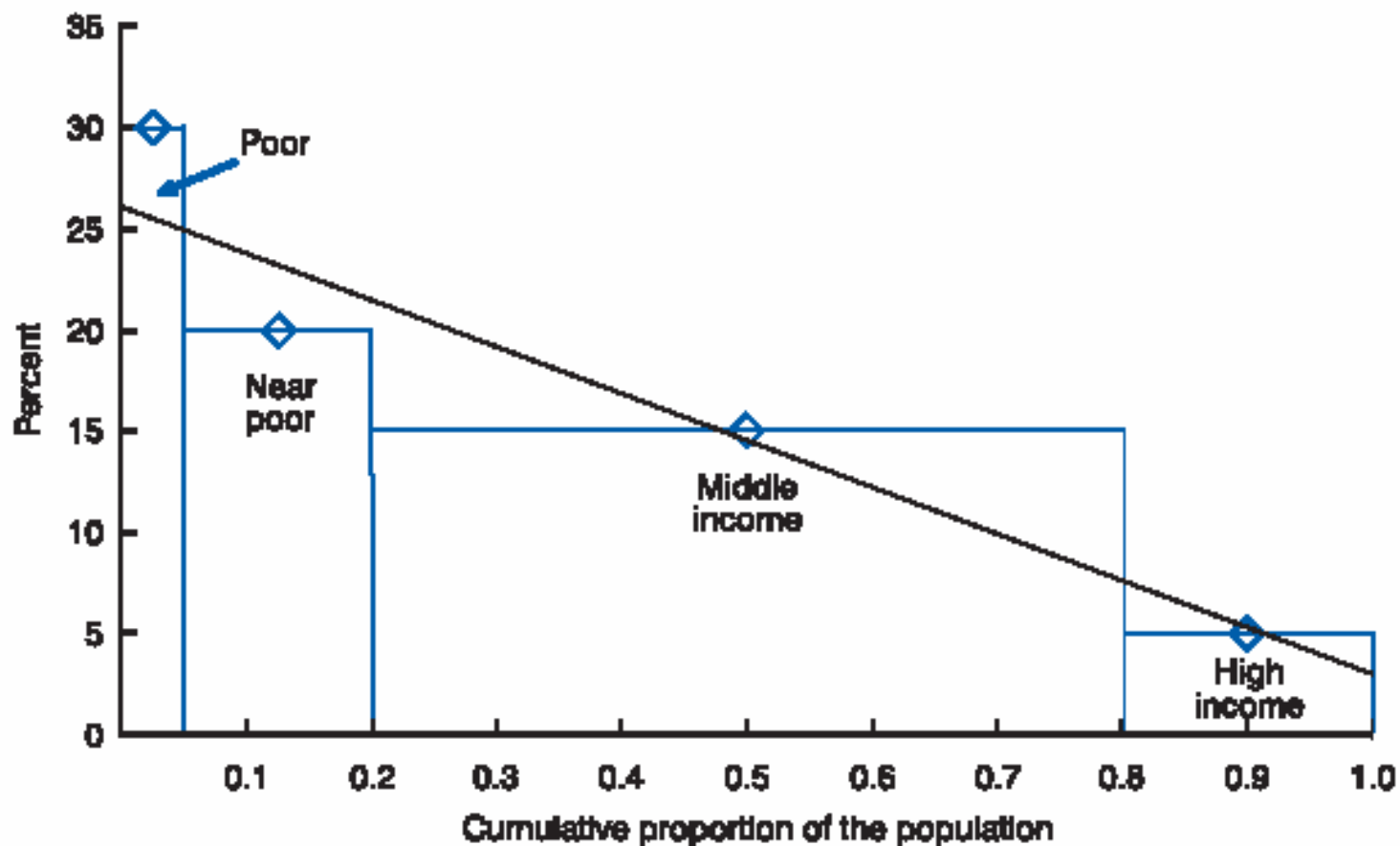
- The choice of whether to weight the component groups when summarizing disparity across a domain should take into consideration the reason for computing the summary measures.
- In addition, implications with respect to other types of decisions, such as the choice of a reference point, need to be considered.
- The size of the groups and the number of persons affected in each group should be taken into account when assessing the impact of disparities.

# Regression Based Measure

**Table G. Percentages of two hypothetical populations in fair or poor health by income level**

Population	Poor	Near poor	Middle income	High income
1 .....	30	20	15	5
2 .....	30	20	5	15

NOTE: Income levels are defined as a percentage of the poverty threshold. Poor is income less than 100 percent of the poverty threshold. Near poor is 100 to less than 200 percent of the poverty threshold. Middle income is between 200 and less than 400 percent of the poverty threshold. High income is 400 percent or more of the poverty threshold.



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Figure 3. Percentages of hypothetical population in fair or poor health by income level

**Table H. Percentages in fair or poor health by income level and regression-based summary indices of disparity for three hypothetical populations**

Income level	Population 1		Population 2		Population 3	
	Percent in fair or poor health	Proportion of population	Percent in fair or poor health	Proportion of population	Percent in fair or poor health	Proportion of population
Poor <sup>1</sup> . . . . .	30	0.05	30	0.05	30	0.2
Near poor <sup>2</sup> . . . . .	20	0.15	20	0.15	20	0.2
Middle income <sup>3</sup> . . . . .	15	0.60	5	0.60	15	0.4
High income <sup>4</sup> . . . . .	5	0.20	15	0.20	5	0.2
Regression-based summary index of disparity						
SII <sup>5</sup> . . . . .	-22		-10		-29	
RII <sup>6</sup> (mean) . . . . .	-1.54		-0.94		-1.70	
RII <sup>6</sup> (ratio) . . . . .	7.7		2.8		12.5	

<sup>1</sup>Poor is income less than 100 percent of the poverty threshold.

<sup>2</sup>Near poor is 100 to less than 200 percent of the poverty threshold.

<sup>3</sup>Middle income is between 200 and less than 400 percent of the poverty threshold.

<sup>4</sup>High income is 400 percent or more of the poverty threshold.

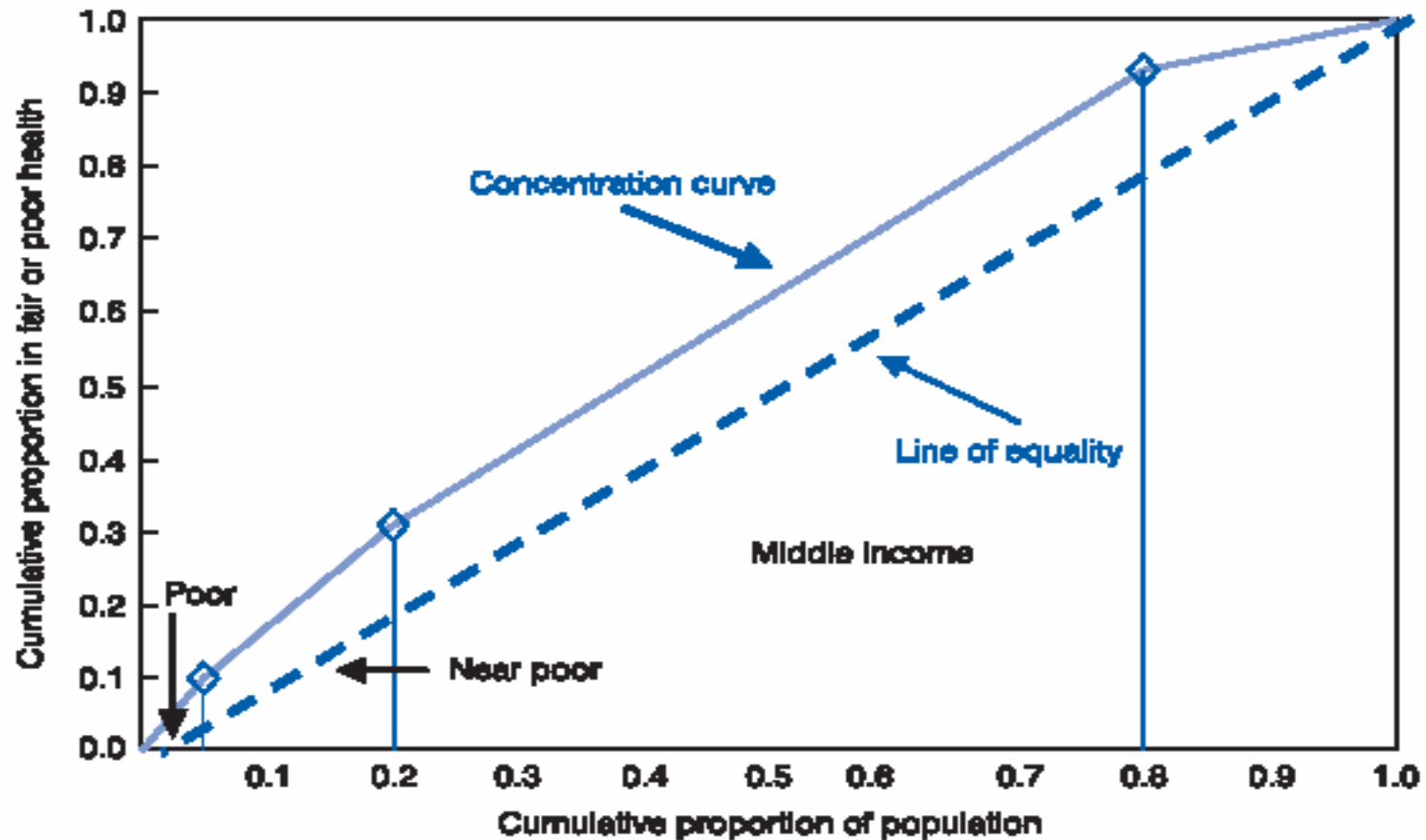
<sup>5</sup>SII is Slope Index of Inequality.

<sup>6</sup>RII is Relative Index of Inequality.

# Regression Based Measures

- SII Slope Index of Inequality
- RII(mean) Relative Index of Inequality
  - $\text{RII}(\text{mean}) = \text{SII} / \text{population rate}$
- RII(ratio) Relative Index of Inequality
  - $\text{RII}(\text{ratio}) = Y_0 / Y_1 = \text{RR}$
  - $Y_0$  Y value at  $x=0$
  - $Y_1$  Y value at  $x=1$

# Concentration Curve Based approach



NOTE: Income levels are defined as a percentage of the poverty threshold. Poor is income less than 100 percent of the poverty threshold. Near poor is 100 to less than 200 percent of the poverty threshold. Middle income is between 200 and less than 400 percent of the poverty threshold. High income is 400 percent or more of the poverty threshold.

Figure 5. Concentration curve for hypothetical population 1

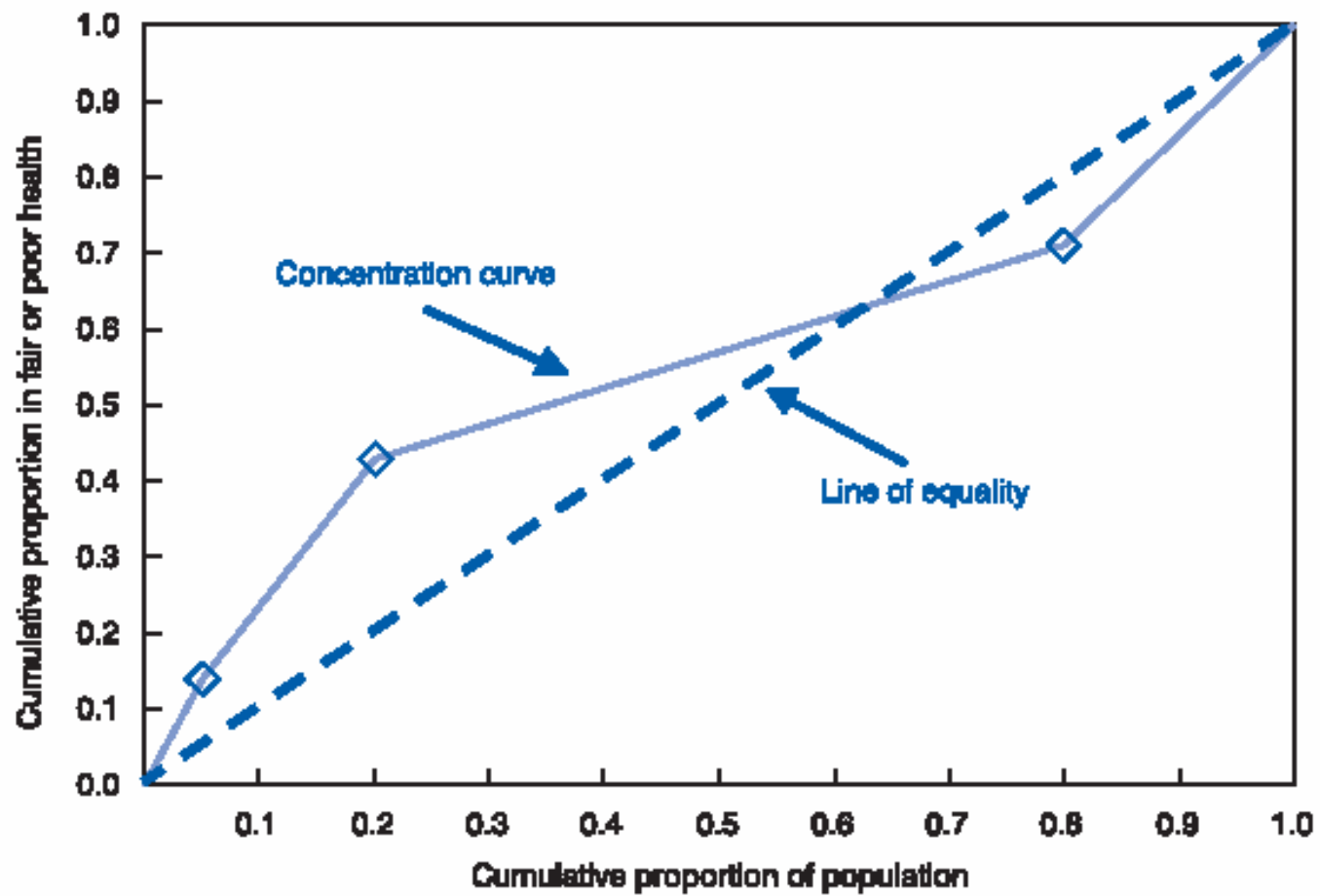


Figure 6. Concentration curve for hypothetical population 2

- When the primary interest is in how health varies with the amount of the characteristic defining the domain rather than with the groups themselves, summary measures of disparity that take into account the order of groups should be considered.

# Precision of Disparity Measures

- The precision of the statistics used to measure disparity should also be considered when these statistics are interpreted.
- Whenever possible, a confidence interval should accompany each measure of disparity.

- 95% confidence interval:
  - Lower limit =  $S - (1.96 \text{ c SEs})$
  - Upper limit =  $S + (1.96 \text{ c SEs})$

where  $S$  is the point estimate for a statistic, and SEs is the standard error for the estimate of  $S$ .

- Estimates of precision for summary measures can be produced using a re-sampling or bootstrap procedure whenever standard errors are available for the underlying rates

# Conclusions

- Disparity is defined as the difference between a group and a reference point. The effects of different choices on measures of disparity were examined. Several guidelines concerning the measurement of disparity are proposed. These guidelines do not prescribe a single way to measure disparity, they are not applicable in all situations, and they are not applicable to all of the ways that differences in indicators of health are measured. Nevertheless, these guidelines are intended to bring greater consistency to the examination of disparities as a function of differences between groups in quantifiable indicators of health.

# Guidelines

- When disparities are measured, the reference point should be explicitly identified and the rationale for choosing a particular reference point should be provided.
- If comparisons are made between two groups, the more favorable group rate should be used as the reference point.
- Both absolute and relative terms in order to understand their magnitude, especially when making comparisons over time or across geographic areas, populations, or indicators.

# Guidelines (Cont)

- Pair-wise comparisons are called for when the objective is to measure disparity for each group in a do Guidelines main.
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# Guidelines (Cont)

- The choice of whether to weight the component groups when summarizing disparity across a domain should take into consideration the reason for computing the summary measures.
- In addition, implications with respect to other types of decisions, such as the choice of a reference point, need to be considered.
- The size of the groups and the number of persons affected in each group should be taken into account when assessing the impact of disparities.

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# References

- Keppel K, Pamuk E, Lynch J, et al. Methodological issues in measuring health disparities. National Center for Health Statistics. Vital Stat 2(141). 2005.
- Lynch J, Harper S. Measuring health disparities. CD Ram. Prevention Research Center of Michigan. 2005.