Health Disparity Measures

Measuring health disparities is essential for informing targeted efforts to reduce disparities. Health disparities can be measured between racial or ethnic groups, geographic regions, gender identities, socioeconomic statuses, or other group statuses (e.g., migrant or refugee status, experience of homelessness, incarceration). Changes in measures over time can indicate progress or setbacks in eliminating health disparities. Different disparity measures can provide different results in magnitude and direction.[1-6] The measures described in this document represent a subset of commonly used measures in public health.[2,4-5,7] No gold standard measure exists, so the literature recommends measuring disparities in both absolute and relative terms to help ensure robustness of findings.[1-2,4]

Pairwise measures show disparities **between two groups**. Examples of **pairwise measures** include:[5,8-9]

Absolute Rate Difference

$$Rate_1 - Rate_2$$

Group 2 is the comparison group, such as the group with the lowest rate.

Knowing the direction (positive or negative) of the rate difference is also important.

Rate Ratio

$$\frac{Rate_1}{Rate_2}$$

Group 2 is the comparison group, such as the group with the lowest rate.

If **Rate_1** > **Rate_2**, the rate ratio will be greater than 1.
If **Rate_1** = **Rate_2**, the rate ratio will be equal to 1.
If **Rate_1** < **Rate_2**, the rate ratio will be less than 1.

Composite measures show disparities **in a whole population**. Examples of **composite measures** include:

Population Attributable Proportion (PAP)[2,8,10]

This is the proportion of cases attributable to disparities between **groups**.

$$1 - \frac{Rate_{lowest}}{Rate_{overall}}$$

Rate_overall is the rate in the total population.

Rate_lowest is the **rate** in **the group with the lowest rate** (i.e. **the comparison group**).

If **Rate_lowest** = 0, all cases are attributable to disparities, and the PAP will equal 1.

If **Rate_overall** = **Rate_lowest**, no cases are attributable to disparities, and the PAP will equal 0.

References
1. Keppel et al. 2005. Vital Health Stat. 2. Regidor 2004b. J Epidemiol Community Health. 3. Anand et al. 2001. Oxford University Press. 4. Harper et al. 2010. Milbank Q. 5. Harper et al. 2008. Am J Epidemiol. 6. Moonesinghe et al. 2017. Epidemiology. 7. Regidor 2004a. J Epidemiol Community Health. 8. McCree et al. 2020. AIDS and Behavior. 9. Sekikawa and Kuller. 2004. J Womens Health Gend Based Med. 10. Chesson et al. 2018. Sex Transm Dis. 11. Pearcy and Keppel. 2002. Public Health Reports. 12. Penman-Aguilar et al. 2016. J Public Health Manag Pract. 13. McCree et al. 2020. JAIDS.

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Absolute and Relative Indices of Disparity[5,8,10-11]

Index of Disparity

0 = No disparity; higher values indicate greater disparity.

$$\frac{100 \times \left(\dfrac{\sum_{i=1}^{N} |Rate_i - Rate_{overall}|}{N} \right)}{Rate_{overall}}$$

> If only the numerator is used (i.e., you choose not to divide by **Rate_overall**), this measure is the absolute index of disparity.

> If you choose to divide by **Rate_overall,** this measure is the relative index of disparity, expressed as a percentage of the overall rate.

Rate_i is the **rate** in **group i**.
Rate_overall is the rate in the total population.
N is the total number of groups.

Population-Weighted Index of Disparity*

This index of disparity is weighted by the population size of each group.

$$\frac{100 \times \left(\dfrac{\sum_{i=1}^{N} |Rate_i - Rate_{overall}| \times Population_i}{Population_{overall}} \right)}{Rate_{overall}}$$

Population_i is the **number of people** in **group i**.
Population_overall is the total number of people, equaling the sum of all **Population_i**.
*There are equity considerations to account for when deciding whether to weight measures or not.[4,12]

Gini Coefficient[7-8,10,13]

0 = No disparity; 1 = maximum disparity

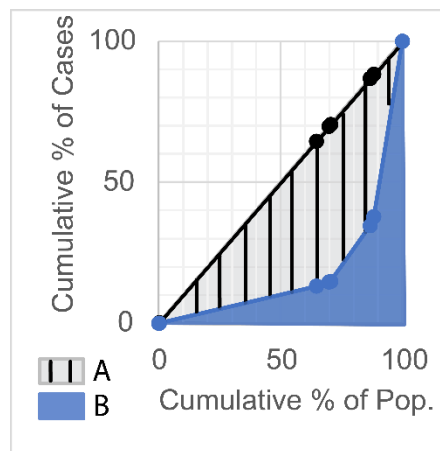$$1 - \sum_{i=1}^{N} (Y_i + Y_{i-1})(X_i - X_{i-1})$$

Groups are ranked from 1 to **N** by their **rates**.
X_i is the cumulative percentage of the population after including **group i**.
Y_i is the cumulative percentage of cases/diagnoses after including **group i**.
X_0 and Y_0 are both 0.
N is the total number of groups.

The **blue** line plots X_i and Y_i from the table below. The **black** line shows the hypothetical situation of no disparity, where each group's share of cases equals their share of the population. The Gini Coefficient would equal 0.

Group	Cases	Rate	Population	Cumulative % of Pop. (X_i)	Cumulative % of Cases (Y_i)
Native Hawaiian/Other Pacific Islander	1	0.5	213,000	0.2	0.03
White	425	0.5	80,189,000	64.6	13.1
Asian	48	0.8	6,400,000	69.8	14.6
American Indian/Alaska Native	10	1.1	901,000	70.5	14.9
Hispanic/Latino	644	3.2	20,252,000	86.7	34.7
Multiple Races	99	5.2	1,908,000	88.3	37.7
Black/African American	2027	13.9	14,583,000	100.0	100.0
Total	3254	2.6	124,446,000	100.0	100.0

The Gini Coefficient is also equal to **A**/(**A**+**B**). The larger the gap (area **A**) between the no disparity line (in **black**) and the actual data (in **blue**), the greater the disparities in the total population.

The table was adapted from HIV case data in McCree et al. 2020.[13] The above figure plots data from this table in **blue**.