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UNIVERSITY OF MICHIGAN

Part II – Issues in Measuring Health Disparities

Part II. In this section, we review the main issues you need to consider when measuring health disparities.   By the end of Part II, you should be able to:

1. Define relative and absolute disparity.

2. Calculate relative and absolute disparity.

3. Explain why relative and absolute measures can give different estimates of the extent of disparity and its trends over time.

4. Recognize how accounting for the size of population sub-groups can affect measurement of disparity.

5. Define a reference group.

6. Describe how the choice of reference group can affect disparity measurement.

7. Differentiate between groups that can be ranked and those that cannot.

8. Describe some common issues in measuring health disparities.

Issues to consider in measuring health disparity

Issues in Measuring Health Disparities

1: Relative vs. Absolute Difference
2: Reference group
3: Population size
4: Ranking
5: Populations over time
6: Multiple health indicators
7: Positive vs. negative health outcomes

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We will discuss in detail each of seven issues.

Relative vs. absolute difference

> ## How Should We Measure Health Disparities?
>
> • Issue #1:
>
> Relative vs. Absolute Difference
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Issue #1: Relative versus Absolute Difference.

When using data to compare two or more groups, we focus on the differences in the data values. These disparities are expressed in either relative or absolute terms.

A **relative difference** is a ratio or fraction that results from dividing one number by another.

An **absolute difference** is a subtraction of one number from another. Choosing one type of measure over another can influence the apparent difference between groups; therefore, we need to be aware of the distinction between the two measures.

It is critical to note with absolute and relative measures that the terms difference, risk and disparity may be used interchangeably.

Relative vs. absolute difference
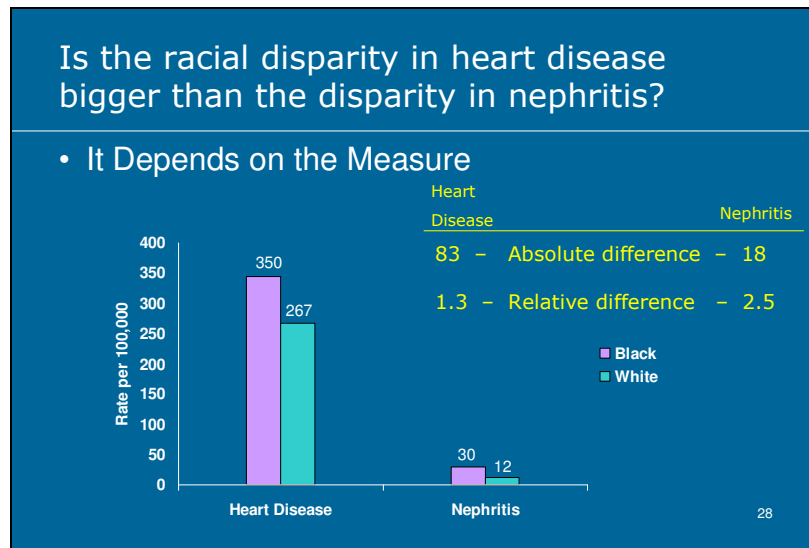
This graph contains data on the rates of heart disease and nephritis (a type of kidney disease) among blacks and whites.

First let's examine absolute difference and heart disease. If we compare the absolute difference in the rates of heart disease between blacks and whites, there is an arithmetic difference of 83 deaths per 100,000. To determine this number, we take the rate for blacks, which is 350, and subtract the rate for whites, 267. The difference is 83.

Next, examining relative difference and heart disease: alternatively, we can express that difference in relative terms as a ratio by dividing 267 into 350. We find that the ratio of black-to-white rates is 1.3. In other words, blacks have a 30% higher rate of heart disease.

When we look at the absolute and relative difference for nephritis, we find that the absolute difference in the rates of nephritis between blacks and whites is 18 deaths (30 minus 12), but the relative difference is 2.5 (30 divided by 12). Blacks are 250% more likely to die as a result of nephritis than whites.

Now, if we want to compare the disparity in heart disease to that of nephritis, we can ask the question: Is the racial disparity in heart disease bigger than the disparity in nephritis? Clearly it depends on how we measure it.

If we use an absolute measure, the disparity in heart disease is larger.

If we use a relative measure, the disparity in nephritis is larger.
Using either measure is valid, but there is no way to say which disparity is larger because it depends on which method we choose to calculate it.

Relative vs. absolute difference

Is the Disparity between Group A & B the Same at Time 1 and Time 2?
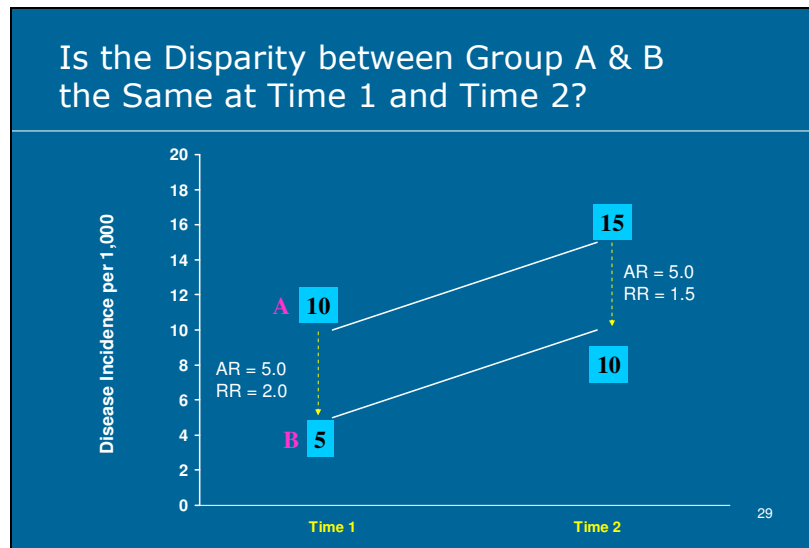
Let's look at this another way: Let's look at absolute risk and relative risk.
Absolute risk (AR) or absolute difference refers to the absolute value of the subtraction of rates of disease incidence between two groups
Relative risk (RR) or relative difference refers to the ratio of the rates of disease incidence between two groups.

Here are two time points for two social groups: A and B.
At Time 1, the rate in Group A is 10 and the rate in Group B is 5.
At Time 2, the rate in Group A is 15 and the rate in Group B is 10.
The absolute risk (AR) difference is the same at Time 2 as it is at Time 1 since 15 minus 10 equals 5 (for Time 2) and 10 minus 5 equals 5 (for Time 1).

In this example, the relative risk differs between the two groups at Time 1 and Time 2. The relative risk at Time 1 is 2 (or 10 divided by 5) and the relative risk at Time 2 is 1.5 (or 15 divided by 10).

In this example, there is no difference in the absolute risk over time, but the relative risk over time gets lower.

Now ask yourself: Is the disparity between Group A and Group B the same over time? This example again demonstrates that it depends on which measure you use—absolute risk or relative risk.

Relative vs. absolute difference

Is the Disparity between Group A & B the Same at Time 1 and Time 2?
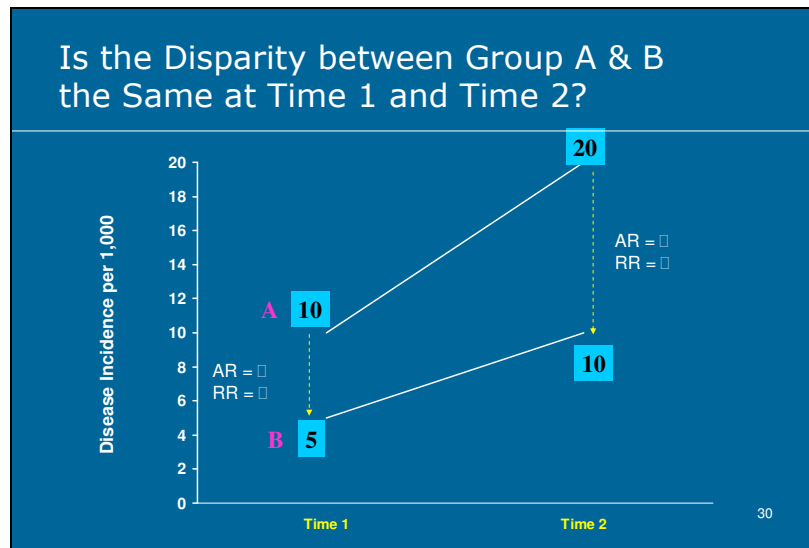
In this example, the relative risk remains constant over time, but the absolute risk changes from Time 1 to Time 2.

At Time 1, the rates are 10 and 5 for groups A and B respectively.

At Time 2, the rates are 20 and 10 for groups A and B respectively.

Calculate the absolute risk (AR) and relative risk (RR) at Time 1 and Time 2 by typing your answers in the empty boxes.

Here the relative risk is 2, calculated by dividing the rate at Time 1 for Group A by the rate at Time 1 for Group B. The relative risk is also 2 at Time 2.

However, the absolute risk is 10 minus 5 equals 5 at Time 1 and 20 minus 10 equals 10 at Time 2. Suppose this was our data pattern and we were asked if the disparity between Group A and Group B was the same. As in the previous example, the answer still remains: It depends on how you measure it.

Relative vs. absolute difference

Black/White Disparity in Infant Mortality over the 20th Century (USA)
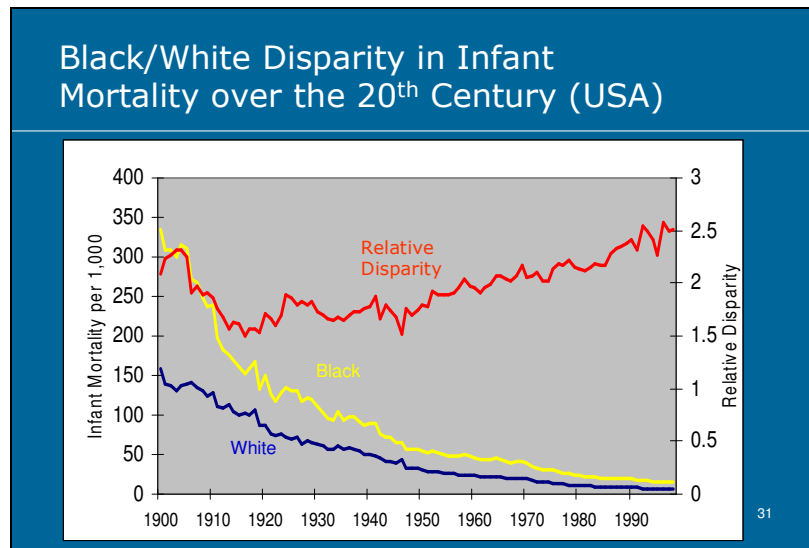
Let's look at an example using real data to illustrate again that the size of the disparity depends on the measure used.

Here's the black/white disparity in infant mortality across the Twentieth Century in the U.S.

The yellow line is the rate for black infants.
The blue line is the rate for white infants.
You can see continuous declines in infant mortality over the 20th Century.

The red line in this graph is calculated as the **relative disparity or relative risk**, that is, the ratio of the black to the white rate. You can see that, from about the 1920s, it has steadily increased over time.

Relative vs. absolute difference

Black/White Disparity in Infant Mortality over the 20th Century (USA)
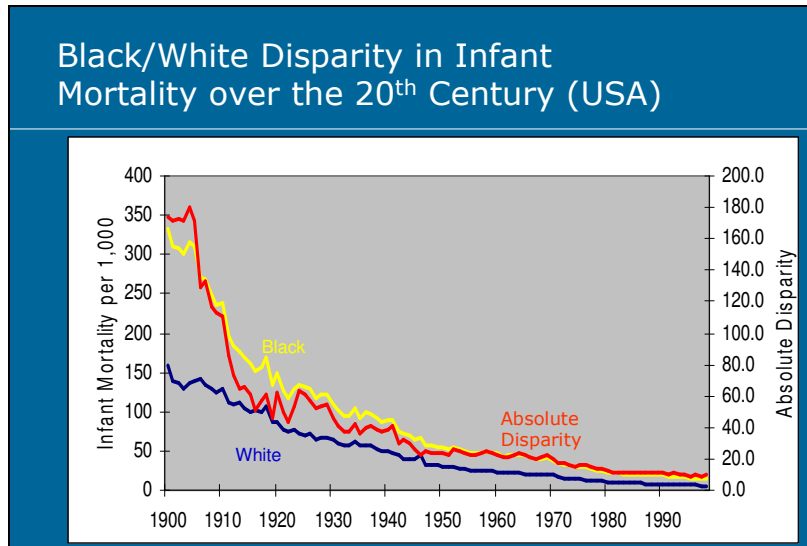
However, if we look at the **absolute disparity or absolute risk** in this graph, the difference between the black and the white rate declined steadily over the century.

Relative vs. absolute difference

Black/White Disparity in Infant Mortality over the 20th Century (USA)
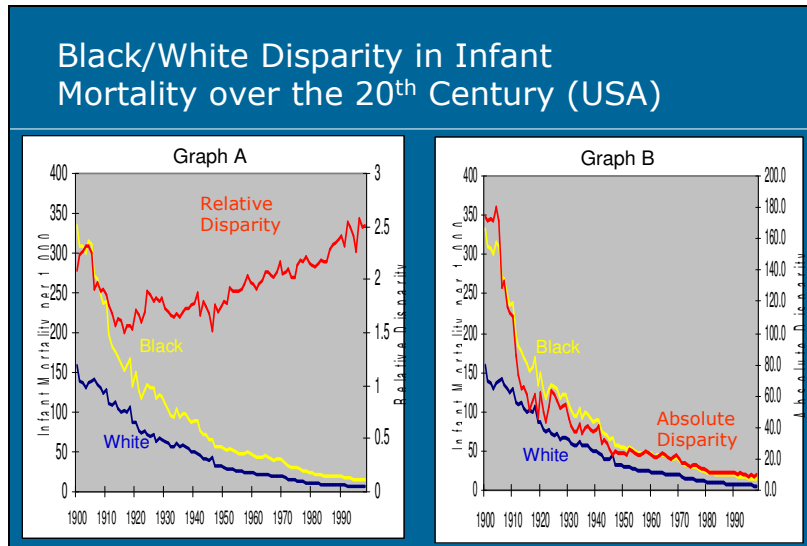
What has happened to black/white infant mortality disparity over the century?

Has it gone up?

Has it gone down?

Once again, the answer depends on which measure you use.

Relative vs. absolute difference

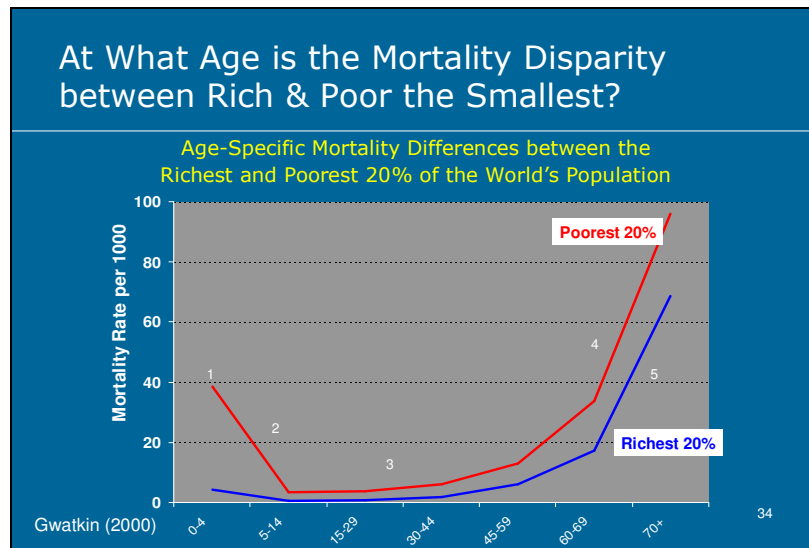We are going to examine simulated, age-specific death rates for the poorest 20% (in red) and the richest 20% (in blue) of the world's populations, from birth to over seventy years of age.

You can see a large gap on the X-axis, at the age of 0 to 4, between the infant mortality rates of the richest 20% as compared to the poorest 20%. Those rates decline as children reach the ages of 5 to 14. The mortality rates remain very low in both groups, until we reach ages 45 to 59. The rate then climbs most steeply among the poorest 20%, but the rate also increases in the richest 20%.

Visually inspect those two curves—the red curve and the blue curve.
For which age group would you say the mortality disparity between rich and poor is the smallest? It seems natural that our eyes go to that point where those lines are closest together so you are probably looking at the 5 to 14 age group. This point represents the smallest absolute difference.

What happens if we plot the relative difference?

Relative vs. absolute difference

At What Age is the Mortality Disparity between Rich & Poor the Smallest?

Age-specific Mortality Differences between the Richest and Poorest 20% of the World's Population

The point of lowest absolute disparity is the point of highest relative disparity

Poorest 20%

Richest 20%

RR

Mortality Rate per 1000

Gwatkin (2000)
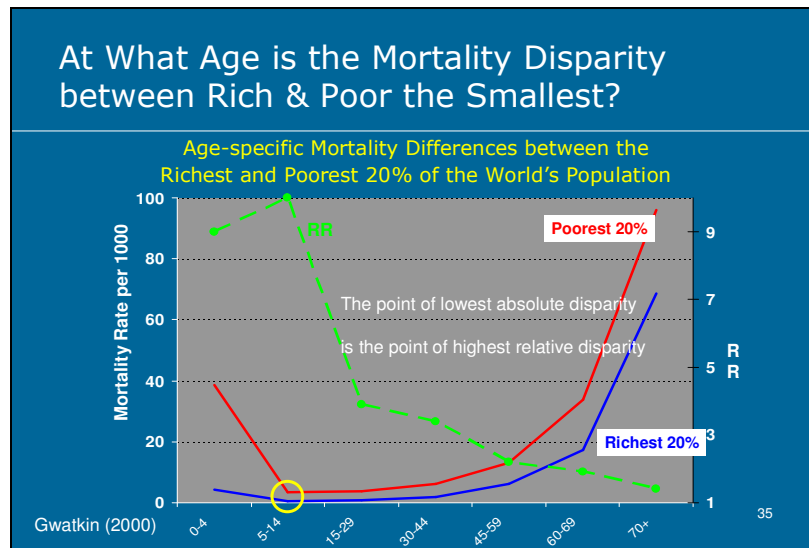
We find that the relative risk or difference between the richest 20% and the poorest 20% is highest at exactly the point where the absolute risk or difference is lowest.

This will not always be the case. It is true here because the mortality rate is so low among the richest 20% that, mathematically, it is very easy to generate a high relative risk. The denominator is very small, so the ratio is likely to be high.

This is yet another example to sensitize you to the fact that sometimes the relative difference and the absolute difference give you different answers about which disparity is larger. We will return to this important point in Part III.

Reference group

How Should We Measure Health Disparities?

- Issue #2:

    Reference Group

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Issue #2: Does it matter which reference group we choose for measuring disparities?

Reference group

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Different from What?

- Are we measuring differences between two groups or differences among several groups?
- If we are measuring differences among several group rates, from where should we measure the difference?
- What should be our reference?
  - Total population rate?
  - Target rate (e.g., HP 2010 target)?
  - Rate in the healthiest group?

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</div>

Do you remember former Surgeon General Satcher's statements about health disparities? He talked about a comparison to the **majority** population. The NIH Strategic Plan talked about a comparison to the **general** or **whole** population.

When we talk about a health disparity as a difference, we must define "different from what group?" In other words, we have to define a reference group in the population. Are we measuring differences between two groups or differences among several groups? It's easy if there are just two groups. Then we know exactly whom we're comparing.

But what if we look at a category with a broad range of groups? What, exactly, are we comparing? What should be our reference point? There are different arguments for different reference groups.

Possible reference groups are: The total population rate or a target rate that has been established by an external standard. Healthy People 2010 has set target rates based on the notion that we should do "better than the best," by attaining gains in health status across all groups.

A third possibility is to choose the rate in the healthiest group as the reference point.

Again, there is no "right choice" but be aware that the choice of reference group will affect the size of the disparity.

Reference group
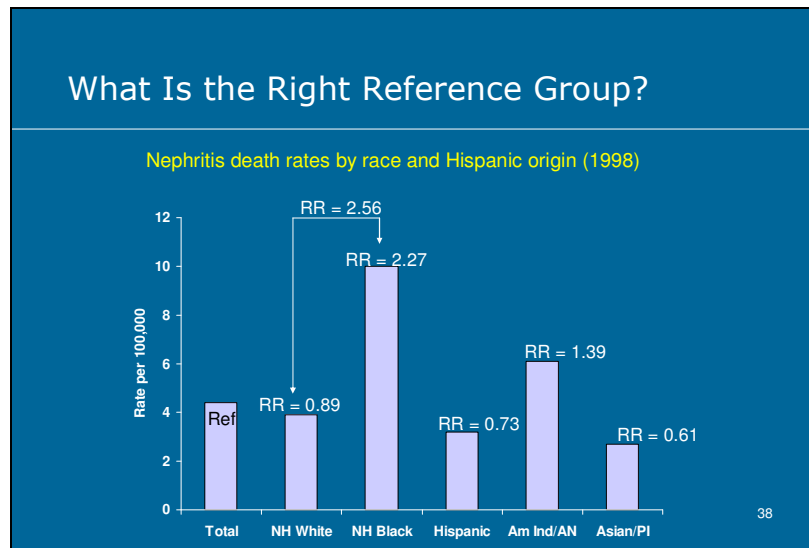
Here is an illustration of how the choice of reference group can affect the size of the disparity. This graph illustrates the rates of nephritis from different race/ethnic groups. The first bar on the left shows the Total rate, which is a weighted average, accounting for different sizes of the population groups. Because size is a factor, the total rate doesn't look much different than the non-Hispanic white rate (NH White). Why? Because that is the majority group in the total population and the largest in size of the five groups.

Using the Total rate as the reference group, the relative risks across the social groups are displayed at the top of each bar. Compared to the total population rate, non-Hispanic black (NH Black) experience 2.27 times the rate of nephritis deaths whereas, Asian/Pacific Islanders experience .61 or a 39% lower risk as compared to the total population.

If, however, we didn't use the total population, but instead used the non-Hispanic White (NH White)—the majority group—as the reference group, that comparison changes the relative risk between the groups. Click on the NH White bar to see the change in relative risk. Now we would say, compared to the majority non-

Hispanic White population, non-Hispanic Black experience 2.56 times the rate of nephritis deaths. In other words, they have a 256% higher risk of dying from nephritis. Changing the reference group makes the disparity look larger. Using the total population as the reference group, the relative rate difference was 2.27. Now, using the non-Hispanic White population as the reference group, it is 2.56.

Click on the bar representing the healthiest group, Asian/Pacific Islander (Asian/PI) to see the change in relative risk using this reference group.

Population size

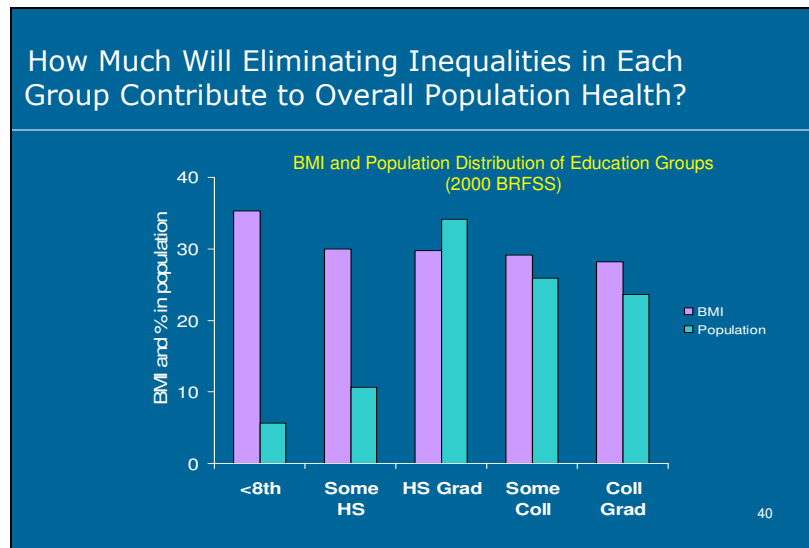How Should We Measure Health Disparities?

- Issue #3:

Population Size

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Issue #3: Does the size of the population groups matter when measuring disparities?

Population size

How Much Will Eliminating Inequalities in Each Group Contribute to Overall Population Health?

BMI and Population Distribution of Education Groups (2000 BRFSS)

This graph shows, in purple, the distribution of body mass index (BMI) across educational categories in the United States, based on Behavioral Risk Factor Surveillance Survey (BRFSS) data. Here you can see the average BMI, by educational group. The green bars represent the percentage of the U.S. population in each educational group. Note that college graduates have a BMI of just under 30; whereas, those with less than an eighth-grade education have a BMI of around 35.

How much will eliminating disparities between each of the groups contribute to improving overall population health?

The tendency might be to think, "Well, the group that is the worst-off is the group containing those people with less than an eighth grade education. They are the ones we should target because they have the highest adverse rate—the highest BMI."

However, if you look at how large that group is in size, you quickly realize that this is, by *far*, the smallest population group. The question then becomes: When

planning a health intervention, do we just consider the fact that the rate is high in a particular group, even though it comprises a small proportion in the population?

While there is no correct answer to this question, it is important to consider this issue explicitly. Make sure you think about the size of population subgroups, in addition to their rates of disease or poor health.

Ranking

How Should We Measure Health Disparities?

- Issue #4:

  Ranking

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Issue #4: Does it matter if the groups we are trying to compare are ordered or unordered? Do they have a quantifiable ranking?

Ranking

Categories that have a quantifiable order can be ranked. For categories like education groups can be ranked according to their level. We know that obtaining a college degree takes more years than a high school education. Income and age are other categories you can rank.

What about social groups you cannot order, groups where there is no quantifiable ranking? One of the most important disparities we're trying to understand and measure in the U.S. is across race/ethnic groups. There is no order for those groups so that one is higher or better than another. This is also true for gender, sexual orientation, geography and disability. Most of the social groups—in fact, all of the social groupings other than the socioeconomic ones— cannot be ordered.

This is important because some measures of disparity can not be used with groups that cannot be ordered.

Ranking
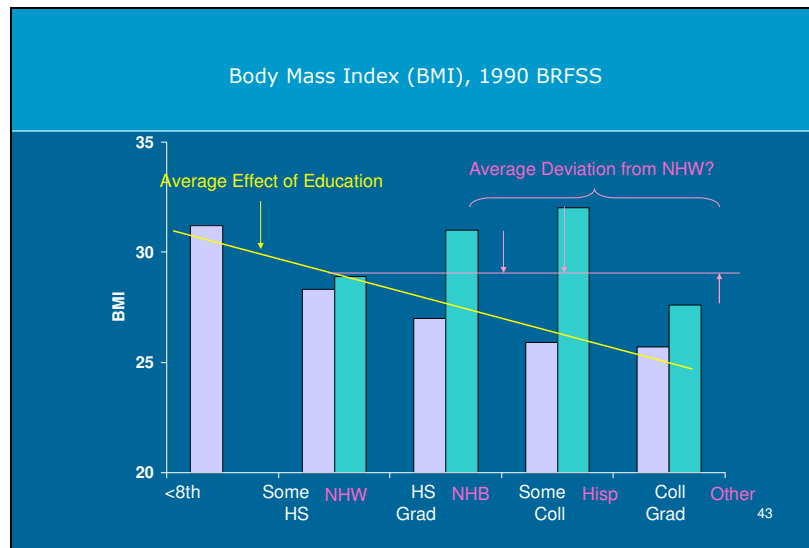
Let's look at body mass index (BMI) again, across different educational groups. This data is from the 1990 BRFSS. These are the BMI levels for college graduates versus the other educational groups. Because education can be ranked, we can calculate the average effect on body mass index from increasing or decreasing education from a regression equation.

We can not calculate the average effect on body mass index for different race/ethnic groups because we cannot order them from high to low. All we can do is measure their average deviation from a selected comparison group such as Non-Hispanic Whites.

Populations over time

Issue #5: Does it matter whether we are measuring disparity at a single point in time, or over time?

Populations over time

What changes occur over time that impact efforts to monitor and measure health disparities? Demographics change. The size of different educational groups, for example, changes over time. The size of the group of people with less than eight years of education in our society is getting smaller and smaller over time. Should our measure of disparity reflect the changes in the population size of those groups?

Immigration patterns also shift over time. As a result, population, race, and ethnic subgroups also change. Additionally, the definitions of those social groups change. This occurred in the race/ethnic classification in the Census from 1990 to 2000.

Some problems emerge in tracking outcomes and trends in health disparities from changes over time: Can we compare mortality rate disparities between non-Hispanic whites and non-Hispanic blacks in 1990 to disparities between single-race, non-Hispanic whites and 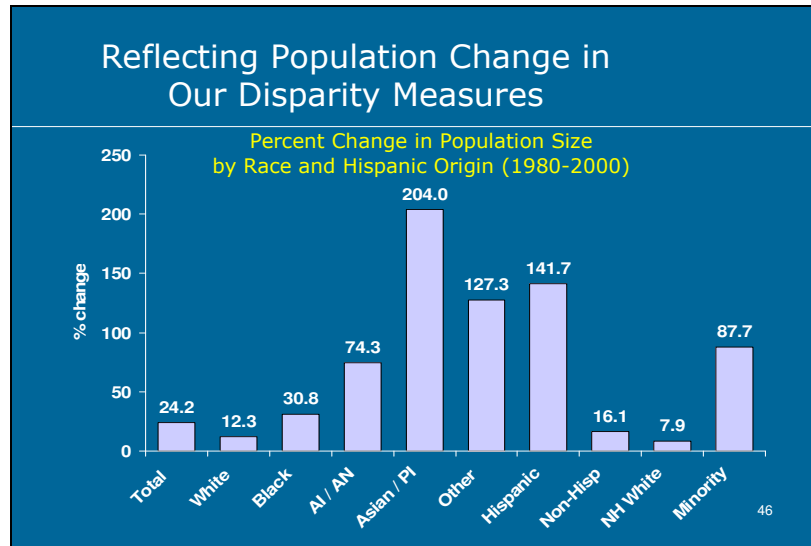single-race, non-Hispanic blacks in 2000? Any changes in the definitions or characteristics of these groups make that task very difficult.

Populations over time

Here we see the percent change in population size by race and Hispanic origin from 1980 to 2000.

Over this twenty-year period, we see an enormous increase in the Asian/Pacific Islander and Hispanic groups in particular. Now, suppose we are going to monitor disparities in health in these race/ethnic groups. We need to consider this: A disparity between the Asian/Pacific Islander population and the total population increases in importance over time as the size of the Asian/Pacific Islander population increases. Should we reflect this important change over time in our disparity measure?
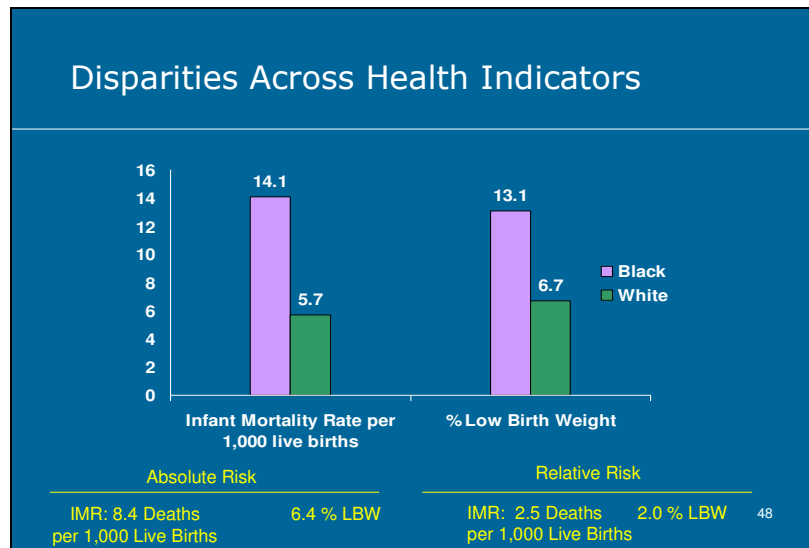
Multiple health indicators

Issue #6: Does it matter if we compare the size of disparity across different health indicators?

Multiple health indicators

We will confront situations in which we want to measure the size of the disparity across two or more health indicators.

For example, let's examine a black/white disparity in infant mortality rate using this chart.

The absolute risk in infant mortality is 8.4 deaths per 1,000 live births.
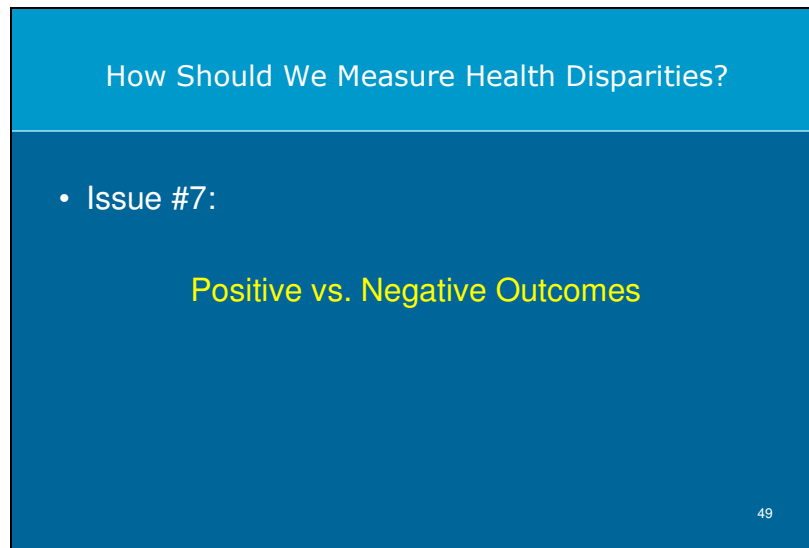The absolute risk in the percentage of low birth weight is 6.4%.
However, there is not a straightforward way to compare whether 6.4% is bigger than 8.4 because these absolute differences are expressed in different units.

Relative risk ratios, on the other hand, are useful across health indicators since these differences are unit-less. As indicated, blacks are 2.5 times more likely to experience infant mortality over whites and 2 times more likely to experience low birth weight.

In general, we need a relative indicator to make sense of comparisons across outcomes that are measured on different scales. When the units of measurement are different, you cannot compare absolute measures in a meaningful way.
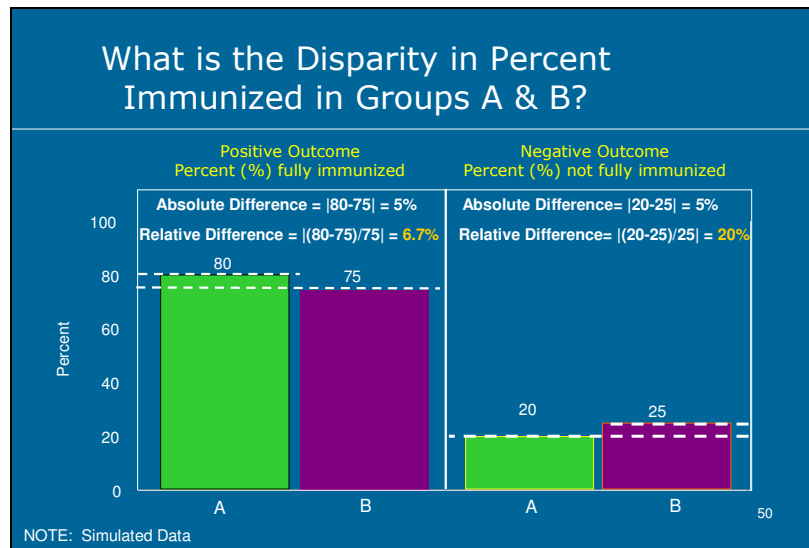
Positive vs. negative health outcomes

Issue #7: Does it matter if we use a positive or a negative outcome to measure health disparity?

Positive vs. negative health outcomes

What is the Disparity in Percent Immunized in Groups A & B?

Positive Outcome
Percent (%) fully immunized

Negative Outcome
Percent (%) not fully immunized

Absolute Difference = |80-75| = 5%
Relative Difference = |(80-75)/75| = 6.7%

Absolute Difference= |20-25| = 5%
Relative Difference= |(20-25)/25| = 20%

NOTE: Simulated Data

In the previous example, we talked about infant mortality, a negative outcome. We could also talk about infant survival, which is the inverse of mortality and which is a positive outcome.

To illustrate the impact of using positive or negative outcomes on disparity measures, let's review these data and bar charts on immunization coverage. This is simulated data.

Using the positive outcome called Percent Fully Immunized (the chart on left):

In group A, 80% are fully immunized.

In group B, 75 % are fully immunized.

Using the negative outcome called Percent Not Fully Immunized (the chart on right):

In Group A, 20% are not fully immunized.

In Group B, 25% are not fully immunized.

For each group, the positive and negative outcomes add up to 100%

80 + 20 for group A.

75 + 25 for group B.

The measure of absolute difference is the same for each group when expressed either for a positive or negative outcome. The absolute risk, or difference, is 5%

For the positive outcome 80 - 75

For the negative outcome 20 - 25

When using percentages that add up to 100, the absolute difference is always the same for positive and negative outcomes between two social groups.

Notice that absolute and relative difference are expressed here as an absolute value, not as a negative number.

Using a relative measure, we see that the absolute value of the relative difference is not the same when calculated for positive and negative outcomes. For percent fully immunized the relative difference is 6.7%; for percent not fully immunized, the relative difference is 20%.

In looking at measures of disparity, it is important to choose either positive or negative outcomes consistently and to be aware of the influence on calculations of absolute and relative measures. Positive and negative outcomes should not be mixed. Generally speaking, the Healthy People 2010 goals are expressed in negative outcomes, such as mortality rather than survival; percent without health insurance, rather than with.