# Measuring Progress Toward Target Attainment and the Elimination of Health Disparities in Healthy People 2030

Data Evaluation and Methods Research

# Measuring Progress Toward Target Attainment and the Elimination of Health Disparities in Healthy People 2030

Data Evaluation and Methods Research

# Contents

## Text Figures

## Text Tables

# Contents—Con.

**Detailed Table**

**Appendix Figure**

# Dedication



**This report is dedicated to Richard J. Klein, M.P.H.**
**(August 26, 1948–December 22, 2022)**

Richard's public health statistics career spanned 45 years, first as a federal employee with the National Center for Health Statistics' (NCHS) Division of Vital Statistics and the Office of Analysis, Epidemiology, and Health Promotion (now the Division of Analysis and Epidemiology); and then, after his retirement, as a contractor with NCHS. From 1992 to 2011, Richard was the Chief of the Health Promotion Statistics Branch, where he led the tracking and analysis of progress toward national health promotion and disease prevention objectives for the Healthy People initiative. Following his retirement in 2011 until his untimely passing in 2022, he continued to make major contributions to this and other national health monitoring initiatives as a statistical consultant to NCHS. Richard continually demonstrated his unwavering commitment to NCHS and public health as he worked with colleagues to promote high-quality methods and data for monitoring the nation's health. He was esteemed by many throughout CDC and HHS for his remarkable knowledge of measures and data systems (including for the Healthy People initiative over its five iterations), his ability to present complex information thoughtfully and practically, his dedication to the importance of measuring progress on Healthy People's goals to eliminate health disparities and achieve health equity, and his ever-constructive and diplomatic nature in navigating sometimes contentious decisions about measures and data sources. This report reflects many of Richard's insights during the development of initial drafts. He was a treasured colleague and a true friend; he will genuinely be missed.

# Acknowledgments

---

# Measuring Progress Toward Target Attainment and the Elimination of Health Disparities in Healthy People 2030

by David T. Huang, Ph.D., M.P.H., C.P.H., Allan Uribe, Dr.P.H., M.P.H., C.P.H., and Makram Talih, Ph.D.

## Abstract

### Introduction

The Healthy People initiative provides science-based, 10-year public health objectives and targets for the U.S. population. As in the previous four initiatives, Healthy People 2030 established overarching goals and objectives (with targets) at the start of the decade and will be monitoring progress toward the attainment of targets and elimination of health disparities among population subgroups over the course of the decade.

### Objective

This report outlines Healthy People 2030 measurement practices for both progress toward target attainment and elimination of disparities and compares the 2030 measurement practices with those that were in place in 2020, highlighting strengths and limitations.

### Methods

Progress toward target attainment is assessed for the total population. The "percentage of targeted change achieved" quantifies movement toward targets, and the "percentage change from baseline" can be calculated for all core objectives. Based on the percentage of targeted change achieved or percentage change from baseline, as well as the statistical significance of these measures (when applicable), core objectives in Healthy People 2030 are classified into four mutually exclusive categories: Target met or exceeded, Improving, Little or no detectable change, or Getting worse. Disparities at a single timepoint are assessed by a suite of six measures: the between-group rate difference and ratio; summary rate difference and ratio; and maximal rate difference and ratio. To enable comparisons among those six measures, changes in disparities over time are assessed using the percentage change from baseline. Variability (standard errors and 95% confidence intervals) and statistical significance for all six measures, when applicable, are derived using a resampling/bootstrap procedure.

### Conclusion

Expanding and building on the approaches to measurement in previous decades, methods to measure progress toward target attainment and elimination of health disparities in Healthy People 2030 represent a further evolution of these methods and address methodological issues and limitations previously identified.

**Keywords:** Healthy People objectives • population subgroups • health equity • disparities methods

## Introduction

Established in 1979, Healthy People is an initiative of the U.S. Department of Health and Human Services that provides science-based, 10-year national objectives with numerical targets for improving the health of all Americans. For every decade since Healthy People 2000 (launched in 1990), the Healthy People initiative has also included an overarching goal related to health disparities. For Healthy People 2030, the disparities-related goal is to "Eliminate health disparities, achieve health equity, and attain health literacy to improve the health and well-being of all" (1).

This report focuses on describing Healthy People 2030 measurement practices for progress toward target attainment and the elimination of health disparities, comparing them with those that were in place in Healthy People 2020 (2–4). In addition, this report highlights the strengths and limitations of the Healthy People 2030 measurement practices and provides a methodological reference upon which future publications and analyses may expand further.

### Vision, Mission, and Overarching Goals

The framework for Healthy People 2030, which includes a vision, mission, and overarching goals, serves to provide context and rationale for the initiative. The vision of Healthy People 2030 is "A society in which all people can achieve their

full potential for health and well-being across the lifespan." Its mission is "To promote, strengthen, and evaluate the nation's efforts to improve the health and well-being of all people" (1).

The overarching goals for Healthy People 2030 are to:

- Attain healthy, thriving lives and well-being free of preventable disease, disability, injury, and premature death.
- Eliminate health disparities, achieve health equity, and attain health literacy to improve the health and well-being of all.
- Create social, physical, and economic environments that promote attaining the full potential for health and well-being for all.
- Promote healthy development, healthy behaviors, and well-being across all life stages.
- Engage leadership, key constituents, and the public across multiple sectors to take action and design policies that improve the health and well-being of all.

## Objectives and Targets

Healthy People 2030 includes three types of objectives. Most objectives are core objectives, which are objectives that reflect high-priority public health issues and are associated with evidence-based interventions. Core objectives have valid, reliable, nationally representative data, including baseline data from no earlier than 2015 and an expectation of at least two follow-up data points during the Healthy People 2030 decade. In addition, all core objectives include targets for the decade. (These objectives were called measurable objectives in Healthy People 2020.) Healthy People 2030 also includes developmental objectives, which represent high-priority public health issues that are associated with evidence-based interventions but do not yet have a reliable data source and baseline data, and research objectives, which represent public health issues with a high health or economic burden or significant disparities between population groups but do not yet have evidence-based interventions (5). The methods outlined in this report apply only to core objectives and do not apply to developmental and research objectives.

The inclusion of quantifiable, 10-year targets has distinguished Healthy People from most other federal health indicator initiatives. Each of the 359 core objectives in Healthy People 2030 has an associated target generally set by topic area workgroups consisting of federal and nonfederal policy and subject matter experts using the baseline value for the total population for each objective and one of six target-setting methods: percent improvement; percentage point improvement; projection; minimal statistical significance; consistency with national programs, regulations, policies, or laws; and maintain baseline (6).

## Progress Toward Target Attainment

The examination of data relative to targets is critical to the usefulness of Healthy People, as targets communicate policy expectations and expert or evidence-based recommendations to a wide range of stakeholders. Targets offer a marker for assessing progress for each objective individually or for groups of objectives (including the initiative as a whole). The primary measure for assessing progress in Healthy People, the "percentage of targeted change achieved," was first introduced in Healthy People 2010 and will continue to be used in Healthy People 2030. More detail is provided in the Methods section.

## Population Template

The standard data template shown in Table A, also referred to as the population template, is generally used for all population-based objectives in Healthy People 2030, although variations exist. Data are shown when collected, analyzed, and available from the data source for these groups and the applicable presentation criteria are met. If data for a particular demographic group are not collected, analyzed, or available, or if data for that group are suppressed because they fail to meet the applicable criteria for statistical reliability, data quality, or confidentiality, the Healthy People website cites one of these explanations for the reason data are not shown. Data presentation standards applicable to National Center for Health Statistics data systems are detailed in previous reports (7,8).

Additionally, in Healthy People 2030, health disparities are assessed for all applicable groups in the population template, marking an evolution from 2010 and 2020, when disparities were only assessed for selected population characteristics when applicable (specifically sex, race and ethnicity, educational attainment, family income, geographic location, and disability status).

## Progress Toward the Elimination of Health Disparities

Healthy People 2020 and 2030 define health disparity as "a particular type of health difference that is closely linked with social, economic, and/or environmental disadvantage" (9). Population groups more adversely affected by health disparities are those who have systematically experienced greater obstacles to health based on characteristics that have been historically linked to discrimination or exclusion, such as race, ethnicity, religion, socioeconomic status, sex, age, mental health, disability, sexual orientation, gender identity, and geographic location.

In Healthy People 2030, as in 2020 and 2010, disparities are operationalized as measurable quantities, such as (absolute) differences, percentage differences, or ratios relative to a reference point, regardless of social, economic, or environmental disadvantage of the groups being compared.

**Table A. Healthy People 2030 standard population template**

| Population categories[1,2] | Population categories[1,2] |
|---|---|
| Total | Health insurance status |
|   Sex |   Insured |
|     Male |     Private |
|     Female |     Public |
|   Race and ethnicity |   Uninsured |
|     American Indian or Alaska Native only | Geographic location or region |
|     Asian only |   Metropolitan |
|     Native Hawaiian or Other Pacific Islander only |   Nonmetropolitan |
|     Black or African American only | Marital status |
|     White only |   Married or cohabiting partner |
|     Two or more races |   Divorced, separated, or widowed |
|     Hispanic or Latino |   Never married |
|     Not Hispanic or Latino | Country of birth |
|       American Indian or Alaska Native only, not Hispanic or Latino |   United States |
|       Asian only, not Hispanic or Latino |   Outside United States |
|       Native Hawaiian or Other Pacific Islander only, not Hispanic or Latino | Veteran status |
|       Black only, not Hispanic or Latino |   Veteran |
|       White only, not Hispanic or Latino |   Nonveteran |
|       Two or more races, not Hispanic or Latino | Disability |
|   Age group (standard groups by data system) |   People with disabilities |
|   Educational attainment |   People without disabilities |
|     Less than high school | Sexual orientation |
|     High school |   Straight |
|     Some college or associate's degree |     Straight, male |
|     4-year college degree or more |     Straight, female |
|   Family income (percentage of poverty threshold) |   Gay or lesbian |
|     Less than 100% |     Gay, male |
|     100%–199% |     Gay or lesbian, female |
|     200%–399% |   Bisexual |
|     400% or more |     Bisexual, male |
| |     Bisexual, female |
| | Gender identity (standard groups by data system) |

[1]If data are not collected, analyzed, available, or presented for a particular demographic group by a data source, a symbol or acronym (DNC [Data for specific population not collected], DNA [Data have not been analyzed], DSU [Data do not meet the criteria for statistical reliability, data quality, or confidentiality]) will be displayed to indicate the reason data are not shown.

[2]Categories and demographic groups may vary from this template, and additional categories and demographic groups may be included on a case-by-case basis.

NOTE: People of Hispanic origin may be of any race.

SOURCE: National Center for Health Statistics, Healthy People 2030 database.

As in previous Healthy People reports of a similar nature (3,4), this report focuses on the operationalization rather than the conceptualization of health disparities measurement. Continuing the practice from Healthy People 2020, a suite of measures provides a comprehensive presentation of findings related to health disparities, with the number of measures expanded from four in Healthy People 2020 to six in 2030.

Briefly, the Healthy People 2030 suite of measures includes between-group and overall measures assessed in absolute and relative terms. For any given population characteristic, the six disparities measures used in Healthy People 2030 are:

## Between-group measures

- **Between-group rate difference**—The absolute difference between the reference and comparison group rates.

- **Between-group rate ratio**—The ratio between the reference and comparison group rates, defined so that its numerator is larger than its denominator.

## Overall measures

- **Maximal rate difference**—The absolute difference between the highest and lowest group rates.

- **Maximal rate ratio**—The ratio of the highest to the lowest group rates.

- **Summary rate difference**—The absolute difference between the reference group rate and the average rate of all other subgroups.

- **Summary rate ratio**—The ratio between the reference group rate and the average rate of all other subgroups, defined so that its numerator is larger than its denominator.

The above six measures are presented in detail in the Methods section, with further discussion about each measure's strengths and weaknesses in the Discussion section.

# Methods

Healthy People 2030 objectives are tracked using a variety of measurement units, such as percentages, rates, and counts. Of the current 359 Healthy People 2030 core objectives, 239 (66.6%) are measured using percentages and 85 (23.7%) are measured using rates (for example, per 100,000 population), for a total of 324 objectives (90.3%) measured using either a percentage or a rate. The remaining 35 objectives (9.7%) use other measurement units, including but not limited to case or event counts and volumetric units. For this report, the term "rate" is used as shorthand for rate, percentage, proportion, or any other unit of measurement for which a meaningful assessment of disparities can be made. Disparities are not usually assessed for objectives that are measured using counts, because any differences between population groups for such objectives may not be distinguishable from differences in the relative sizes of the groups in the population (10).

## Measuring Progress

Analyses of progress in Healthy People are multifaceted. Assessment of progress toward Healthy People 2030 targets focus on the total targeted population—because that is the basis for target setting for each objective—and uses the "percentage of targeted change achieved" for objectives moving toward their targets. The "percentage change from baseline" can also be calculated for all measurable objectives with a baseline and at least one follow-up data point, regardless of their targets or whether the change is in the desired direction.

### Measuring progress toward target attainment

At the launch of Healthy People 2030 in August 2020, targets were set to be achieved by the end of the decade. Progress toward target attainment may be evaluated for Healthy People 2030 objectives that have a baseline, a target and desired direction of change, and at least one follow-up data point, and is monitored throughout the decade. Progress toward target attainment cannot be evaluated for objectives with only baseline data and objectives with no Healthy People 2030 targets or desired direction of change (developmental and research objectives). As explained below, objectives for which progress toward target attainment can be measured fall under three mutually exclusive categories: moving toward their targets; moving away from their targets; or demonstrating little or no detectable change.

**Progress for objectives moving toward their targets**

As in Healthy People 2020, the percentage of targeted change achieved quantifies progress toward target attainment for Healthy People 2030 objectives that are moving toward their targets. The percentage of targeted change achieved expresses the difference between the baseline and the most recent value relative to the targeted change from baseline (4), as follows:

$$\text{Percentage of targeted change achieved} = \frac{\text{Most recent value} - \text{Baseline value}}{\text{HP2030 target} - \text{Baseline value}} \cdot 100$$

The assessment of statistical significance of the percentage of targeted change achieved (when measures of variability are available) is detailed in the Appendix: Measures of Variability.

**Progress for objectives moving away from their targets**

The percentage of targeted change achieved does not adequately quantify progress for objectives moving away from their targets, as demonstrated in the Technical Appendix of the Healthy People 2010 Final Review (11). To quantify progress toward target attainment for Healthy People 2030 objectives that are moving away from their baseline and target values, the percentage change from baseline, discussed in the next section, is used instead to

capture the deficit from baseline and faithfully represent the progress needed to achieve the target. For example, a percentage change from baseline of 10% in magnitude (absolute value)—and away from the target—indicates that the objective is 10% in deficit relative to its baseline, a deficit that would need to be made up in addition to the targeted change from baseline once the baseline value is regained.

**Progress for objectives demonstrating little or no detectable change**

Healthy People 2030 objectives that are moving toward their targets but for which the percentage of targeted change achieved is small or, otherwise, not statistically significant (when measures of variability are available) are categorized as having demonstrated little or no detectable change. Objectives that are moving away from their targets but for which the percentage change from baseline is small or not statistically significant, as well as for objectives for which the change from baseline is zero, are similarly categorized. When measures of variability are not available, the specific numerical threshold for the magnitude of the percentage of targeted change achieved or the percentage change from baseline to be considered little or not detectable is discussed in the "Determination of Healthy People 2030 status categories" section.

## Percentage change from baseline for all objectives

The percentage change from baseline is defined as:

$$\text{Percentage change from baseline} = \frac{\text{Most recent value} - \text{Baseline value}}{\text{Baseline value}} \cdot 100$$

Note that the percentage change from baseline can also be expressed as a function of the ratio between the most recent and baseline values:

$$\text{Percentage change from baseline} = \left[\frac{\text{Most recent value}}{\text{Baseline value}} - 1\right] \cdot 100$$

The assessment of the statistical significance of the percentage change from baseline (when measures of variability are available) is detailed in the Appendix: Measures of Variability.

The percentage change from baseline could be calculated and presented for any objective that has a baseline and at least one follow-up data point, regardless of its target or desired direction of change.

The percentage change from baseline quantifies change over time in the indicator that is tracked by a given Healthy People 2030 objective (for example, Healthy People 2030 objective AHS-01, "Increase the proportion of people with health insurance," tracks the percentage of people under 65 who report coverage by any type of public or private health insurance). As a relative measure, the percentage change from baseline is unit-free and, therefore, allows for comparisons for the total population among objectives across the Healthy People 2030 topics (health conditions, health behaviors, populations, settings and systems, and social determinants of health); among population subgroups for which data are available; and, when applicable, across disparities measures when tracking changes in disparities over time.

Analyses based on the percentage change from baseline allow for the classification of Healthy People 2030 objectives into data-driven categories.

- Objectives for which the rate for the total population is moving away from its baseline and target values may be categorized as GETTING WORSE or demonstrating LITTLE OR NO DETECTABLE CHANGE depending on the statistical significance of the percentage change from baseline (when applicable) and whether the change is 10% or more in absolute value (Table B).

- As a supplement to the measurement of progress toward target attainment, described in "Measuring Progress Toward Target Attainment," objectives that are moving in the desired direction may be further categorized; for example, as showing less than 10%, 10%–49%, 50%–99%, or at least 100% change from baseline, akin to the categorization of changes in disparities in Healthy People 2010 (12). Objectives that are moving away from their baselines may be similarly characterized. Such analyses would inform a more in-depth comparative assessment of progress and may be appropriate for: (a) all Healthy People 2030 objectives; (b) a selected subset of Healthy People 2030 objectives, such as the Healthy People 2030 Leading Health Indicators; or (c) population subgroups.

## Determination of Healthy People 2030 status categories

Healthy People 2030 objectives can be classified into several mutually exclusive categories: TARGET MET OR EXCEEDED, IMPROVING, LITTLE OR NO DETECTABLE CHANGE, GETTING WORSE, BASELINE ONLY, DEVELOPMENTAL, or RESEARCH. Progress cannot be assessed for the last three categories of objectives, because those objectives have only baseline data, do not have reliable baseline data, or are not yet associated with (an) evidence-based intervention(s), respectively. As was the case in Healthy People 2020, the first four categories are the progress status categories used for Healthy People 2030 core objectives with tracking data (a baseline and at least one follow-up data point).

### Objectives that met or exceeded their targets

When the desired direction is an increase, an objective is considered to have met or exceeded the target at the most recent timepoint if its most recent value is at or above the

## Table B. Classification of Healthy People 2030 objectives, by progress status

| Objective status | Short explanation |
|---|---|
| TARGET MET OR EXCEEDED | Target met or exceeded. |
| IMPROVING | Movement is toward the target and is either:<br>– Statistically significant when measures of variability are available.<br>  OR – Ten percent or more of the targeted change when measures of variability are unavailable. |
| LITTLE OR NO DETECTABLE CHANGE | Objective demonstrates little or no detectable change, because either:<br>– Movement toward the target is not statistically significant when measures of variability are available.<br>  OR – Movement is toward the target, but the objective has achieved less than 10% of the targeted change when measures of variability are unavailable.<br>  OR – Movement is away from the baseline and target and is not statistically significant when measures of variability are available.<br>  OR – Movement is away from the baseline and target, but the objective has moved less than 10% relative to its baseline when measures of variability are unavailable.<br>  OR – There was no change between the baseline and most recent data point. |
| GETTING WORSE | Movement is away from the baseline and target and is either:<br>– Statistically significant when measures of variability are available.<br>  OR – Ten percent or more relative to the baseline when measures of variability are unavailable. |
| BASELINE ONLY | Objective has only baseline data; progress cannot be assessed. |
| DEVELOPMENTAL | Objective is a high-priority public health issue associated with (an) evidence-based intervention(s), but it doesn't yet have reliable baseline data. |
| RESEARCH | Objective represents a public health issue with a high health or economic burden or significant disparities between population groups, but it is not yet associated with (an) evidence-based intervention(s). |

SOURCE: National Center for Health Statistics, Healthy People 2030 database.

Healthy People 2030 target. On the other hand, when the desired direction is a decrease, an objective has met or exceeded its target if the most recent value is at or below the Healthy People 2030 target.

Consistent with Healthy People 2020, Healthy People 2030 objectives that have met or exceeded their target are classified in the TARGET MET OR EXCEEDED progress status category (Table B). In this scenario, the percentage of targeted change achieved is 100% or more. Even though the statistical significance of the percentage of targeted change achieved is calculated and displayed in published tables, objectives that have met or exceeded their target are categorized as TARGET MET OR EXCEEDED regardless of whether the percentage of targeted change achieved was statistically significant.

### Objectives moving toward their targets

When the desired direction is an increase, an objective is moving toward the target at the most recent timepoint if its most recent value is higher than the baseline but remains lower than the Healthy People 2030 target. On the other hand, when the desired direction is a decrease, an objective is moving toward the target if the most recent value is lower than the baseline but remains higher than the Healthy People 2030 target.

Consistent with Healthy People 2020, Healthy People 2030 objectives that are moving toward but have not met or exceeded their targets are classified in the IMPROVING or LITTLE OR NO DETECTABLE CHANGE progress status categories,

depending on the magnitude or, when applicable, statistical significance of the percentage of targeted change achieved (Table B). Specifically, an objective that is moving toward but has not met or exceeded its target at the most recent timepoint is classified as IMPROVING if the percentage of targeted change achieved is statistically significant (when standard errors [SEs] are available), regardless of the magnitude of the change, or, when statistical significance cannot be tested, if 10% or more of the targeted change is achieved. If, when tested for statistical significance, the percentage of targeted change achieved is not statistically significant, or, when statistical significance cannot be tested, if less than 10% of the targeted change is achieved, the objective is classified as showing LITTLE OR NO DETECTABLE CHANGE.

### Objectives moving away from their baselines and targets

When the desired direction is an increase, an objective is moving away from the baseline and target at the most recent timepoint if its most recent value is lower than the baseline and Healthy People 2030 target. On the other hand, when the desired direction is a decrease, an objective is moving away from the baseline and target if the most recent value is higher than its baseline and target.

Consistent with Healthy People 2020, Healthy People 2030 objectives that are moving away from the baselines and targets are classified in the GETTING WORSE or LITTLE OR NO DETECTABLE CHANGE progress status categories (Table B). Specifically, an objective that is moving away from its baseline and target at the most recent timepoint is

classified as GETTING WORSE if the percentage change from baseline is statistically significant (when SEs are available), regardless of the magnitude of the change, or, when statistical significance cannot be tested, if the change from baseline is 10% or more in magnitude (absolute value). An objective is classified as showing LITTLE OR NO DETECTABLE CHANGE when the percentage change from baseline is not statistically significant (when SEs are available), or, in the absence of significance testing, if the absolute change from baseline is less than 10% in magnitude.

**Objectives that show no change between the baseline and most recent data points**

When the most recent value for an objective is equal to the baseline value, there is no movement in either direction. In this scenario, either the percentage change from baseline or the percentage of targeted change achieved can be used to determine the applicable progress status category, as both are equal to 0.0%. Because zero is less than 10% in magnitude and, even when statistical significance can be tested, zero cannot be statistically significant at the 0.05 significance level, the objective is classified as showing LITTLE OR NO DETECTABLE CHANGE.

## Percentage change from baseline for population subgroups

As learned from analyses related to the Healthy People 2020 Final Review (13), there are limitations to examining progress by population subgroups using the percentage of targeted change achieved, especially for groups that have already met or exceeded the target at baseline. Therefore, it may be more appropriate to assess progress by population subgroups using the percentage change from baseline as an alternate or supplementary measure to the percentage of targeted change achieved, allowing for comparisons between groups regardless of where they started the decade relative to the target.

## Measuring Health Disparities

In Healthy People 2030, as in Healthy People 2020 and 2010, disparities are operationalized as (absolute) differences, percentage differences, or ratios relative to a reference point, regardless of the social, economic, or environmental disadvantage of the groups being compared (9,10). Comparisons among population subgroups can be conducted using several choices for the reference point—for example, the Healthy People 2030 target, the total population, the group with the largest share of the population, or the group with the most favorable rate (or, when a decrease is desired, least adverse)—which has implications for the size and direction of disparity (10,14,15). As mentioned previously, comparisons with the Healthy People 2030 target may not be meaningful for population subgroups because Healthy People 2030 targets are set based on the total population—a

weighted average of the subgroup rates—and some groups may already have exceeded the target at baseline (6). Comparisons with the total population rate may be inconclusive because, when examining changes over time, it can be difficult to distinguish the effects of changes in group rates from changes in the relative sizes of the groups in the population. Comparisons with the group with the largest share of the population may not be meaningful when, in many cases, smaller population groups achieve better health outcomes. Consequently, in Healthy People 2030, as in 2020 and 2010, disparities are relative to the most favorable (or, when a decrease is desired, least adverse) group rate that is observed among the subgroups for a given population characteristic in the population template (for example, by sex, race and ethnicity, or family income; see Table A).

## Disparities at a single timepoint

The following sections provide formal mathematical definitions corresponding to the disparities measures used in Healthy People 2030. Table C provides an overview of the constructs used in disparities measurement.

**Notation**

Let $R_1, R_2, …, R_K$ denote the group-specific rates for population subgroups $g = 1, 2, …, K$. Let $R_{(1)} \leq R_{(2)} \leq … \leq R_{(K)}$ denote their ordered values, from smallest to largest. Using this notation, for an objective expressed in terms of an adverse outcome or condition that is to be decreased, the reference rate $R_{\text{ref}}$ (the least adverse group rate) is equal to the lowest rate $R_{(1)}$, and the highest rate $R_{(K)}$ is the most adverse group rate. On the other hand, for an objective expressed in terms of a favorable outcome or condition to be increased, $R_{\text{ref}} = R_{(K)}$ (the most favorable group rate), and $R_{(1)}$ is the least favorable group rate. Let $R_{\text{ave}}$ denote the average rate of the $K - 1$ groups other than the group that achieved the reference rate $R_{\text{ref}}$, calculated as:

$$R_{\text{ave}} = \frac{R_{(1)} + R_{(2)} + \cdots + R_{(K-1)}}{K-1} \text{ or } R_{\text{ave}} = \frac{R_{(2)} + R_{(3)} + \cdots + R_{(K)}}{K-1}$$

when the reference rate $R_{\text{ref}}$ is the highest rate, $R_{(K)}$, or the lowest rate, $R_{(1)}$, respectively.

**Handling ties**

To avoid ties between groups, unrounded values for rates are used in Healthy People 2030 disparities calculations. When two group rates are tied even after their unrounded values are compared, the tie is resolved using their unrounded SEs, when available, as follows:

- When a decrease is desired, a tie for the $r^{\text{th}}$ smallest value, $R_{(r)} = R_{(r+1)}$, with $r = 1, 2, …,$ or $K - 1$, is resolved using the group with the smaller unrounded SE as the group that achieves the $r^{\text{th}}$ smallest rate $R_{(r)}$.
- Conversely, when an increase is desired, a tie for the $r^{\text{th}}$ largest value, $R_{(r-1)} = R_{(r)}$, with $r = K, K - 1, …,$ or 2, is

# Table C. Overview of disparities measurement in Healthy People 2030

| Construct | Formula | Absolute or relative | Between-group or overall | Maximal or summary | Notes |
|---|---|---|---|---|---|
| Population subgroup rates | $R_1, R_2, \ldots, R_K$ | … | … | … | Group-specific rates are indexed by $g = 1, 2, \ldots,$ or $K$. Any ties in ranking are resolved using unrounded estimates and standard errors, when available, as described in "Methods." |
| Ordered group rates (smallest to largest) | $R_{(1)} \leq R_{(2)} \leq \ldots \leq R_{(K)}$ | … | … | … | |
| Reference rate | $R_{ref} = R_{(1)}$ if decrease desired | … | … | … | If decrease is desired, the reference rate is the lowest group rate. |
| | $R_{ref} = R_{(K)}$ if increase desired | … | … | … | If increase is desired, the reference rate is the highest group rate. |
| Average rate for all $K - 1$ groups other than the group that achieved the reference rate | $R_{ave} = \dfrac{R_{(2)} + R_{(3)} + \cdots + R_{(K)}}{K - 1}$ if decrease desired | … | … | … | Average rate for all $K$–1 groups other than the group with the lowest rate. |
| | $R_{ave} = \dfrac{R_{(1)} + R_{(2)} + \cdots + R_{(K-1)}}{K - 1}$ if increase desired | … | … | … | Average rate for all $K$–1 groups other than the group with the highest rate. |
| Between-group rate difference | $RD_g = \lvert R_{ref} - R_g \rvert$ | Absolute | Between-group | … | Measures the absolute difference between the reference and the group-specific rates for $g = 1, 2, \ldots,$ or $K$; remains greater than or equal to 0. |
| Between-group rate ratio | $RR_g = \max \{ R_{ref} / R_g, R_g / R_{ref} \}$ <br> $= R_g / R_{ref}$ If decrease desired <br> $= R_{ref} / R_g$ If increase desired | Relative | Between-group | … | Measures the directional ratio between the reference and the group-specific rates for $g = 1, 2, \ldots,$ or $K$; remains greater than or equal to 1. |
| Maximal rate difference | $MRD = R_{(K)} - R_{(1)}$ | Absolute | Overall | Maximal | Measures the difference between the highest and lowest group rates; remains greater than or equal to 0. |
| Maximal rate ratio | $MRR = R_{(K)} / R_{(1)}$ | Relative | Overall | Maximal | Measures the ratio of the highest to the lowest group rates; remains greater than or equal to 1. |
| Summary rate difference | $SRD = \lvert R_{ref} - R_{ave} \rvert$ | Absolute | Overall | Summary | Measures the absolute difference between the reference rate and the average rate for all $K$–1 groups other than the group with the reference rate; remains greater than or equal to 0. |
| Summary rate ratio | $SRR = \max \{ R_{ref} / R_{ave}, R_{ave} / R_{ref} \}$ <br> $= R_{ave} / R_{ref}$ If decrease desired <br> $= R_{ref} / R_{ave}$ If increase desired | Relative | Overall | Summary | Measures the directional ratio between the reference rate and the average rate for all $K$–1 groups other than the group with the reference rate; remains greater than or equal to 1. |
| Percentage change from baseline for disparities measure $M$ | $\text{Percentage change in } M \text{ from baseline} = \left[ \dfrac{\text{Most recent } M \text{ value}}{\text{Baseline } M \text{ value}} - 1 \right] \bullet 100$ | Relative | … | … | Quantifies the percentage change from baseline for measure $M$, where $M$ is a between-group rate difference or ratio, the maximal rate difference or ratio, or the summary rate difference or ratio. |

See footnotes at end of table.

## Table C. Overview of disparities measurement in Healthy People 2030—Con.

| Construct | Formula | Absolute or relative | Between-group or overall | Maximal or summary | Notes |
|---|---|---|---|---|---|
| Categories of change in disparities measure $M$ over time | $M$ is **narrowing** if the percentage change in $M$ from baseline is less than 0 and statistically significant (when applicable), or the percentage change in $M$ from baseline is less than or equal to −10%.<br><br>$M$ is showing **little or no detectable change** if the percentage change in $M$ from baseline is not statistically significant (when applicable), or the percentage change in $M$ from baseline is greater than −10% and less than 10%.<br><br>$M$ is **widening** if the percentage change in $M$ from baseline is greater than 0 and statistically significant (when applicable), or the percentage change in $M$ from baseline is greater than or equal to 10%. | Relative | … | … | Statistical significance of the percentage change from baseline (when applicable) is assessed as described in the Appendix: Measures of Variability. |

… Category not applicable.

NOTES: Standard errors and 95% confidence limits are derived using resampling/bootstrap, as described in the Appendix: Measures of Variability, for the following constructs: the ordered population subgroup rates and their corresponding ranks; the reference rate and the average rate for all $K$–1 groups other than the group that achieved the reference rate; the between-group rate differences and ratios; the maximal rate difference and ratio; and the summary rate difference and ratio.

SOURCE: National Center for Health Statistics, Healthy People 2030 database.

resolved using the group with the smaller unrounded SE as the group that achieves the $r^{th}$ largest rate $R_{(r)}$.

In the unlikely event that the unrounded SEs corresponding to the tied group rates, when available, are also tied, or when SEs are not available, the group that achieves the $r^{th}$ smallest (respectively, $r^{th}$ largest) rate $R_{(r)}$ is defined to be the group with the larger share of the total population.

**Between-group measures**

In Healthy People 2030, differences between each population subgroup rate and the reference rate are measured as absolute differences, whereas ratios are expressed as ratios of the larger rate to the smaller rate, which remain greater than or equal to one (directional ratios). In Healthy People 2020, only the between-group ratios were calculated (2). Even though between-group rate differences cannot be used for direct comparisons across objectives that are tracked using different measurement units, they remain useful for tracking absolute changes in disparities over time in the original units of measurement and can supplement findings based on the rate ratios (16). As a result, they have been added to the suite of disparities measures for Healthy People 2030.

*Between-group rate difference and between-group rate ratio*

The rate difference $RD_g$ and rate ratio $RR_g$ are used for between-group comparisons and assess the absolute difference and directional ratio, respectively, between the group-specific rate $R_g$ and the reference rate $R_{ref}$:

$$RD_g = \left| R_g - R_{ref} \right| \text{ and}$$

$$RR_g = \max \left\{ R_g / R_{ref}, R_{ref} / R_g \right\}, g = 1, 2, \ldots, K$$

The rate difference $RD_g$ remains nonnegative (absolute value of the simple difference in the rates). For the rate ratio $RR_g$, note that regardless of whether the objective is expressed as a favorable outcome to be increased, in which case $RR_g = R_{ref} / R_g$, or as an adverse outcome to be decreased, in which case $RR_g = R_g / R_{ref}$, the value will remain greater than or equal to one.

**Overall measures**

Whereas between-group measures allow detailed comparisons to the reference group rate for all subgroups within a population domain (sex, race and ethnicity, education, etc.), overall measures can be useful for quantifying the overall extent of disparity across all groups within that domain and provide a broad overview (3,10).

*Maximal rate difference and maximal rate ratio*

The maximal rate difference (*MRD*) and maximal rate ratio (*MRR*) are overall measures of disparity based on estimates of the highest and lowest rates among the population subgroups of interest. These measures were both used in Healthy People 2020 (4).

*MRD* is the difference and *MRR* is the ratio between the highest and lowest rates. Regardless of the desired directionality of the objective, they are defined as:

$$MRD = R_{(K)} - R_{(1)} \text{ and } MRR = R_{(K)} / R_{(1)}$$

*Summary rate difference and summary rate ratio*

The summary rate difference (*SRD*) and ratio (*SRR*) are also overall measures, comparing the reference rate $R_{ref}$ to the average rate $R_{ave}$ for all the groups other than the reference group for the given population characteristic. The *SRR* was introduced in Healthy People 2020 and extends the Healthy People 2010 Index of Disparity, a special case of the *SRR* when objectives were (re-) expressed in terms of adverse outcomes or conditions to be reduced (4). For Healthy People 2030, the *SRR* is supplemented by the *SRD*, an absolute measure, to allow for both absolute and relative assessments of summary disparity. Because the *SRD* and *SRR* compare the reference rate with the average rate for all the other groups for a given population characteristic, their variability is reduced in comparison with the *MRD* and *MRR*, respectively, which compare the two extreme rates (most and least favorable, or least and most adverse) (3).

*SRD* is the absolute difference and *SRR* the directional ratio between $R_{ref}$ and $R_{ave}$:

$$SRD = \left| R_{ave} - R_{ref} \right| \text{ and } SRR = \max \left\{ R_{ave} / R_{ref}, R_{ref} / R_{ave} \right\}$$

**Considerations in Disparities Measurement**

No single measure serves as the gold standard in the measurement of health disparities. Additionally, the importance of considering multiple measures and multiple types of health disparities, like absolute versus relative, between-group versus overall, and maximal versus summary measures, to provide more context for health disparities assessment is well established. Consequently, Healthy People 2030 methodology expands on Healthy People 2020 to allow for the examination of health disparities at a point in time and changes in disparities over time using all six measures above. Specifically, the between-group rate difference and summary rate difference, counterparts on an absolute scale to the between-group rate ratio and summary rate ratio on a relative scale, have been added to the suite of measures considered in 2030 compared with 2020 (so that each measure on a relative scale has a corresponding measure on an absolute scale).

The constructs used in disparities measurement in Healthy People 2030 are summarized in Table C.

## Changes in disparities over time

Changes in disparities over time in Healthy People 2030 will be assessed primarily on a relative scale to allow for direct comparisons between the multiple health disparities measures—although changes over time could be assessed on an absolute scale when only considering a single measure, such as the *SRR* in the Healthy People 2020 Final Review (17,18). Specifically, the percentage change from baseline allows for direct comparisons of the relative magnitude (and direction) of the change in disparities regardless of the measure used—for example, by calculating the percentage agreement among various overall measures of health disparities (3), such as the *MRD*, *MRR*, *SRD*, and *SRR*, which are summarized in Table C.

The percentage change from baseline in a given disparities measure *M*, for example, $RD_g$, $RR_g$, *MRD*, *MRR*, *SRD*, or *SRR*, is given by:

$$\text{Percentage change in } M \text{ from baseline} = \left[ \frac{\text{Most recent } M \text{ value}}{\text{Baseline } M \text{ value}} - 1 \right] \cdot 100$$

Disparities may be classified as "narrowing," showing "little or no detectable change," or "widening" between the baseline and most recent timepoints, depending on the magnitude of the percentage change from baseline as well as its statistical significance (when applicable) (3); see below and Table C. In Healthy People 2030, for a given disparities measure *M*, those categories of change in disparities over time are defined as in 2020:

● Disparities measure *M* is said to be *narrowing* when the percentage change in *M* from baseline is negative and statistically significant (when applicable) or when the percentage change is less than or equal to −10%.

● Disparities measure *M* is said to be showing *little or no detectable change* when the percentage change in *M* from baseline is not statistically significant or when the percentage change is between −10% and +10%.

● Disparities measure *M* is said to be *widening* when the percentage change in *M* from baseline is positive and statistically significant (when applicable) or when the percentage change is greater than or equal to +10%.

The assessment of statistical significance of the percentage change from baseline is detailed in the Appendix: Measures of Variability.

### Measurement of variability for disparities measures

To account for (a) the uncertainty in the ranking of the group rates from smallest to largest, (b) the variability in the reference group rate, and (c) the correlations among the ordered group rates, which impact the disparities measures described above, SEs and 95% confidence intervals (CIs) are derived using a resampling/bootstrap procedure, as detailed

in the Appendix: Measures of Variability. Similar procedures have been employed in Healthy People 2010 for the Index of Disparity (11), which, as mentioned previously, is a special case of the *SRR* when objectives are (re-)expressed in terms of adverse outcomes or conditions to be reduced, as well as for disparities measures used in the National Cancer Institute's *HD\*Calc* software (19–21).

# Findings

This section presents examples of the Healthy People 2030 measures of progress and disparities defined in this report, along with how these data may be analyzed and displayed in publications and/or online tools.

## Findings Related to Progress Toward Target Attainment

Table D presents examples of how progress data may be displayed for selected Healthy People 2030 objectives as of May 2024. The table displays the progress status category; the baseline, most recent, and target values; the percentage change from baseline for all objectives; the percentage of targeted change achieved for objectives that were moving toward their targets; and the statistical significance of the movement. For objectives that were moving toward or that had met or exceeded their targets at the most recent data point, the statistical significance of the movement was that of the percentage of targeted change achieved. For objectives that were moving away from their baselines and targets, the statistical significance of the movement was that of the percentage change from baseline.

The examples in Table D illustrate several scenarios.

● Reduce stroke deaths (HDS-03)—The 2022 data point moved away from the baseline and target values, with a percentage change of 6.5% from the baseline rate of 37.1 per 100,000 (age adjusted). Because the percentage change from baseline was statistically significant, the objective was designated as Getting worse.

● Increase the proportion of adults with diabetes who have a yearly eye exam (D-04)—The 2022 data point moved away from the baseline and target values, with a percentage change of −0.3% from the baseline of 64.8% (age adjusted). Because the percentage change from baseline was not statistically significant, the objective was designated as demonstrating Little or no detectable change.

● Reduce emergency department visits related to nonmedical use of prescription opioids (MPS-02)—The 2020–2021 data point exceeded the target of 3.5 per 10,000 population, with a percentage of targeted change achieved of 250.0%. Although the percentage of targeted change achieved was not statistically significant, the objective was designated as Target met or exceeded (Table B).

# Table D. Examples of progress status calculations and categories for Healthy People 2030

| Objective | Progress status category | Baseline value (year) | Most recent value (year) | Target | Percent change from baseline | Percent of targeted change achieved[1] | Movement statistically significant[2] |
|---|---|---|---|---|---|---|---|
| Reduce stroke deaths — HDS-03<br>Stroke deaths (per 100,000 population, age adjusted) | Getting worse | 37.1 (2018) | 39.5 (2022) | 33.4 | 6.5 | Not applicable | Yes |
| Increase the proportion of adults with diabetes who have a yearly eye exam — D-04<br>Annual eye examinations among adults with diagnosed diabetes (percent, age adjusted) | Little or no detectable change | 64.8 (2019) | 64.6 (2022) | 70.3 | -0.3 | Not applicable | No |
| Reduce emergency department visits related to nonmedical use of prescription opioids — MPS-02<br>Emergency department visits for harms from nonmedical use of prescription opioids (per 10,000 population) | Target met or exceeded | 3.9 (2016–2017) | 2.9 (2020–2021) | 3.5 | -25.6 | 250.0 | No |
| Reduce new cases of work-related hearing loss — OSH-06<br>New cases of occupational hearing loss (per 10,000 full-time workers) | Target met or exceeded | 1.7 (2016) | 1.4 (2019) | 1.4 | -17.6 | 100.0 | Not tested |
| Reduce the syphilis rate in men who have sex with men — STI-05<br>New cases of primary and secondary syphilis among men who have sex with men (per 100,000 men) | Improving | 419.0 (2018) | 402.0 (2020) | 392.0 | -4.06 | 63.0 | Not tested |

[1]Calculated for all objectives except in the following two scenarios: a) the objective is moving away from the baseline and target values or b) the baseline and target values for the objective are equal because the targeted change from baseline was zero. Objectives in either of these two scenarios for which percentage of targeted change achieved is not calculated are indicated as "Not applicable" in the table.

[2]Assessed at the 0.05 level using a one-sided test when measures of variability are available. Statistical significance is based on the percentage change from baseline for objectives moving away from their baseline and target values, or when the baseline and target values for the objective are equal. For all other objectives, statistical significance is based on the percentage of targeted change achieved. Objectives with data for which measures of variability were unavailable are indicated as "Not tested" in the statistical significance column.

SOURCE: National Center for Health Statistics, Healthy People 2030 database.

- Reduce new cases of work-related hearing loss (OSH-06)—The 2019 data point met the target of 1.4 per 10,000 full-time workers, with a percentage of targeted change achieved of 100.0%. Although statistical significance could not be assessed (measures of variability unavailable), the objective was designated as Target met or exceeded.

- Reduce the syphilis rate in men who have sex with men (STI-05)—The objective was moving toward its target at the 2020 data point but had not met or exceeded the target of 392.0 per 100,000 men. The percentage of targeted change achieved was 63.0% and statistical significance could not be tested due to lack of measures of variability. As a result, the objective was designated as Improving.

## Findings Related to Progress by Population Subgroups

The Table shows age-adjusted suicide rates—Healthy People 2030 objective Mental Health and Mental Disorders (MHMD)-01, a Leading Health Indicator—for the period 2018–2022 by the following race and ethnicity groups: Hispanic or Latino (subsequently, Hispanic); American Indian or Alaska Native, not Hispanic or Latino (American Indian or Alaska Native); Asian, not Hispanic or Latino (Asian); Native Hawaiian or Other Pacific Islander, not Hispanic or Latino (Native Hawaiian or Other Pacific Islander); Black or African American, not Hispanic or Latino (Black); White, not Hispanic or Latino (White); and two or more races, not Hispanic or Latino (multiracial).

All but the American Indian or Alaska Native and the White populations had already met or exceeded the Healthy People 2030 target of 12.8 suicides per 100,000 (age adjusted) at the 2018 baseline (Table). As a result, the assessment of progress toward target attainment by population subgroup does not meaningfully convey differences in how the group-specific suicide rates changed from 2018 to 2022. Instead, the percentage change from baseline in suicide rates provides a more complete comparative assessment.

The White population, historically with higher age-adjusted suicide rates than all but the American Indian or Alaska Native population, showed a percentage decrease of 2.9% (95% CI: 1.4%–4.3%) between 2018 and 2022, from 18.1 to 17.6 suicides per 100,000 (age adjusted) (Table). However, the Hispanic population, as well as the American Indian or Alaska Native, Black, and multiracial populations, showed statistically significant increases between 2018 and 2022, ranging from 8.9% (95% CI: 4.5%–13.5%) for the Hispanic population to 23.3% (95% CI: 17.4%–29.4%) for the Black population. The percentage changes between 2018 and 2022 for the remaining race and ethnicity groups were not statistically significant at the 0.05 level.

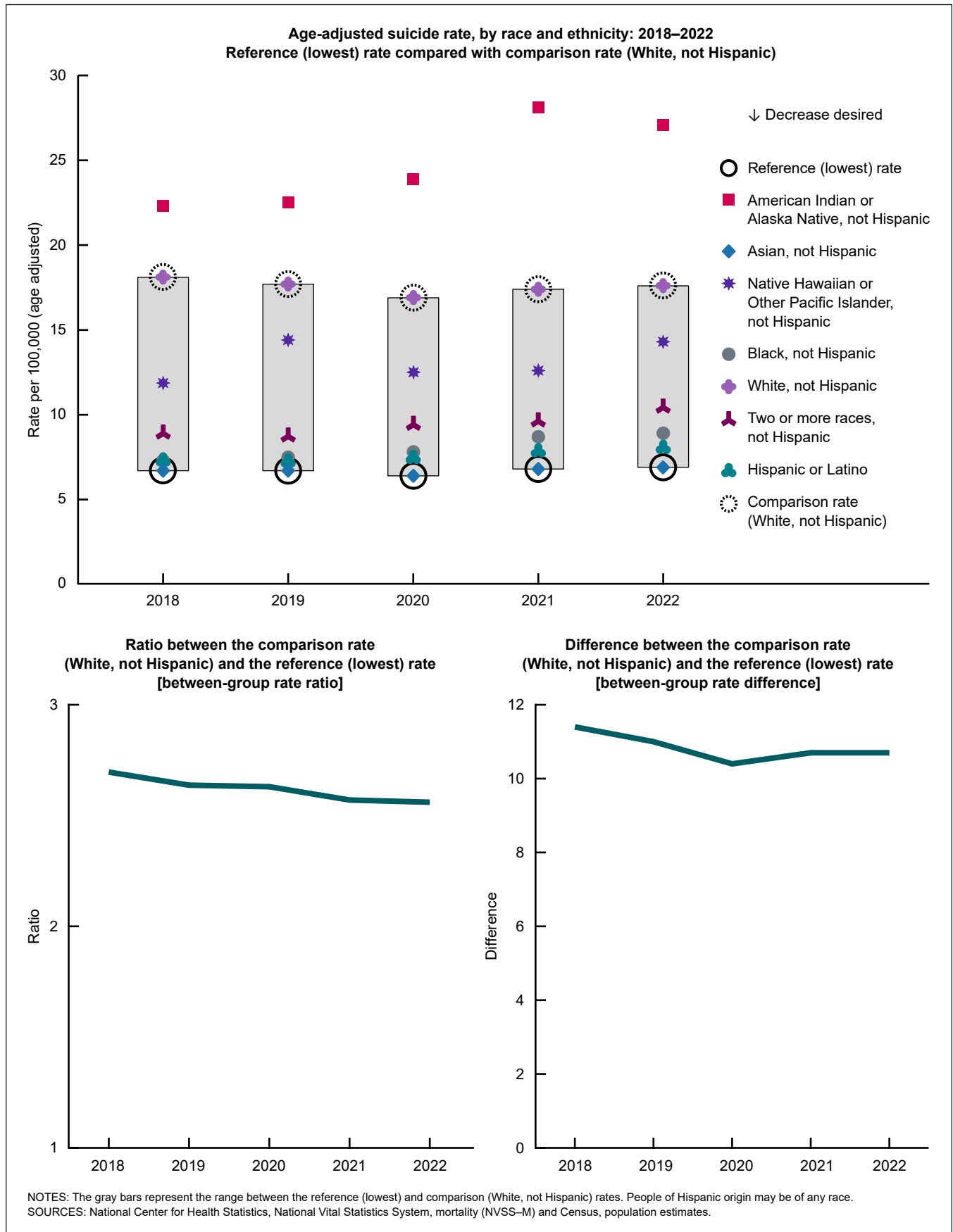## Findings Related to Disparities and Changes in Disparities Over Time

Figures 1–3 provide examples of the Healthy People 2030 disparities measures defined in this report, along with how these data may be analyzed and displayed in publications and/or online tools. Figures 1–3 show disparities in the age-adjusted suicide rates by race and ethnicity, using the data in the Table. The lowest suicide rate (reference) among the selected race and ethnicity groups was seen in the Asian population throughout 2018–2022. The top panel in Figure 1 visualizes the change over time in the gap between the reference rate and the suicide rate for the White population. The between-group disparity in suicide rates can be measured using an absolute measure, the rate difference $RD_g$ (bottom right panel in Figure 1), which decreased by 5.8% from 11.4 in 2018 to 10.7 in 2022, or a relative measure, the rate ratio $RR_g$ (bottom left panel in Figure 1), which decreased by 4.8% from 2.696 in 2018 to 2.566 in 2022 but was not statistically significant at the 0.05 level. As a result, the two between-group disparities measures lead to different classifications for the change in disparity for the White population over the 2018–2022 tracking period, with the rate difference $RD_g$ indicating a narrowing and the rate ratio $RR_g$ indicating little or no detectable change (Table C).

Figure 2 (top panel) visualizes the change over time in the gap between the highest and lowest suicide rates among the selected race and ethnicity groups. The maximal overall disparity in suicide rates can be measured using an absolute measure, the maximal rate difference $MRD$ (Figure 2, bottom right), which increased by 30.2% from 15.5 in 2018 to 20.2 in 2022, or a relative measure, the maximal rate ratio $MRR$ (Figure 2, bottom left), which increased by 19.2% from 3.315 in 2018 to 3.953 in 2022, leading to a widening of disparities for both measures.

Figure 3 (top) visualizes the change over time in the gap between the reference rate and the average suicide rate among the groups other than the group that achieved the reference rate. The summary overall disparity in suicide rates can be measured using an absolute measure, the summary rate difference $SRD$ (Figure 3, bottom right), which increased by 27.5% from 5.9 in 2018 to 7.6 in 2022, or a relative measure, the summary rate ratio $SRR$ (Figure 3, bottom left), which increased by 11.7% from 1.883 in 2018 to 2.103 in 2022, leading to a widening of disparities for both measures.

An Excel-based tool (the Health Disparities Tracking Tool) allowing users to replicate the charts shown in Figures 1–3 and calculate all disparities measures, changes in disparities over time, and bootstrapped SEs and 95% CIs, is available for download from: https://www.cdc.gov/nchs/healthy_people/hp2030/hp2030-methods.htm.

**Figure 1. Example output from the Health Disparities Tracking Tool showing between-group disparities in age-adjusted suicide rate, by race and ethnicity: 2018–2022**



NOTES: The gray bars represent the range between the reference (lowest) and comparison (White, not Hispanic) rates. People of Hispanic origin may be of any race.
SOURCES: National Center for Health Statistics, National Vital Statistics System, mortality (NVSS–M) and Census, population estimates.

**Figure 2. Example output from the Health Disparities Tracking Tool showing maximal disparities in age-adjusted suicide rate, by race and ethnicity: 2018–2022**
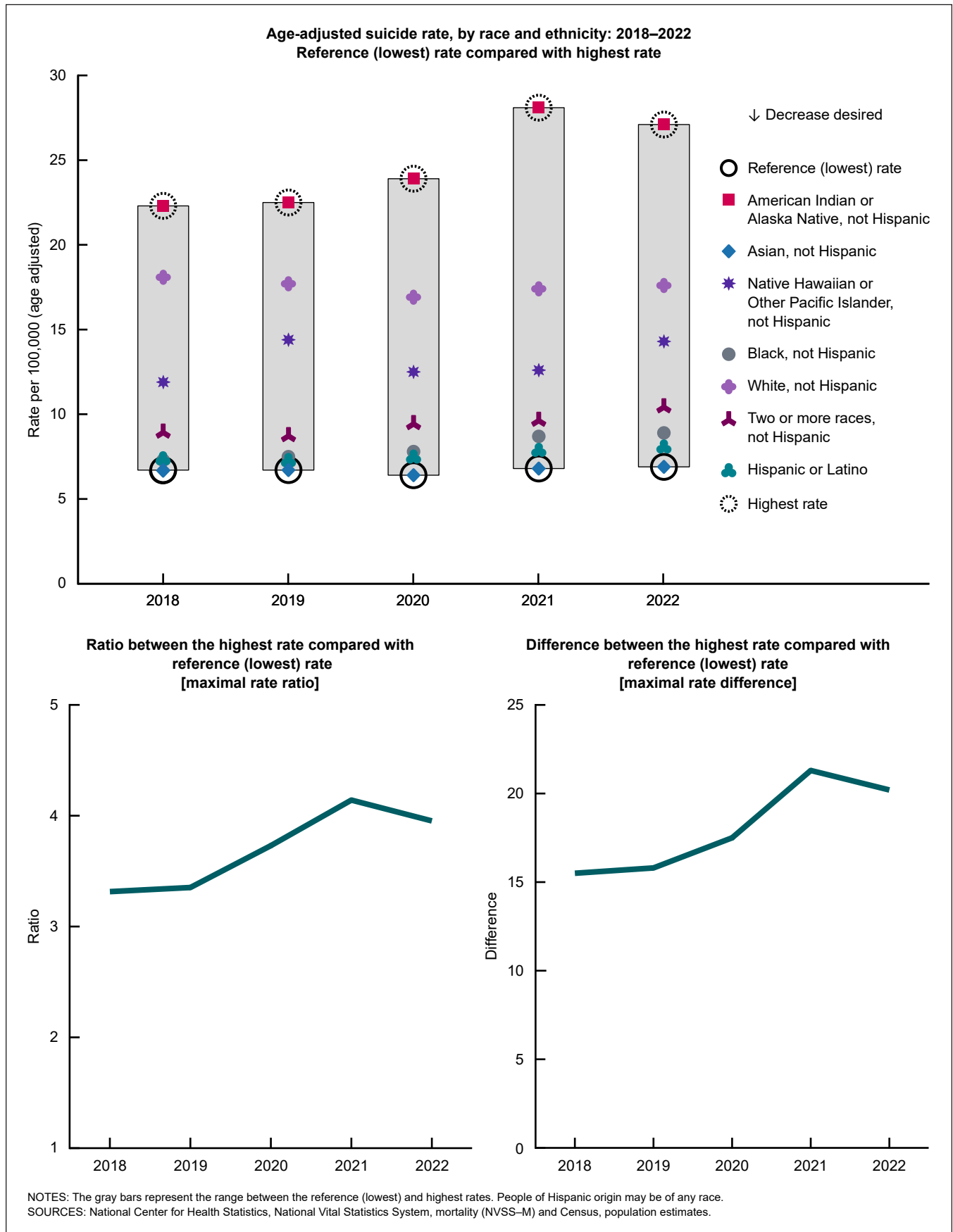
**Figure 3. Example output from the Health Disparities Tracking Tool showing summary disparities in age-adjusted suicide rate, by race and ethnicity: 2018–2022**



NOTES: The gray bars represent the range between the reference (lowest) rate and the average of the other rates. People of Hispanic origin may be of any race.
SOURCES: National Center for Health Statistics, National Vital Statistics System, mortality (NVSS–M) and Census, population estimates.
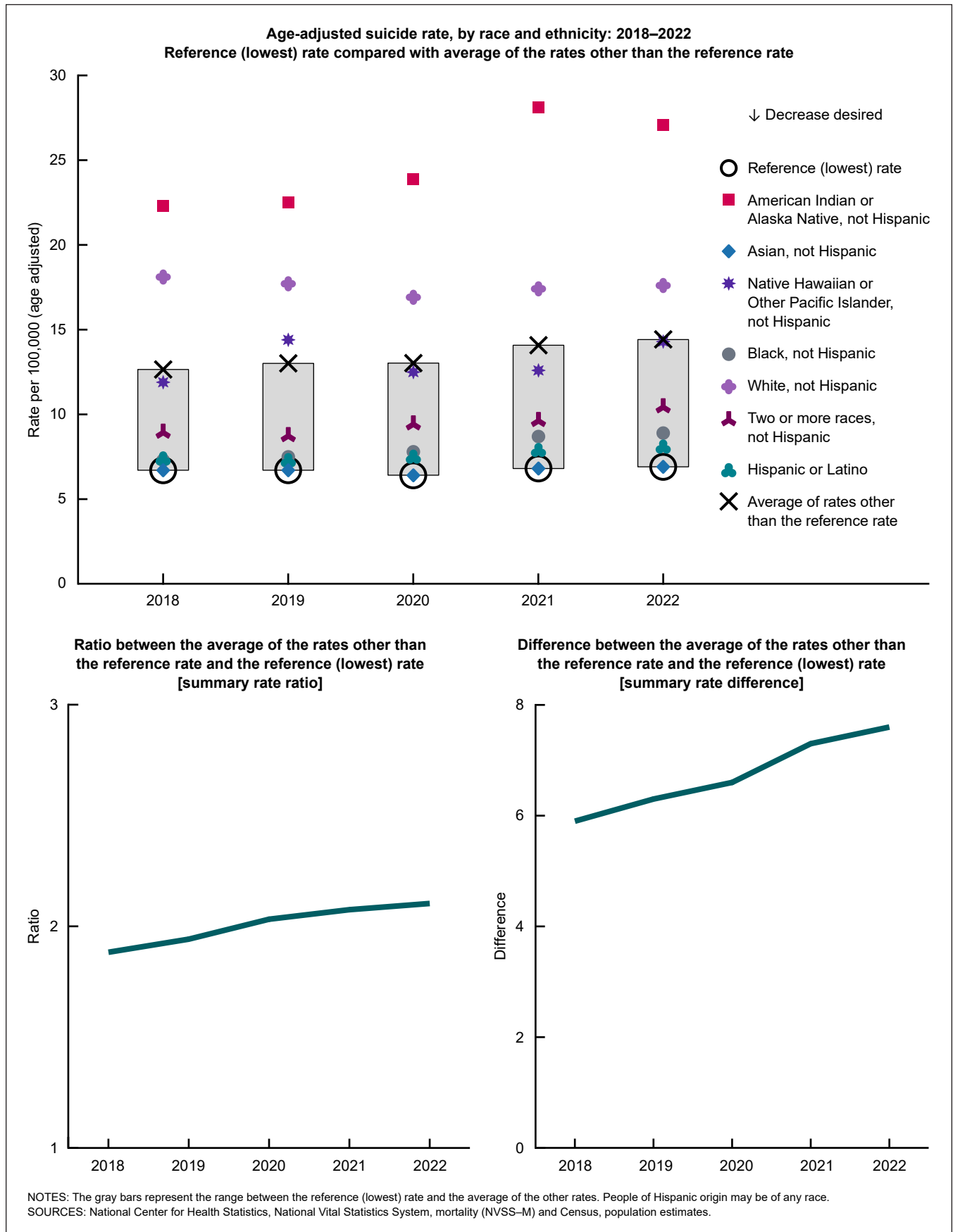
# Discussion

## Progress

Assessments of progress, whether using the percentage of targeted change achieved for objectives moving toward their targets or the percentage change from baseline for other scenarios (including objectives moving away from their baselines and targets as well as assessments of progress by population subgroups), are subject to a few considerations. In Healthy People 2020 reports, the percentage change from baseline for the total population was only calculated and presented for objectives that were moving away from their baselines and targets (2–4). Plans for Healthy People 2030 reports are yet to be determined. However, consistent with Healthy People 2020, the percentage change from baseline will not factor into the determination of the Healthy People 2030 progress status categories for objectives that are moving in the desired direction, toward their targets; see the "Determination of Healthy People 2030 status categories" section and Table B. While the percentage of targeted change achieved is the primary measure for objectives moving in the desired direction, analyses based on the percentage change from baseline allow for complementary data-driven assessments that can inform policy discussions, for example, regarding progress away from the targets or progress by population subgroups.

Also, assessments of progress in Healthy People 2030 do not consider trend data or intermediate data points. There may be situations, for example, when the target is met for a particular objective at an intermediate timepoint but not at the most recent timepoint. And trend analyses, such as analyses using the National Cancer Institute's Joinpoint software (22,23) are not currently conducted across the initiative in assessments of progress. Note that Healthy People 2030 only required assurance of three data points over the course of the decade, which limits the types of analyses that can be conducted related to progress.

Another important consideration is that the Healthy People 2030 measures for assessing progress, the percentage of targeted change achieved, and percentage change from the baseline have different denominators, as the former uses the targeted change at baseline (difference between the target and baseline values) and the latter uses only the baseline value. As a result, a 10% change from baseline (in the direction of the target), for example, is not equivalent to a 10% of targeted change achieved.

# Health Disparities

To recap, the six disparities measures used in Healthy People 2030, as summarized in Table C, are the between-group rate difference and ratio, allowing comparisons of each population subgroup to the reference rate; the maximal rate difference and ratio, which are overall measures that allow comparisons between the highest and lowest group rates for a given population characteristic; and the summary rate difference and ratio, which are overall measures that compare the reference group rate to the average rate of all other subgroups.

Using appropriate measures of disparity has recently been identified as a key principle for health equity (24). In the absence of a single gold standard measure, the three primary characteristics discussed in this report for selecting the suite of six health disparities measures for Healthy People 2030, namely, absolute versus relative, between-group versus overall, and maximal versus summary, each have pros and cons that may be considered in the selection of specific measures. Absolute measures are easier to visualize than relative measures on a linear scale, which most people are accustomed to using. However, because relative measures are unit-free, they can be used to compare objectives with different units of measure (rate per 100,000, rate per 10,000, percent, etc.). Between-group measures are useful, particularly in analyses that focus on a specific population, such as the Hispanic or Latino population, because the group of interest can be kept the same in comparisons. On the other hand, overall measures are useful for analyses of data across multiple population group rates, such as analyses across groups by educational attainment. Finally, maximal measures may be attractive for their simplicity of calculation, which only requires the two extreme group rates; however, they are also more sensitive to changes in the values used in their calculations, which are the highest and lowest group rates for a given population characteristic. Conversely, summary measures consider all the population subgroup rates for a given population characteristic, and they are less subject to variability over time, particularly for population characteristics with a larger number of groups, such as race and ethnicity, but they are more complex to calculate and understand.

Again, assessing changes in disparities over time is primarily done on a relative scale to allow for direct comparisons between multiple health disparities measures. However, analyses of changes over time could be done on an absolute scale when only considering a single measure, such as the *SRR* in the Healthy People 2020 Final Review (2).

- Healthy People 2030 adds two measures (summary rate difference and between-group rate difference) to the suite of four disparities measures used in Healthy People 2020. This expanded suite of six measures includes absolute and relative, between-group and overall, and summary and maximal measures, ensuring congruence and complementarity in the scale and scope of measures used.

- Healthy People 2030 expands the use of the "percentage change from the baseline" to all core objectives (and population subgroups), which provides advantages compared with relying primarily on the "percentage of targeted change achieved." Analyses based on the percentage change from baseline allow for the classification of objectives into data-driven categories that may inform policy discussions beyond what the percentage of targeted change achieved provides.

- Healthy People 2030 reintroduces the resampling/bootstrap procedure to estimate measures of variability (SEs and 95% CIs) for all six disparities measures. In Healthy People 2010, measures of variability for the Index of Disparity, a special case of the *SRR*, were based on the resampling/bootstrap procedure. Measures of variability for the between-group rate ratio in Healthy People 2010 and the four disparities measures in 2020 were based on analytic, formula-based approximations to their SEs. The resampling/bootstrap procedure for Healthy People 2030 accounts for the uncertainty in the ranking of the groups, the variability in the reference group rate, and the correlations among the ordered group rates, which are not accounted for in the formula-based approach.

## Conclusion

Measurement of progress toward target attainment and elimination of health disparities in Healthy People has evolved since its inception in 1979, and this report outlines the latest developments that expand and build on the work of previous decades and further addresses methodological issues and limitations previously identified. Changes for Healthy People 2030 have been implemented to:

- Enhance understanding of progress toward target attainment and elimination of health disparities by considering multiple measures (also referred to as a multipronged approach in Healthy People 2020).

- Expand the scope of disparities measures to provide a more complete picture of disparities than was previously considered.

- Improve variance estimation for disparities measures using the resampling/bootstrap procedure described in the Appendix: Measures of Variability.

- Beyond the health disparities data available on the Healthy People website, provide users with an Excel-based tool (the Health Disparities Tracking Tool) to calculate disparities from their own input data, calculate SEs and 95% CIs (when applicable), assess changes in disparities over time, and generate dot plots (equiplots) (25) and trend charts to track disparities.

In doing so, the measurement approaches outlined in this report not only build on the work of past decades, but also further advance the potential utility of Healthy People 2030 for the broader public health community.

## References

1. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Healthy People 2030 framework. 2023. Available from: https://health.gov/healthypeople/about/healthy-people-2030-framework.

2. National Center for Health Statistics. Healthy People 2020 final review. 2021. DOI: https://dx.doi.org/10.15620/cdc:111173.

3. Huang DT, Bassig BA, Hubbard K, Klein RJ, Talih M. Examining progress toward elimination of racial and ethnic health disparities for Healthy People 2020 objectives using three measures of overall disparity. National Center for Health Statistics. Vital Health Stat 2(195). 2022. DOI: https://dx.doi.org/10.15620/cdc:121266.

4. Talih M, Huang DT. Measuring progress toward target attainment and the elimination of health disparities in Healthy People 2020. Healthy People Statistical Notes, no 27. Hyattsville, MD: National Center for Health Statistics. 2016. Available from: https://www.cdc.gov/nchs/data/statnt/statnt27.pdf.

5. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. About the objectives. Available from: https://health.gov/healthypeople/objectives-and-data/about-objectives.

6. Hubbard K, Talih M, Klein RJ, Huang DT. Target-setting methods in Healthy People 2030. Healthy People Statistical Notes, no 28. Hyattsville, MD: National Center for Health Statistics. 2020. Available from: https://www.cdc.gov/nchs/data/statnt/statnt28-508.pdf.

7. Parker JD, Talih M, Malec DJ, Beresovsky V, Carroll M, Gonzalez JF Jr, et al. National Center for Health Statistics data presentation standards for proportions. National Center for Health Statistics. Vital Health Stat 2(175). 2017.

8. Parker JD, Talih M, Irimata KE, Zhang G, Branum AM, Davis D, et al. National Center for Health Statistics data presentation standards for rates and counts. National Center for Health Statistics. Vital Health Stat 2(200). 2023. DOI: https://dx.doi.org/10.15620/cdc:124368.

9. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Health equity and health disparities environmental scan. 2022.

10. Keppel K, Pamuk E, Lynch J, Carter-Pokras O, Kim I, Mays V, et al. Methodological issues in measuring health disparities. National Center for Health Statistics. Vital Health Stat 2(141). 2005.

11. National Center for Health Statistics. Appendix A: Technical appendix. Healthy People 2010 final review. 2011.

12. Keppel K, Garcia T, Hallquist S, Ryskulova A, Agress L. Comparing racial and ethnic populations based on Healthy People 2010 objectives. Healthy People Statistical Notes, no 26. Hyattsville, MD: National Center for Health Statistics. 2008. Available from: https://www.cdc.gov/nchs/data/statnt/statnt26.pdf.

13. National Center for Health Statistics. Healthy People 2020 progress by population group. Healthy People 2020 final review. 2021. DOI: https://dx.doi.org/10.15620/cdc:111173.

14. Harper S, King NB, Meersman SC, Reichman ME, Breen N, Lynch J. Implicit value judgments in the measurement of health inequalities. Milbank Q 88(1):4-29. 2010.

15. Penman-Aguilar A, Talih M, Huang D, Moonesinghe R, Bouye K, Beckles G. Measurement of health disparities, health inequities, and social determinants of health to support the advancement of health equity. J Public Health Manag Pract 22(Suppl 1):S33–S42. 2016.

16. Asada Y. On the choice of absolute or relative inequality measures. Milbank Q 88(4):616–22. 2010.

17. National Center for Health Statistics. Healthy People 2020 overview of health disparities. Healthy People 2020 final review. 2021. DOI: https://dx.doi.org/10.15620/cdc:111173.

18. National Center for Health Statistics. Healthy People 2020 progress table. Healthy People 2020 final review. 2021. DOI: https://dx.doi.org/10.15620/cdc:111173.

19. Ahn J, Harper S, Yu M, Feuer EJ, Liu B. Improved Monte Carlo methods for estimating confidence intervals for eleven commonly used health disparity measures. PLoS One 14(7):e0219542. 2019. DOI: https://dx.doi.org/10.1371/journal.pone.0219542.

20. National Cancer Institute. Health disparities calculator version 3.0.0. Bethesda, MD. Available from: https://seer.cancer.gov/hdcalc/.

21. Breen N, Scott S, Percy-Laurry A, Lewis D, Glasgow R. Health disparities calculator: A methodologically rigorous tool for analyzing inequalities in population health. Am J Public Health 104(9):1589–91. 2014.

22. National Cancer Institute. Joinpoint Regression Program, Version 5.0.2. 2023.

23. Kim HJ, Fay MP, Feuer EJ, Midthune DN. Permutation tests for joinpoint regression with applications to cancer rates. Stat Med 19(3):335–51. 2000.

24. Burton DC, Kelly A, Cardo D, Daskalakis D, Huang DT, Penman-Aguilar A, et al. Principles of health equity science for public health action. Public Health Rep 139(3):277–83. 2024. DOI: https://dx.doi.org/10.1177/00333549231213162.

25. The International Center for Equity in Health. Equiplot. Available from: https://www.equidade.org/equiplot.

26. Casella G, Berger R. Statistical inference. Boca Raton, FL: CRC Press. 2024.

27. DiCiccio TJ, Efron B. Bootstrap confidence intervals. Stat Sci 11(3):189–228. 1996.

28. Tukey JW. Exploratory data analysis. Vol 2. Reading, MA: Springer. 1977.

**Table. Age-adjusted suicide rate for selected race and ethnicity groups, 2018–2022**

| Race and ethnicity | 2018 (baseline) | | 2019 | | 2020 | | 2021 | | 2022 | | Percentage change from 2018 to 2022 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | 95% confidence interval[2] | |
| | Rate per 100,000 | Standard error | Rate per 100,000 | Standard error | Rate per 100,000 | Standard error | Rate per 100,000 | Standard error | Rate per 100,000 | Standard error | Percent | Standard error[1] | Lower limit | Upper limit |
| Hispanic or Latino . . . . . . . . . . . . . . . | 7.4 | 0.116 | 7.3 | 0.113 | 7.5 | 0.114 | 7.9 | 0.115 | 8.1 | 0.116 | 8.9 | 2.212 | 4.5 | 13.5 |
| American Indian or Alaska Native, not Hispanic or Latino . . . . . . . . . . . . . . | 22.3 | 0.970 | 22.5 | 0.976 | 23.9 | 1.002 | 28.1 | 1.085 | 27.1 | 1.078 | 21.7 | 6.581 | 8.4 | 36.6 |
| Asian, not Hispanic or Latino . . . . . . . | 6.7 | 0.187 | 6.7 | 0.185 | 6.4 | 0.180 | 6.8 | 0.185 | 6.9 | 0.181 | 2.1 | 3.879 | -5.3 | 10.0 |
| Native Hawaiian or Other Pacific Islander, not Hispanic or Latino . . . . | 11.9 | 1.409 | 14.4 | 1.536 | 12.5 | 1.420 | 12.6 | 1.401 | 14.3 | 1.473 | 20.3 | 17.343 | -11.6 | 63.7 |
| Black or African American, not Hispanic or Latino . . . . . . . . . . . . . . | 7.3 | 0.134 | 7.5 | 0.136 | 7.8 | 0.138 | 8.7 | 0.146 | 8.9 | 0.146 | 23.3 | 2.770 | 17.4 | 29.4 |
| White, not Hispanic or Latino. . . . . . . | 18.1 | 0.097 | 17.7 | 0.096 | 16.9 | 0.094 | 17.4 | 0.096 | 17.6 | 0.096 | -2.9 | 0.752 | -4.3 | -1.4 |
| Two or more races, not Hispanic or Latino . . . . . . . . . . . . . . . . . . . . . . . | 9.0 | 0.429 | 8.8 | 0.417 | 9.6 | 0.424 | 9.7 | 0.421 | 10.5 | 0.435 | 17.1 | 6.873 | 3.5 | 32.6 |

[1]Calculated using formula 1 in the Appendix: Measures of Variability.
[2]Calculated using an asymmetric lognormal confidence interval for the ratio, $100 \cdot \left\{ \exp\left[ \ln\left(m_t/m_0\right) \pm 1.959964 \cdot SE_{\ln\left(m_t/m_0\right)} \right] - 1 \right\}$, where the standard error of the logarithm of the ratio is calculated using formula 3 in the Appendix: Measures of Variability.

NOTES: People of Hispanic origin may be of any race. Mortality rates are based on single-race estimates by selected race (American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, White, two or more races) and ethnicity (Hispanic or Latino, not Hispanic or Latino) population groups with underlying cause of death ICD–10 codes *U03, X60–X84, and Y87.0, and are age adjusted to the year 2000 standard population.

SOURCES: National Center for Health Statistics, National Vital Statistics System, mortality (NVSS–M) and Census, population estimates.

# Appendix: Measures of Variability

## Standard Error and Statistical Significance of the Percentage Change From Baseline

Let $m_t$ denote the most recent value and $m_0$ the baseline value for a given rate or measure $M$. Using this notation, the percentage change from baseline is given by:

$$100 \cdot \frac{m_t - m_0}{m_0}$$

In Healthy People 2020, the standard error (SE) of the percentage change from baseline, used to assess statistical significance of movement for objectives that are moving away from their baselines and targets (4), is derived using the following approximation:

$$SE\left(\frac{m_t - m_0}{m_0}\right) = \frac{|m_t - m_0|}{m_0} \sqrt{\frac{SE^2(m_t) + SE^2(m_0)}{(m_t - m_0)^2} + \frac{SE^2(m_0)}{m_0^2}} \quad [1]$$

A closely related approximation, derived from observing that the SE of $(m_t - m_0)/m_0$ is the same as the SE of $m_t/m_0$, is the following:

$$SE\left(\frac{m_t}{m_0}\right) = \left(\frac{m_t}{m_0}\right) \sqrt{\frac{SE^2(m_t)}{m_t^2} + \frac{SE^2(m_0)}{m_0^2}} \quad [2]$$

Using the logarithmic transformation allows correction for potential lack of normality in the underlying measure and results in the following approximation:

$$SE\left(\ln\left[\frac{m_t}{m_0}\right]\right) = \frac{SE(m_t/m_0)}{m_t/m_0} = \sqrt{\frac{SE^2(m_t)}{m_t^2} + \frac{SE^2(m_0)}{m_0^2}} \quad [3]$$

The significance of the percentage change from baseline can be evaluated by testing the null hypothesis that

$$\frac{m_t - m_0}{m_0} = 0, \text{that } \frac{m_t}{m_0} = 1, \text{ or that } \ln\left[\frac{m_t}{m_0}\right] = 0.$$

The resulting test statistics are:

$$z_1 = \frac{\text{sgn}(m_t - m_0)}{\sqrt{\dfrac{SE^2(m_t) + SE^2(m_0)}{(m_t - m_0)^2} + \dfrac{SE^2(m_0)}{m_0^2}}}$$

$$z_2 = \frac{1 - (m_0/m_t)}{\sqrt{\dfrac{SE^2(m_t)}{m_t^2} + \dfrac{SE^2(m_0)}{m_0^2}}}$$

$$z_3 = \frac{\ln[m_t/m_0]}{\sqrt{\dfrac{SE^2(m_t)}{m_t^2} + \dfrac{SE^2(m_0)}{m_0^2}}}$$

respectively, where $\text{sgn}(m_t - m_0) = +1$ when $m_t > m_0$, 0 when $m_t = m_0$, and −1 when $m_t < m_0$.

Those three test statistics are such that $z_2 \leq z_1$ and $z_2 \leq z_3$. As a result, when compared with the critical value 1.959964, say, to assess significance at the 0.05 level of an increase from baseline ($m_t > m_0$), significance based on $z_2 > 1.959964$ also implies significance based on $z_1 > 1.959964$ and $z_3 > 1.959964$, whereas $z_2 \leq 1.959964$ fails to reject the null hypothesis in cases where either $z_1 > 1.959964$ or $z_3 > 1.959964$ (or both) can be true. As a result, a significance test based on $z_1$ or $z_3$ is more powerful (more likely to reject the null hypothesis that the percentage change is zero when it truly is nonzero) than one based on $z_2$ for assessing increase from baseline (Figure) (26). Additionally, as seen in the graph for the range -10 to 10 in the Figure, a test based on $z_2$ is more biased than a test based on either $z_1$ or $z_3$, in that the probability of rejecting the null hypothesis when the percentage increase is larger than zero but less than five drops below the 0.05 significance level of the test, meaning that it would be more likely to reject the null when it is true than when it is false in those cases, which is suboptimal.
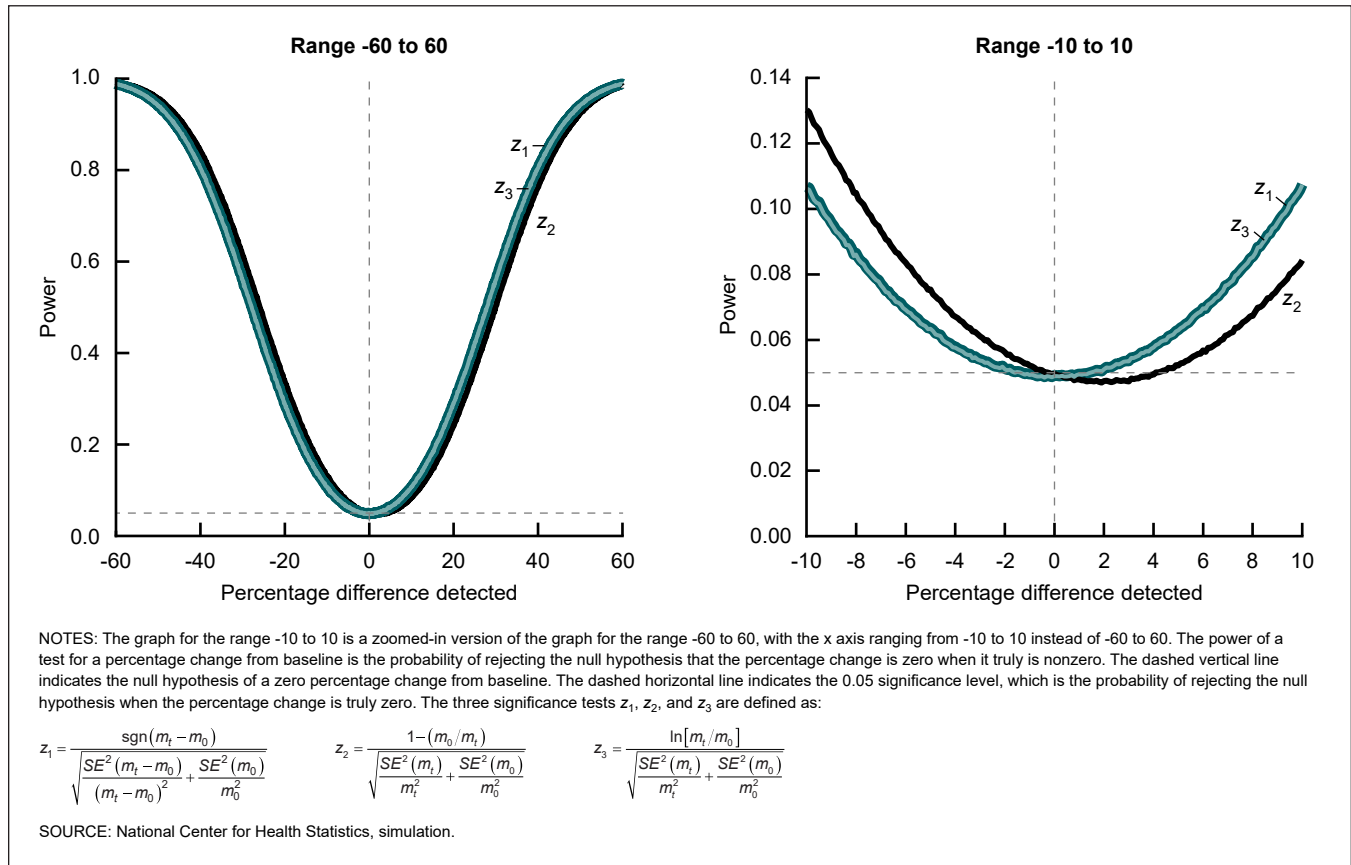
Unlike the $z_2$-based test, tests based on $z_1$ and $z_3$ also have symmetric power functions around the null hypothesis of a zero percent change, meaning that they are equally powerful in detecting, say either a 10% increase or a 10% decrease from baseline. Additionally, for all practical purposes, the latter appear to be equivalent, as seen in the overlapping power functions in the Figure. As a result, either could be used for statistical testing in Healthy People 2030, without any practical drawback of using one versus the other. Still, because it remains more convenient to describe change over time in the underlying rate using the percentage change from baseline, significance testing in Healthy People 2030 for the percentage change from baseline is based on the two-sided test for $z_1$, namely $z_1 > 1.959964$ or $z_1 < -1.959964$.

For objectives that are moving away from their baselines and targets, significance is based on the one-sided test of the magnitude $|z_1|$ of $z_1$, namely $|z_1| > 1.644854$, and is used to determine the GETTING WORSE or LITTLE OR NO DETECTABLE CHANGE categories (4).

On the other hand, for assessing changes in disparities over time, the percentage change from baseline in measure $M$ is more readily expressed in terms of the ratio $m_t/m_0$, because $m_t$ and $m_0$ are themselves differences ($RD_g$, $MRD$, $SRD$) or

**Figure. Power to detect nonzero percentage differences from baseline for three significance tests of the percentage change from baseline**



NOTES: The graph for the range -10 to 10 is a zoomed-in version of the graph for the range -60 to 60, with the x axis ranging from -10 to 10 instead of -60 to 60. The power of a test for a percentage change from baseline is the probability of rejecting the null hypothesis that the percentage change is zero when it truly is nonzero. The dashed vertical line indicates the null hypothesis of a zero percentage change from baseline. The dashed horizontal line indicates the 0.05 significance level, which is the probability of rejecting the null hypothesis when the percentage change is truly zero. The three significance tests $z_1$, $z_2$, and $z_3$ are defined as:

$$z_1 = \frac{\text{sgn}(m_t - m_0)}{\sqrt{\frac{SE^2(m_t - m_0)}{(m_t - m_0)^2} + \frac{SE^2(m_0)}{m_0^2}}} \qquad z_2 = \frac{1 - (m_0/m_t)}{\sqrt{\frac{SE^2(m_t)}{m_t^2} + \frac{SE^2(m_0)}{m_0^2}}} \qquad z_3 = \frac{\ln[m_t/m_0]}{\sqrt{\frac{SE^2(m_t)}{m_t^2} + \frac{SE^2(m_0)}{m_0^2}}}$$

SOURCE: National Center for Health Statistics, simulation.

ratios ($RR_g$, $MRR$, $SRR$) in the underlying group rates; as a result, significance testing for changes in disparities over time is based on the two-sided test for $z_3$, namely $z_3 < -1.959964$ or $z_3 > 1.959964$ (3).

## Confidence Intervals for the Percentage Change From Baseline

Any of the SE approximations in formulas 1–3 above could be used to construct a 95% confidence interval (CI) for the percentage change from baseline. For consistency with the use of $z_1$ or $z_3$ for significance testing, as described above, a symmetric (Wald) CI can be obtained from equation 1 as follows:

$$100 \cdot \left\{ \left( \frac{m_t - m_0}{m_0} \right) \pm 1.959964 \cdot SE \left( \frac{m_t - m_0}{m_0} \right) \right\}$$

whereas an asymmetric (lognormal) CI can be obtained from equation 3 as follows:

$$100 \cdot \left\{ \exp \left[ \ln \left( \frac{m_t}{m_0} \right) \pm 1.959964 \cdot SE \left( \ln \left( \frac{m_t}{m_0} \right) \right) \right] - 1 \right\}$$

## Standard Error and Statistical Significance of the Percentage of Targeted Change Achieved

Using the notation from the previous section, the percentage of targeted change achieved is:

$$100 \cdot \frac{m_t - m_0}{m_T - m_0}$$

where $m_T$ denotes the Healthy People 2030 target. The SE of the percentage of targeted change achieved, used to assess statistical significance of movement for objectives that are moving toward their targets (4), is derived using the following approximation:

$$SE \left( \frac{m_t - m_0}{m_T - m_0} \right) = \left| \frac{m_t - m_0}{m_T - m_0} \right| \sqrt{\frac{SE^2(m_t) + SE^2(m_0)}{(m_t - m_0)^2} + \frac{SE^2(m_0)}{(m_T - m_0)^2}}$$

For objectives that are moving toward their targets, the significance of the percentage of targeted change achieved can be evaluated by testing the null hypothesis that

$$\frac{m_t - m_0}{m_T - m_0} = 0$$

against the one-sided alternative

$$\frac{m_t - m_0}{m_T - m_0} > 0.$$

The resulting test statistic is:

$$z_4 = \frac{1}{\sqrt{\dfrac{SE^2(m_t) + SE^2(m_0)}{(m_t - m_0)^2} + \dfrac{SE^2(m_0)}{(m_T - m_0)^2}}}$$

Values of $z_4 > 1.644854$ determine the IMPROVING category, whereas values of $z_4$ such that $0 \leq z_4 \leq 1.644854$ determine the LITTLE OR NO DETECTABLE CHANGE category (4).

# Computation of Standard Errors and Confidence Intervals for Disparities Measures

In contrast with Healthy People 2020 (4), where SEs were calculated using formula-based approximations that assumed independence between the groups and CIs were Wald CIs (of the form Estimate $\pm$ 1.959964 • SE), SEs and CIs for all six disparities measures in Table C are evaluated using a resampling/bootstrap procedure, to better account for the uncertainty in the ranking of the groups from smallest to largest, the variability in the reference group rate, and the correlations among the ordered group rates $R_{(1)} \leq R_{(2)} \leq \ldots \leq R_{(K)}$.

The resampling/bootstrap procedure uses the rate and SE for each population subgroup to randomly draw each group rate 25,000 times according to a normal distribution, truncated to ensure resampled values remain in the desired range (for example, 0–100 for percentages). Based on each set of simulated group rates, 25,000 estimates of the relative rankings as well as the reference rate and each of the six disparities measures are generated. Subsequently, the frequency distribution of these estimates is used to estimate the empirical SEs and 95% CIs. For the CIs, the lower and upper limits are set to the corresponding 2.5th and 97.5th percentiles (27). For the SE, the interquartile range (75th percentile minus 25th percentile) is divided by 1.349 to provide a robust estimate that is less sensitive than the average squared deviation from the sample mean to aberrant random draws (28). Similar procedures have been employed in Healthy People 2010 for the Index of Disparity (11), a special case of the *SRR*, as well as for disparities measures used in the National Cancer Institute's *HD\*Calc* software (19,20).

## Statistical Significance Testing for Disparities Measures

As in Healthy People 2020, statistical significance of disparities measures in Healthy People 2030 is based on one-sided tests. For the between-group rate difference,

maximal rate difference, and summary rate difference, the statistic for testing the null hypothesis that the difference is zero versus the alternative hypothesis that it is positive is $z = \text{difference}/SE_{\text{difference}}$, which is compared with the normal critical value 1.644854 to determine significance at the 0.05 level. For the between-group rate ratio, maximal rate ratio, and summary rate ratio, which are such that their numerators are larger than their denominators, the statistic for testing that the ratio is one versus the alternative that it is larger than one is $z = \ln(\text{ratio})/SE_{\ln(\text{ratio})}$, where the natural logarithm $\ln(\text{ratio}) = 0$ if and only if ratio = 1. The standard errors $SE_{\text{difference}}$ and $SE_{\ln(\text{ratio})}$ are obtained from the resampling/bootstrap procedures described previously.

Note that the bootstrapped SE for the reference rate will differ from the SE for the rate of the group that was identified as the reference group. Similarly, the bootstrapped SEs for the lowest and highest rates will differ from the SEs for the rates of the groups that achieved the lowest and highest rates, respectively. As a result, the use of resampling/bootstrap to assess the variability and statistical significance of the Healthy People 2030 disparities measures may lead to seemingly contradictory findings if not interpreted with care.

For example, suppose group A, identified as achieving the lowest rate for a given objective, has a rate of 39.0% with $SE = 3.000$, whereas group C, identified as achieving the highest rate, has a rate of 46.5 with $SE = 6.000$. Assuming a decrease is desired for this objective, the lowest rate attained by group A is the reference rate, and the between-group difference between groups C and A is 7.5 percentage points. The SE of the difference is approximately 6.708, whether calculated using the bootstrap- or the formula-based approach (namely, $\sqrt{3.000^2 + 6.000^2} = \sqrt{45}$), and, therefore, the difference is not statistically significant ($z$ score is approximately 7.5/6.708 = 1.118 < 1.644854). However, if one were to take into account an intermediate rate between the lowest and highest, then the maximal rate difference, which remains 7.5 percentage points, may very well become statistically significant if its bootstrap-based SE is small enough, say 4.500 ($z$ score is 7.5/4.500 = 1.667 > 1.644854). This situation could occur in a bootstrap sample when the intermediate rate was statistically near the highest rate (say, group B has rate 45.5 and $SE = 2.000$), reducing the uncertainty regarding the highest rate being 46.5, regardless of which group achieved it. (In this scenario, the bootstrap-based SE for the highest rate would be approximately 3.570 instead of 6.000.)

An Excel-based tool (the Health Disparities Tracking Tool) illustrating the Healthy People 2030 methodology for estimating SEs and CIs and statistical significance testing, and allowing users to replicate the methodology and examples shown in this report is available for download from: https://www.cdc.gov/nchs/healthy_people/hp2030/hp2030-methods.htm.

# Vital and Health Statistics Series Descriptions

## Active Series

**Series 1. Programs and Collection Procedures**
Reports describe the programs and data systems of the National Center for Health Statistics, and the data collection and survey methods used. Series 1 reports also include definitions, survey design, estimation, and other material necessary for understanding and analyzing the data.

**Series 2. Data Evaluation and Methods Research**
Reports present new statistical methodology including experimental tests of new survey methods, studies of vital and health statistics collection methods, new analytical techniques, objective evaluations of reliability of collected data, and contributions to statistical theory. Reports also include comparison of U.S. methodology with those of other countries.

**Series 3. Analytical and Epidemiological Studies**
Reports present data analyses, epidemiological studies, and descriptive statistics based on national surveys and data systems. As of 2015, Series 3 includes reports that would have previously been published in Series 5, 10–15, and 20–23.

## Discontinued Series

**Series 4. Documents and Committee Reports**
Reports contain findings of major committees concerned with vital and health statistics and documents. The last Series 4 report was published in 2002; these are now included in Series 2 or another appropriate series.

**Series 5. International Vital and Health Statistics Reports**
Reports present analytical and descriptive comparisons of U.S. vital and health statistics with those of other countries. The last Series 5 report was published in 2003; these are now included in Series 3 or another appropriate series.

**Series 6. Cognition and Survey Measurement**
Reports use methods of cognitive science to design, evaluate, and test survey instruments. The last Series 6 report was published in 1999; these are now included in Series 2.

**Series 10. Data From the National Health Interview Survey**
Reports present statistics on illness; accidental injuries; disability; use of hospital, medical, dental, and other services; and other health-related topics. As of 2015, these are included in Series 3.

**Series 11. Data From the National Health Examination Survey, the National Health and Nutrition Examination Surveys, and the Hispanic Health and Nutrition Examination Survey**
Reports present 1) estimates of the medically defined prevalence of specific diseases in the United States and the distribution of the population with respect to physical, physiological, and psychological characteristics and 2) analysis of relationships among the various measurements. As of 2015, these are included in Series 3.

**Series 12. Data From the Institutionalized Population Surveys**
The last Series 12 report was published in 1974; these reports were included in Series 13, and as of 2015 are in Series 3.

**Series 13. Data From the National Health Care Survey**
Reports present statistics on health resources and use of health care resources based on data collected from health care providers and provider records. As of 2015, these reports are included in Series 3.

**Series 14. Data on Health Resources: Manpower and Facilities**
The last Series 14 report was published in 1989; these reports were included in Series 13, and are now included in Series 3.

**Series 15. Data From Special Surveys**
Reports contain statistics on health and health-related topics from surveys that are not a part of the continuing data systems of the National Center for Health Statistics. The last Series 15 report was published in 2002; these reports are now included in Series 3.

**Series 16. Compilations of Advance Data From Vital and Health Statistics**
The last Series 16 report was published in 1996. All reports are available online; compilations are no longer needed.

**Series 20. Data on Mortality**
Reports include analyses by cause of death and demographic variables, and geographic and trend analyses. The last Series 20 report was published in 2007; these reports are now included in Series 3.

**Series 21. Data on Natality, Marriage, and Divorce**
Reports include analyses by health and demographic variables, and geographic and trend analyses. The last Series 21 report was published in 2006; these reports are now included in Series 3.

**Series 22. Data From the National Mortality and Natality Surveys**
The last Series 22 report was published in 1973. Reports from sample surveys of vital records were included in Series 20 or 21, and are now included in Series 3.

**Series 23. Data From the National Survey of Family Growth**
Reports contain statistics on factors that affect birth rates, factors affecting the formation and dissolution of families, and behavior related to the risk of HIV and other sexually transmitted diseases. The last Series 23 report was published in 2011; these reports are now included in Series 3.

**Series 24. Compilations of Data on Natality, Mortality, Marriage, and Divorce**
The last Series 24 report was published in 1996. All reports are available online; compilations are no longer needed.

For more NCHS Series Reports, visit:
https://www.cdc.gov/nchs/products/series.htm