

2019 NATIONAL HEALTHCARE QUALITY & DISPARITIES REPORT

Introduction and Methods



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Suggested citation: National Healthcare Quality and Disparities Report Introduction and Methods. Rockville, MD: Agency for Healthcare Research and Quality; December 2020. AHRQ Publication No.20(21)-0045-EF.

2019 National Healthcare Quality and Disparities Report Introduction and Methods

DEPARTMENT OF HEALTH AND HUMAN SERVICES
AGENCY FOR HEALTHCARE RESEARCH AND QUALITY
5600 Fishers Lane Rockville, MD 20857
www.ahrq.gov

AHRQ Publication No. 20(21)-0045-EF
December 2020



ACKNOWLEDGMENTS

The National Healthcare Quality and Disparities Report (NHQDR) is the product of collaboration among agencies from the U.S. Department of Health and Human Services (HHS), other federal departments, and the private sector. Many individuals guided and contributed to this effort. Without their magnanimous support, the report would not have been possible. Specifically, we thank:

Primary AHRQ Staff: Gopal Khanna, David Meyers, Virginia Mackay-Smith, Jeff Brady, Erin Grace, Karen Chaves, Darryl Gray, Barbara Barton, Doreen Bonnett, Irim Azam, and Cecilia Hahn.

HHS Interagency Workgroup (IWG) for the NHQDR: Girma Alemu (HRSA), Irim Azam (AHRQ), Andreea Balan-Cohen (IMPAQ), Barbara Barton (AHRQ), Doreen Bonnett (AHRQ), Deron Burton (CDC), Victoria Chau (SAMHSA), Karen Chaves (AHRQ), Xiuhua Chen (Atlas Research), Deborah Duran (NIH-NIMHD), Melissa Evans (CMS), Camille Fabiyi (AHRQ), Paul Gorrell (Atlas Research), Darryl Gray (AHRQ), Kirk Greenway (IHS), Sarah Heppner (HRSA), Ed Huff (CMS), DeLoris Hunter (NIH-NIMHD), Susan Jenkins (ACL), Christine Lee (FDA), Doris Lefkowitz (AHRQ), Jesse Lichstein (HRSA), Lan Liang (AHRQ), Shari Ling (CMS), Iris Mabry-Hernandez (AHRQ), Marlene Matosky (HRSA), Tracy Matthews (HRSA), Christine Merenda (FDA), Kamila Mistry (AHRQ), Ernest Moy (VHA), Samia Noursi (NIH-NIDA), Kathy O'Connor (CDC), Rajasri Roy (NIH-OD-ORWH), Dianne Rucinski (OASH), Asel Ryskulova (CDC), Adelle Simmons (ASPE), Robin Streeter (HRSA), Loida Tamayo (CMS), Caroline Taplin (ASPE), Emmanuel Taylor (NIH-NCI), Michelle Washko (HRSA), and Ying Zhang (IHS).

IWG Subgroup – Access to Care: Karen Chaves (Chair), Girma Alemu (HRSA), Robin Cohen (CDC), Kirk Greenway (IHS), Lan Liang (AHRQ), Pradip Muhuri (AHRQ), Barbara Barton (AHRQ).

NHQDR Team: Irim Azam (CQuIPS), Barbara Barton (CQuIPS), Doreen Bonnett (OC), Xiuhua Chen (Atlas Research), James Cleeman (CQuIPS), Noel Eldridge (CQuIPS), Camille Fabiyi (OEREP), Paul Gorrell (Atlas Research), Erin Grace (CQuIPS), Darryl Gray (CQuIPS), Lan Liang (CFAC), Kamila Mistry (OEREP), Margie Shofer (CQuIPS).

HHS Data Experts: Cuong Bui (HRSA), Lara Bull (CDC), Robin Cohen (CDC-NCHS), Joann Fitzell (CMS), Elizabeth Goldstein (CMS), Irene Hall (CDC-HIV), Norma Harris (CDC-HIV), Pradip Muhuri (AHRQ), Jessica King (NPCR), Amanda Lankford (CDC), Denys Lau (CDC-NCHS), Lan Liang (AHRQ), Sharon Liu (SAMHSA), Marlene Matosky (HRSA), Tracy Matthews (HRSA), Robert Morgan (CMS), Richard Moser (NIH-NCI), Kathy O'Connor (CDC-NCHS), Robert Pratt (CDC), Neil Russell (SAMHSA), Asel Ryskulova (CDC-NCHS), Alek Sripipatana (HRSA), Reda Wilson (CDC- NCCDPHP-ONDIEH), Emily Zammitti (CDC-NCHS), and Xiaohong (Julia) Zhu (HRSA).

Other Data Experts: Mark Cohen (ACS NSQIP), Ashley Eckard (University of Michigan), Sheila Eckenrode (MPSMS-Qualidigm), Michael Halpern (American Cancer Society), Clifford Ko (ACS NSQIP), Vivian Kurtz (University of Michigan), Robin Padilla (University of Michigan KECC), Bryan Palis (NCDB, American College of Surgeons), and Yun Wang (MPSMS-Qualidigm).

Other AHRQ Contributors: Cindy Brach, Edwin Lomotan, Karen Migdail, Pamela Owens, Wendy Perry, Mary Rolston, Bruce Seeman, Randie Siegel, and Michele Valentine.

Data Support Contractors: Atlas Research, IMPAQ International.

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INTRODUCTION AND METHODS

This **Introduction and Methods** document provides background on the annual *National Healthcare Quality and Disparities Report* (NHQDR) and modifications that have occurred over time. This document includes an overview of the methods used to generate estimates, measure trends, and examine disparities.

Background on the National Healthcare Quality and Disparities Report and Related Chartbooks

For the 17th year in a row, the Agency for Healthcare Research and Quality (AHRQ) has reported on progress and opportunities for improving healthcare quality and reducing healthcare disparities. As mandated by the U.S. Congress, the report focuses on “national trends in the quality of health care provided to the American people” (42 U.S.C. 299b-2(b)(2)) and “prevailing disparities in health care delivery as it relates to racial factors and socioeconomic factors in priority populations” (42 U.S.C. 299a1(a)(6)).

The NHQDR is produced with the support of a Department of Health and Human Services (HHS) Interagency Work Group (IWG)ⁱ and guided by input from AHRQ’s National Advisory Council and the Institute of Medicine (IOM), now known as the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine.

The 2019 report tracks about 250 healthcare process, outcome, and access measures, covering a wide variety of conditions and settings. Data years vary across measures; most trend analyses include data points from 2000-2002 to 2013-2018. An exception is rates of uninsurance, which are reported through 2019.

Measures used in the NHQDR fall into two categories:

- Core measures are used in the main NHQDR, or “core report.” These summarize the status of overall quality, status of disparities, and trends in quality and disparities. Core measures are approved by the IWG for inclusion and are

ⁱ Federal participants on IWG: AHRQ, Administration for Children and Families, Administration for Community Living, Assistant Secretary for Planning and Evaluation, Centers for Disease Control and Prevention, Centers for Medicare & Medicaid Services, Food and Drug Administration, Health Resources and Services Administration, Indian Health Service, National Institutes of Health, Office of the Assistant Secretary for Health, Substance Abuse and Mental Health Services Administration, and Veterans Health Administration.

nationally representative. AHRQ receives these data regularly. Refer to the Quality section and the Access section of the NHQDR for the list of core measures.

- Supplemental measures are not discussed in the core report, except to highlight important topical issues. Supplemental measures are typically new measures and/or have limited data availability. These measures have not been approved by the IWG for inclusion in the core measure set and core measure summary analyses.

Both categories of measures are available in the [Data Query Tool](#).

Changes to the National Healthcare Quality and Disparities Report

The NHQDR was significantly shaped by several IOM reports. Two of these reports, *Crossing the Quality Chasm*¹ and *To Err Is Human*², raised awareness about gaps in the quality of healthcare and patient safety. The extensive literature review included in a third report, *Unequal Treatment*,³ drew attention to disparities in the care rendered to racial and ethnic populations, low-income populations, and other vulnerable groups.

Since the report's inception as the *National Healthcare Quality Report* (NHQR) and *National Healthcare Disparities Report* (NHDR) in 2003, AHRQ has worked over time to enhance and refine the NHQDR measure set and methodology. These enhancements include introducing core measures and composite measures and refining the methods of analysis. In addition, the area of patient safety was expanded to include sections on healthcare-associated infections and patient safety culture. The NHQDR team also added sections on lifestyle modification and care coordination.

In response to IOM recommendations, the NHQDR team produced a single Highlights chapter that integrated findings from the NHQR and NHDR. In addition, we introduced measure-specific benchmarks that reflect the high level achieved by the best performing states. To address the three quality improvement aims of better care, healthy people, and affordable care (also known as the Triple Aimⁱⁱ), we organized the reports into six priority areas (e.g., Patient Safety, Healthy Living) that could help achieve the three aims.

In 2014, the NHQR and NHDR were combined to provide a more complete and integrated assessment of access to and quality of healthcare, as well as disparities. The new NHQDR also included measures related to other key populations, including

ⁱⁱ More information on the Triple Aim is available from the Institute for Healthcare Improvement at <http://www.ihc.org/Engage/Initiatives/TripleAim/Pages/default.aspx>.

women, children, older adults, people with disabilities and at the end of life, and residents of rural areas and inner cities.

This section covers major changes to the report and summarizes data updates in reverse chronological order, beginning with most recent.

2019 Report

New Features

The 2019 NHQDR has several new features that strengthen the reader's understanding of access to care, the healthcare workforce, and the NHQDR measure set.

In the Overview section of the report, readers will gain an understanding of the healthcare landscape and utilization. Of note is a new subsection that examines racial and ethnic disparities among the U.S. healthcare workforce. Multiple roles within the healthcare system, including nurses, physicians, therapists, and psychologists, are discussed and compared with the U.S. population.

The Access section now features measures and data examining dental care accessibility, Medicare Advantage patients, and dual-eligible beneficiaries. People with Medicare Advantage and those who are dually eligible for Medicare and Medicaid have unique accessibility concerns. The end of the Access section contains tables listing the trend performance (improving, not changing, or worsening over time) of each core measure.

The Quality section of the report highlights the best and worst performing trends across each of the six quality domains featured in the NHQDR. This year, the authors have reintroduced the Care Affordability section, which includes two measures that show improving trends over time. The report features more than 250 measures based on data availability in the 2019 NHQDR. The end of each Quality subsection contains tables listing the trend performance (improving, not changing, or worsening over time) of each core measure.

Based on the quality domain, measures are categorized by sub-area or healthcare setting to help readers identify them. All figures in this year's report have been embedded in the report and are no longer featured in an appendix. In addition, notes below each figure assist with their interpretation.

The Disparities section highlights differences in care experienced by priority populations. This year's report uses the National Institute on Minority Health and Health Disparities research framework to better address the complexity of health disparities. Additional information about disparities experienced by residents of rural

areas is also highlighted. Measures with the largest disparities by residence location are organized by priority area and care setting.

Updates in Data Source Availability

- Healthcare Cost and Utilization Project (HCUP) state data and trend data remains unavailable for the 2019 report due to the change from ICD-9ⁱⁱⁱ diagnosis codes to ICD-10 codes and changes to the AHRQ Quality Indicators (same as the 2018 report).
- Unlike the 2018 report, the 2019 report includes HCUP risk-adjusted benchmarks for some of the Quality Indicators.
- Behavioral Risk Factor Surveillance System data became available for the 2019 report and are included in all analyses.
- Medical Expenditure Panel Survey (MEPS) activity limitation data are not available for the 2019 report. This variable has been replaced with disability status.
- The NHQDR dataset now includes data from the Centers for Medicare & Medicaid Services Minimum Data Set.

Changes Starting With the 2018 Report

New Features

The 2018 NHQDR included a New Measures section that introduced new measures in four areas that aligned with HHS priority areas and addressed gaps in the care continuum. These included new measures for dementia, opioid prescribing, opioid-related deaths, maternal morbidity and mortality, and cancer treatment.

Updates in Data Source Availability

- The “Opioids” section was new for the 2018 report. The 2018 report has eight opioid measures; two are core measures and five are supplemental measures. These measures come from multiple data sources (HCUP, MEPS, National Vital Statistics System, and National Survey on Drug Use and Health).
- The NHQDR dataset now includes data from the Centers for Medicare & Medicaid Services, Outcome and Assessment Information Set.

Data Limitations and Changes

- Before 2018, the NHQDR had about 50 core measures using HCUP data. However, the HCUP state data and trend data were not available for the 2018 report due to the change from ICD-9 diagnosis codes to ICD-10 codes and changes to the AHRQ Quality Indicators.

ⁱⁱⁱ ICD-9 is the International Classification of Diseases, Ninth Revision. ICD-10 is the 10th revision.

- Data for about 20 nursing home care measures and 30 home health care measures were not available for the 2016 and 2017 reports. For the 2018 report, 2013-2016 data were available and were included in the comparisons and trend analyses.
- Since 2016, the NHQDR team has been working to make the analysis methods and results consistent between the NHQDR website and the reports. However, inconsistencies still exist. For 2018, nursing home data became available after the report was prepared, so they were not included there but were included in the website data analysis. In addition, because the opioid crisis is an HHS priority, we included all data for the opioid supplemental measures in the website data analysis even though only two measures were included in the report.
- The benchmark year for the 2018 report did not move forward by 1 year. In previous years, the benchmark year usually moved forward. The benchmark year was 2014 for the 2016 report and 2015 for the 2017 report. For 2018, the benchmark year was still 2015. Therefore, there were more measures, states, and subgroups that reached the benchmark in the 2018 report than in previous years.

Organization of the 2019 National Healthcare Quality and Disparities Report and Related Chartbooks

The 2019 report and chartbooks are organized around the concept of access to care, quality of care, disparities in care, and six priority areas, including patient safety, person-centered care, care coordination, effective treatment, healthy living, and care affordability. Summaries of the status of access, quality, and disparities can be found in the report. Details for individual measures are found in the appendixes.

The report presents information on trends, disparities, and changes in disparities over time, as well as federal initiatives to improve quality and reduce disparities. It includes the following:

- **Overview of U.S. Healthcare System Landscape** describes the healthcare system, encounters, and workers; disease burden; and healthcare costs.
- **Access to Healthcare and Disparities in Access** tracks progress on making healthcare available to all Americans.
- **Trends in Quality of Healthcare** tracks progress on ensuring that all Americans receive appropriate services.
- **Disparities in Healthcare** tracks progress in closing the gap between minority racial and ethnic groups and Whites, as well as income and geographic location gaps (e.g., rural/suburban disparities).
- **Looking Forward** summarizes future directions and research opportunities for healthcare quality and measurement initiatives.

Additional information on each measure can be found in the Data Query section of the NHQDR website (<http://nhqrnet.ahrq.gov/inhqrdr/data/query>). Below each table generated are links to:

- **Data Source**, which provides information about each database analyzed for the report, including data type, sample design, and primary content. The list of data sources is available in appendix X (insert link here).
- **Measure Specifications**, which provide information about how measures are generated and analyzed for the report. Measures highlighted in the report are described, as well as other measures that were examined but not included in the text of the report. The measure specifications can be found online (<https://www.ahrq.gov/sites/default/files/wysiwyg/research/findings/nhqrdr/2018qdr-measurespecs.pdf>).

Methods of the National Healthcare Quality and Disparities Report and Related Chartbooks

Measures

Access to Healthcare

- **Purpose.** Assess access to care for the overall U.S. population and priority populations; identify racial, ethnic, and socioeconomic disparities; track changes in access to care over time; and identify aspects of access to care that are improving and aspects that are not improving.
- **Approach.** Factors that facilitate accessing healthcare, including having health insurance and a usual source of care, have been tracked since the first reports. Measures of timeliness of care and infrastructure to provide healthcare to minority and low-income populations were added to the access measure set.
- **Summaries of Access.** At times, the report will present summary information across a panel of access measures, including measures widely considered important for accessing healthcare, such as getting care in a timely manner.

The access measures panel excludes measures with less clear interpretation. For example, the percentage of people age 65 and over with traditional fee-for-service (FFS) Medicare is tracked in the NHQDR database and is available through the NHQDR Data Query Tool. However, it is not included in the panel, because decreasing rates in traditional FFS could reflect increasing rates of enrollment in Medicare Advantage plans or **Medicare managed care**. Medicare Advantage plans offer medical insurance coverage via health maintenance organizations, preferred provider organizations, and private FFS plans. These plans also cover prescription drug costs.

Similarly, use of emergency departments as a usual source of care is not included in the access measures panel, because rising rates have multiple interpretations. They could reflect meeting a previously unmet community need, which would be desirable, or problems getting care in provider offices, which would be undesirable. Researchers, policymakers, and other users should explore these data further to understand the underlying causes.

Quality of Healthcare

- **Purpose.** Assess quality of care for the overall U.S. population and priority populations; identify disparities among racial, ethnic, and socioeconomic groups; track changes in quality of care over time; and identify aspects of quality of care that are improving and aspects that are not improving.
- **Initial Approach.** The selection of quality measures to include in the first reports involved several steps:
 - IOM provided criteria for the selection of quality measures in 2001: overall importance of the aspects of quality being measured, scientific soundness of the measures, and feasibility of the measures. It also provided criteria for the measure set as a whole: balance, comprehensiveness, and robustness.
 - IOM and AHRQ issued calls for measures that yielded hundreds of measures submitted by private and governmental organizations.
 - A Federal Measures Workgroup was convened to apply the IOM criteria to the measures submitted for consideration.
 - A preliminary measure set was published in the *Federal Register* for public comment; additional comments were obtained through a hearing organized by the National Committee on Vital and Health Statistics.
 - In 2003, this process yielded an initial measure set that included 147 measures from two dozen data sources.
- **Types of Quality Measures.** Most measures tracked in the report reflect processes of care, outcomes of care, and patient perceptions of care:
 - **Processes of Care.** These measures generally represent percentages of people receiving care that they need or percentages of people receiving care that they should not receive. Measures are specified so that everyone in the denominator needs the service and optimal care equals 100%. These measures are generally not adjusted for age and sex since need is captured in the specification of the denominator.

- **Outcomes of Care.** These measures generally represent rates of adverse events or deaths. Because death rates often reflect factors other than healthcare, only death rates with moderate ties to processes of care are tracked. For example, colorectal cancer death rates are tracked because they are related to rates of colorectal cancer screening.
 - **Patient Perceptions of Care.** These measures generally represent percentages of people who perceived problems with aspects of their care.
- **Refinement of the Measure Set.** Since the first reports in 2003, the measure set has been reviewed each year and changes made as needed. All changes are approved by the HHS IWG that supports the NHQDR.
 - **Additions** have been made to the measure set as new domains of quality, data, and measures have become available. For example, Care Coordination and Care Affordability were not recognized quality domains when the reports started, and measures of these domains were identified and added after they were recognized.
 - **Deletions** have been made when data collection for measures ceased or when new scientific information indicated that a measure did not represent high quality care. In addition, process measures that achieve overall performance levels exceeding 95% are not tracked in the report. The success of these measures limits their utility for tracking improvement over time. Because these measures cannot improve to a significant degree, including them in the measure set creates a ceiling effect that may dampen quantification of rates of change over time. Data on retired measures continue to be collected and these measures will be added back to the report if their performance falls below 95%.
 - **Modifications** have been made when clinical recommendations change. For example, clinical recommendations often set new target levels or recommended frequencies for specific services.
- **Summaries of Quality.** At times, the report will present summary information across a panel of quality measures. This panel includes measures that are widely considered important for healthcare quality, such as measures of processes, outcomes, and patient perceptions, as noted above. The panel excludes measures with less clear interpretation, typically measures of infrastructure and costs.

Data Sources

Overview of Data

The data included in the report were determined by the measures chosen for tracking by the IWG and the NHQDR team. The report is based on dozens of data sources to

provide a comprehensive assessment of access to healthcare and quality and disparities of healthcare in the United States. Most are nationally representative or cover the entire U.S. population.

Different types of data are used to provide complementary perspectives of healthcare and include patient and population surveys, provider surveys, administrative data from facilities, medical records, registries, surveillance systems, and vital statistics. Settings of care covered include ambulatory care, health centers, emergency departments, hospitals, nursing homes, hospices, and home health.

Data experts from contributing agencies or organizations generate descriptive summary statistics from the micro data for the NHQDR measures and population groups of interest. For particular measures, the NHQDR team downloads summary statistics directly from trusted websites.

All survey design features are taken into account. The percentages or rates are weighted to represent the targeted population. Statistics with a sample size of fewer than 30 individuals or relative standard errors larger than 30% are suppressed for statistical reliability, data quality, or confidentiality. The suppression criteria are different by data sources and mostly are decided by the NHQDR contributing agencies. If the contributing agencies did not suppress any data, the NHQDR coded the data to DSU if the sample size was <30 or the relative standard error was >30%.

The NHQDR team has maintained the data since 2003, the first year of the reports. Some survey designs, questionnaires, data collection methods, definitions, and data calculation methods have changed over the years. Some contributing agencies updated all of the back years' data so the data are consistent for all analysis, such as MEPS and HCUP data. Some contributing agencies informed the team about the changes, and the noncomparable data were removed from the database. While the team has tried to keep consistency of all data, a small fraction of data has had minor changes over the years.

Only data sources that are regularly included in the report are listed below. Not included on the list are sources that do not collect data on a regular basis; such data are presented intermittently in the report when they address topics or populations not well covered by regular data collections.

Federal Sources of Data

Agency for Healthcare Research and Quality

- Healthcare Cost and Utilization Project (HCUP)
- Medical Expenditure Panel Survey (MEPS)
- CAHPS® Database – CAHPS® Health Plan Survey Database

Centers for Disease Control and Prevention

- Behavioral Risk Factor Surveillance System (BRFSS)
- National Ambulatory Medical Care Survey (NAMCS)
- National Electronic Health Records Survey (NEHRS)
- National Health and Nutrition Examination Survey (NHANES)
- National Health Interview Survey (NHIS)
- National HIV Surveillance System (NHSS)
- National Hospital Ambulatory Medical Care Survey (NHAMCS)
- National Immunization Survey (NIS)
- National Program of Cancer Registries (NPCR)
- National Tuberculosis Surveillance System (NTSS)
- National Vital Statistics System—Linked Birth and Infant Death Data (NVSS-L)
- National Vital Statistics System—Mortality (NVSS-M)
- National Vital Statistics System—Natality (NVSS-N)

Centers for Medicare & Medicaid Services

- Consumer Assessment of Healthcare Providers and Systems (CAHPS®) Hospital Survey (HCAHPS)
- CAHPS® Home Health Survey (HCAHPS)
- CAHPS® Hospice Survey
- Hospital Inpatient Quality Reporting (HIQR) Program
- Hospital Outpatient Quality Reporting (HOQR) Program
- Outcome and Assessment Information Set (OASIS)
- Minimum Data Set (MDS)

Health Resources and Services Administration

- Uniform Data System (UDS)
- HIV/AIDS Bureau - Ryan White HIV/AIDS Program

Indian Health Service

- Indian Health Service (IHS) National Data Warehouse (NDW)

National Institutes of Health

- United States Renal Data System (USRDS)

Substance Abuse and Mental Health Services Administration

- National Survey on Drug Use and Health (NSDUH)
- Substance Use Disorder Treatment Episode Data Set (TEDS)

Multi-Agency Data Sources

- Medicare Patient Safety Monitoring System (MPSMS)

Academic Institutions

University of Michigan

- University of Michigan Kidney Epidemiology and Cost Center (UMKECC)

Professional Organizations and Associations

American Hospital Association

- American Hospital Association Annual Survey Information Technology Supplement

Commission on Cancer and American Cancer Society

- National Cancer Data Base (NCDB)

Populations

Overall U.S. Population

- **Purpose.** A key function of the NHQDR and related chartbooks is to assess access to healthcare and quality of health for the overall U.S. population.
- **Approach.** National data are used as collected without additional exclusions. Common population limitations include the following:
 - Most federal health surveys are limited to the civilian noninstitutionalized population and do not include people on active duty in the military or who reside in nursing homes or penal or mental institutions.
 - Many facility data collections do not include federal facilities run by the Departments of Defense or Veterans Affairs or by IHS.

Priority Populations

- **Purpose.** Another key function of the NHQDR and related chartbooks is to assess access to healthcare and quality of health for select populations defined by age, sex, race, ethnicity, income, education, health insurance, and geographic location.
- **Approach.** To the extent supported by data collection, definitions of priority populations are standardized across different data sources. The NHQDR also includes categories beyond those specified by the statute identifying priority populations. While the statute includes low-income groups, it does not mention other social determinants of health, such as insurance status and education. The NHQDR includes these categories in addition to income, as analyses of disparities in these areas demonstrate the impact of socioeconomic factors on quality of and access to healthcare.

- Typical definitions for the population categories in the NHQDR that are available in multiple databases include:
 - Age: 0-17, 18-44, 45-64, and 65 and over.
 - Sex: Male and female.
 - Race: White, Black, Asian, Native Hawaiian or Pacific Islander, American Indian or Alaska Native, and more than one race.^{iv}
 - Ethnicity: Hispanic and non-Hispanic White.^v
 - Income: Poor, low income, middle income, and high income.^{vi}
 - Education: People with less than a high school education,^{vii} high school graduates, and people with any college.
 - Health insurance, ages 0-64: Any private insurance, public insurance^{viii} only, and no insurance.
 - Health insurance, age 65 and over: Medicare and any private insurance, Medicare and other public insurance, and Medicare only.
 - Disabilities: Basic activity limitations, which include problems with mobility, self-care (activities of daily living), domestic life (instrumental activities of daily living), and activities that depend on sensory functioning (limited to people who are blind or deaf); complex activity limitations, which include limitations experienced in work and in community, social, and civic life. For the purpose of the NHQDR, adults with disabilities are those with physical, sensory, and/or mental health conditions that can be associated with a decrease in functioning in such day-to-day activities as bathing, walking, doing everyday chores, and engaging in work or social activities. The paired measure is intended to be consistent with statutory definitions of disability, such as the first criterion of the

^{iv} Asian includes the former category of Asian or Pacific Islander prior to 1997 Office of Management and Budget guidelines, when information was not collected separately by group. Go to <https://www.gpo.gov/fdsys/granule/FR-1997-10-30/97-28653> for more information.

^v Not all data sources collect information by race and ethnicity separately. In such cases, comparisons are made by combining racial/ethnic group categories (e.g., comparing non-Hispanic Blacks and Hispanics with non-Hispanic Whites).

^{vi} Unless otherwise indicated, throughout this report, poor is defined as having family income less than 100% of the federal poverty level (FPL); low income refers to income of 100% to 199% of the FPL; middle income refers to income of 200% to 399% of the FPL; and high income refers to income of 400% of the FPL and above. These are based on U.S. census poverty thresholds for each data year, which are used for statistical purposes.

^{vii} Less than a high school education refers to people who did not complete high school.

^{viii} Public insurance includes Medicaid, Children’s Health Insurance Program, state-sponsored or other government-sponsored health plans, Medicare, and military plans.

1990 Americans With Disabilities Act and other federal program definitions of disability.

- Children with special health care needs (CSHCN): Children ages 0-17 with activity limitations or need or use of more healthcare or other services than is usual for most children of the same age. Question sequences^{ix} are asked about the following five health consequences: the need or use of medicines prescribed by a doctor; the need or use of more medical care, mental health care, or education services than is usual for most children; limitations or inability to do things most children can do; the need or use of special therapy, such as physical, occupational, or speech therapy; and the need or use of treatment or counseling for emotional, developmental, or behavioral problems. Children with responses to at least one of the five health consequences were identified as having a special health care need.
- Geographic location: Large central metropolitan, large fringe metropolitan, medium metropolitan, small metropolitan, micropolitan, and noncore areas based on the 2013 National Center for Health Statistics Urban-Rural Classification Scheme (https://www.cdc.gov/nchs/data_access/urban_rural.htm). The 2013 scheme includes six urbanization categories, including:
 - ◆ Four metropolitan county designations:
 - Large Central Metropolitan: Large central metropolitan counties in a metropolitan statistical area (MSA) of 1 million or more population:
 1. That contain the entire population of the largest principal city of the MSA, or
 2. Whose entire population is contained within the largest principal city of the MSA, or
 3. That contain at least 250,000 residents of any principal city in the MSA.
 - Large Fringe Metropolitan: Counties in MSAs of 1 million or more population that do not qualify as large central. Large Fringe Metropolitan

^{ix} A CSHCN Screener instrument was developed through a national collaborative process as part of the Child and Adolescent Health Measurement Initiative coordinated by the Foundation for Accountability. For more information, refer to Bethell CD, Read D, Stein REK, et al. Identifying children with special health care needs: development and evaluation of a short screening instrument. *Ambul Pediatr* 2002 Feb;2(1):38-48. <https://www.ncbi.nlm.nih.gov/pubmed/11888437>. Accessed May 23, 2019.

areas are also described as suburban areas. This category is the reference group that all other residence locations are compared with in this report.

- Medium Metropolitan: Counties in MSAs of 250,000 to 999,999 population.
- Small Metropolitan: Counties in MSAs of less than 250,000 population.

♦ Two nonmetropolitan county designations:

- Micropolitan: Counties in a micropolitan statistical area.
- Noncore: Nonmetropolitan counties that are not in a micropolitan statistical area.

- **Special Analyses.** Other important groups have been more difficult to identify in healthcare data:
 - Beginning with the 2012 reports, contrasts by granular racial/ethnic subgroups have been included when available. The NHQDR team has not yet found a healthcare data source that includes all the subgroups of interest, because sample sizes have been too small to yield statistically reliable data. Thus, limited data have been presented for Hispanic subgroups (Mexican, Puerto Rican, Cuban, other Hispanic/Latino/Spanish origin), Asian subgroups (Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, other Asian), Native Hawaiian and Other Pacific Islander subgroups (Native Hawaiian, Guamanian or Chamorro, Samoan, and other Pacific Islanders).
 - Beginning with the 2013 reports, analyses by number of multiple chronic conditions have been included, but data sources differ in the chronic conditions that can be identified. Improving measurement and data for these groups is critical to understand the reasons people with multiple chronic conditions cannot access high-quality healthcare and to develop effective interventions to help them overcome these barriers.

Analyses

All NHQDR analyses mainly include size of disparities, trend, trend in disparities, and benchmark. The summary results of the analysis are summarized in charts, tables, and maps and are posted on the NHQDR website. The source data for all these analyses are the summary statistics, either percentages or rates, at the national or subgroup level, instead of micro data.

Data Preparation

For all analyses, estimates are aligned to the negative direction. For measures where higher estimates are desirable, the estimates are usually reported as percentages instead of rates. The percentages are flipped (negatively aligned) by deducting the percentage from 100%. An example of negative alignment would be changing “Adults who had an influenza vaccine” to “Adults who did not have an influenza vaccine.”

The flipped or negatively aligned estimate will be referred to as the aligned rate in the text below. For measures where lower estimates are desirable, the estimates are not flipped. The result is interpreted based on the direction of the measures, although the rates are aligned to the negative direction for positive measures.

NHQDR applies these methods to quality measure changes and trend analyses and to assess disparities. This approach is used uniformly across all measures from different data sources in order to determine whether the differences between comparison groups and reference groups are statistically significant (not due to chance) and are more likely to be real differences. These methods improve uniformity for comparability and ease of understanding of the findings and increase the sensitivity (i.e., the likelihood of a difference being considered statistically significant) but have some limitations. (Refer to “Analysis Limitations” later in this document.)

For analyses of disparities in the current year and change in disparities over time, comparisons are typically made between a priority population or comparison group and a reference group. The largest subgroup or the subgroup that often received the best healthcare is used as the reference group. The table below provides examples of specific reference groups.

Variable Category	Reference Group
Sex	Males
Age	18-44 years
Ethnicity	Non-Hispanic White
Race	White
Income	High income
Education	Any college education
Activity Limitations	Adults without any activity limitation
Residence Location	Large fringe metropolitan (suburb)
Insurance	Private insurance

For comparisons among racial groups, if a measure had data for separate racial categories, racial data were used. If a measure only had a combined race/ethnicity category, non-Hispanic White, non-Hispanic Black, and Hispanic were used.

Trends in Quality

- **Purpose.** To assess change over time considering both magnitude of change and statistical significance. Magnitude of change was considered important because large databases could have trends that were statistically significant but not large enough to be clinically meaningful.
- **Approach.** Data preparation is applied as discussed above. Unweighted log-linear regression. The rates are assumed to change at a constant percentage of the rate of the previous year. For example, if the annual percentage change is 1%, and the rate is 50 per 1,000 in 2000, then the expected rate is $50 \times 1.01 = 50.5$ in 2001 and $50.5 \times 1.01 = 51.005$ in 2002. Rates that change at a constant percentage every year change linearly on a log scale.^x

In previous years, regression weights were used with $w = (M^2/v)$, where M^2 is the square of the measure value and v is the variance. We recently changed to unweighted regression to be more consistent with methods used in the CMS National Impact Assessments and because analyses demonstrated few differences between weighted and unweighted regressions.

- **Data requirement.** Estimates for at least four time points between 2000 and the most recent year; fewer than four time points were deemed insufficient to calculate slopes of regression lines.
 - **Model.** $\ln(M) = \beta_0 + \beta_1 Y$, where $\ln(M)$ is the natural logarithm of the aligned rate, β_0 is the intercept or constant, and β_1 is the coefficient corresponding to year Y (e.g., the average annual percentage change = $100 \times (\exp(\beta)-1)$).
- **Interpretation:**
 - **Improving** = Average annual percentage change $>1\%$ per year in a favorable direction and $p < 0.10$.^{xi}
 - **Not Changing** = Average annual percentage change $\leq 1\%$ per year or $p \geq 0.10$.
 - **Worsening** = Average annual percentage change $>1\%$ per year in an unfavorable direction and $p < 0.10$.

^x More information is available in Kim HJ, Fay MP, Feuer EJ, et al. Permutation tests for joinpoint regression with applications to cancer rates. *Stat Med* 2000;19:335-51 (correction: 2001;20:655).

^{xi} A probability of 0.10 was selected as the significance level because the magnitude of the standard errors varied considerably by type of data. Favorable direction is defined as negative average annual percentage change for positive measures and positive average annual percentage change for negative measures.

- **Summaries of Trends.** Trends across panels of measures can be summarized in a variety of ways. The average annual percentage change of each measure is calculated and the summary over the panel of measures is presented as a stacked bar chart showing the percentage of measures that are Improving, Not Changing, or Worsening, by priority area and by subgroup.
- **Measures With Extreme Trends.** To help identify measures that are changing the most quickly, measures are sorted by average annual percentage change.
 - **Improving Quickly** = Average annual percentage change >10% per year in a favorable direction and $p < 0.10$.

Achievable Benchmarks

- **Purpose.** To define a high level of performance that has been attained to help readers understand national and state performance and to serve as an achievable quality improvement goal.
- **Approach.** Data preparation is applied as discussed above. Average of the top 10% best performing states:
 - **Data Requirement.** Estimates for 2015 or 2014 are required for at least 30 states. About half of NHQDR measures meet this requirement.
 - **Calculation.** Average of estimates from the top 10% of states (e.g., average of top five states if estimates are available on all 50 states and DC). Territories are included in the calculation of the number of states in the top 10% (e.g., top 5 of 50) but are excluded from the top 10% of states for the benchmark calculation because the estimates usually are associated with larger variance.
 - **Updates.** Data from 2015 are preferred for the benchmark calculation to use more recent data. If a measure does not have 2015 data, 2016 data or 2014 data are used. A benchmark is not calculated if a measure's latest data year is 2013 or earlier, except for the Patients with treated chronic kidney failure who received a transplant within 3 years of date of renal failure measure. The overall state-level benchmark calculated above is used for all comparisons. A benchmark for each priority population group is not calculated.
- **Interpretation:**
 - **Figures.** When available, benchmarks are shown as dashed red lines on figures.
 - ♦ **Time to Benchmark.** When a subpopulation group has at least 4 years of data, time to reach the benchmark is estimated based on the distance between

the benchmark and current year's rate and the average annual change. The average annual change is calculated using unweighted linear regression.

- ◆ **Model.** $M = \beta_0 + \beta_1 Y$, where M is the aligned rate of a subgroup, β_0 is the intercept or constant, and β_1 is the coefficient corresponding to year Y . The average annual change is used to extrapolate forward to the time when the benchmark will be achieved. Year to reach benchmark is calculated using the formula below:
- ◆ Year to reach benchmark = (Benchmark – Current year's rate)/average annual change

The result is classified into five exclusive categories that tell us about the direction of the measure compared with the benchmark:

1. Better than benchmark: rate in the most recent year is better than the benchmark and is changing in the desirable direction.
2. Approaching the benchmark: a rate calculated for cases where the trend shows improvement toward the benchmark. The estimated number of years to reach the benchmark is calculated using the method mentioned above.
3. Insignificant change: the average annual change is not statistically significant ($p \geq 0.05$) or the average annual change is zero.
4. No progress toward benchmark: rate in the most recent year is worse than the benchmark and is changing in the undesirable direction.
5. Better than benchmark and going away from benchmark: rate in the most recent year is better than the benchmark, but the trend showed worsening.

Size of Disparities Between Two Subpopulations

- **Purpose.** To assess whether access or quality differs between two subpopulations for the most recent data year. Comparisons are typically made between a priority population group and a reference group within a population characteristic (e.g., Blacks vs. Whites within the race characteristic). The best performing subgroup is typically used as the reference group.

Before the 2016 report, the latest available data were used for the current year disparities analysis. Since the 2016 report, we have excluded measures from the disparities analysis if the most recent data were 3 years older than the report year. For example, measures without 2013 or later data were excluded from the 2016 report. An exception is applied to the measure of Patients with treated chronic kidney failure who received a transplant within 3 years of date of renal failure. An

additional 2 years of data were used for this measure because the measure includes a 3-year waiting period.

Baseline disparities used the earliest available data since 2000 and before 2013. The baseline disparities are only used to subset measures for the Trends in Disparities analysis.

- **Approach.** Data preparation is applied as discussed above. Two criteria are applied to determine whether the difference between two groups is meaningful:
 - The absolute difference between the priority population group and the reference group must be statistically significant with $p < 0.05$ on a two-tailed test.
 - The relative difference between the priority population group and the reference group must be at least 10% when framed positively or negatively ($(p_1 - p_2)/p_2 > 0.1$), where p_1 is priority group's aligned rate and p_2 is reference group's aligned rate.
- **Interpretation:**
 - **Better** = Priority population estimate more favorable than reference group estimate by at least 10% and with $p < 0.05$.
 - **Same** = Priority population and reference group estimates differ by less than 10% or $p \geq 0.05$.
 - **Worse** = Priority population estimate less favorable than reference group estimate by at least 10% and with $p < 0.05$.
- **Summaries of Disparities.** Disparities across panels of measures are usually summarized as stacked bar charts showing the percentage of measures that are Better, Same, or Worse for priority populations compared with a reference group.

Trends in Disparities Between Two Subpopulations

- **Purpose.** To observe whether the difference in access or quality between two subpopulations has changed over time. Comparisons are typically made between a priority population group and a reference group within a population characteristic (e.g., Blacks vs. Whites within the race characteristic).
- **Approach.** Data preparation is applied as discussed above, and analyses use unweighted linear regression. Before 2015, weighted regressions were used with $\text{weight} = (1/v)$, where v is the variance. With the 2015 report, we changed to unweighted regression on the indexed rate to be more consistent with methods used in the CMS National Impact Assessments and because analyses demonstrated few differences between weighted and unweighted regressions.

To calculate the index, we divided estimates by the earliest estimate of the reference group so that the earliest indexed estimate equaled one and subsequent indexed estimates were relative to the earliest estimate. Starting with the 2016 report, we changed to unweighted regression on the aligned rate without taking the index.

- **Data Requirement.** Estimates for at least four time points between 2000 and the most recent data year for both the priority population and reference group; fewer than four time points were deemed insufficient to calculate slopes of regression lines.
- **Model.** $M = \beta_0 + \beta_1 Y$, where M is the aligned rate of a subgroup, β_0 is the intercept or constant, and β_1 is the coefficient corresponding to year Y .
 - ◆ The coefficient is the average annual change (AAC). For example, if the average annual change is -1 , and the mean rate is 50 per 1,000 in 2000, then the expected mean rate is $50 + (-1) = 49$ in 2001 and $49 + (-1) = 48$ in 2002. It means the mean rate decreased by 1 unit per year.
 - ◆ We calculate the difference in the AAC between the priority population group and the reference group and the standard error:

Difference in AAC = AAC (priority population group) – AAC (reference group)
Standard error = square root of [STDErr(PPG)² + STDErr (Ref Group)²]
 - ◆ We use standard errors from the regression coefficients to calculate the standard error of the absolute difference.

- **Interpretation:**

- Improving = The difference in the AAC of the priority population and reference group is < -1 (in a favorable direction) and $p < 0.10$ for testing that regression coefficients are the same.
- Not Changing = Absolute value of the difference in the AAC of the priority population and reference group is < 1 or the absolute value of the difference in the AAC of the priority population and reference group is > 1 and $p \geq 0.10$ for testing that regression coefficients are the same.
- Worsening = The difference in the AAC of the priority population and reference group is > 1 (in an unfavorable direction) and $p < 0.10$ for testing that regression coefficients are the same.
- Example: Because the rates are aligned to the negative direction, a negative AAC value indicates a measure/subgroup's mean has been decreasing (improving) over the years, and a positive value indicates the subgroup's mean has been

increasing (worsening) over the years. Taking the “hospital admissions for uncontrolled diabetes without complications per 100,000 population” measure as an example, if the AAC in the Black mean rate is -2.9 and the AAC in the White mean is -0.4 , the difference is $(-2.9) - (-0.4) = -2.5$. This difference indicates that the Black mean rate has been improving (decreasing) faster than the White mean rate or the disparity between Blacks and Whites is improving (i.e., narrowing).

- **Summaries of Trends in Disparities.** Trends in disparities across panels of measures are usually summarized as stacked bar charts showing the percentage of measures that are Improving, Not Changing, or Worsening for priority populations compared with a reference group. The summary charts in the 2019 report include subgroups with baseline disparities.
- **Measures With Extreme Trends in Disparities.** To help identify measures with disparities that are changing the most quickly for each priority population, we sort measures by the difference in AAC between the priority population and reference group.
 - **Disparities Eliminated** = Disparity improving and priority population estimates reached or surpassed reference group estimate.

State Maps

- **Purpose:** To show differences in quality between states.
- **Approach:** The quality map featured in the Overview section of the 2019 NHQDR (Figure 27) shows each state’s performance in quartiles based on the state’s performance score. The performance score for individual measures is assigned as follows:
 - -1 point for each measure that was better than the national average.
 - 0 point for each measure that was the same as the national average.
 - 1 point for each measure that was worse than the national average.

The state’s performance score is calculated by summing the individual scores over all measures and then dividing by the total number of measures.

$$\text{Performance score} = (-1 * \text{Number of Better measures} + \text{Number of Worse measures}) / \text{Total number of measures}$$

Then the state’s performance scores are ranked by quartiles for the map.

- Interpretation: The first quartile (best quality) of the map indicates that the states performed better on more measures and performed worse on fewer measures than the national average. The fourth quartile (worst quality) indicates that the states performed better on fewer measures and performed worse on more measures than the national average.

Analysis Limitations

As noted earlier, the methods used in the NHQDR improve uniformity for comparability and ease of understanding of the findings and increase the sensitivity (i.e., the likelihood of a difference being considered statistically significant) but have some limitations.

To analyze all measures across the measure set in the same way for assessing disparities, some measures are flipped so that all measures are aligned in the negative direction (e.g., “Adults who had an influenza vaccine” is changed to “Adults who did not have an influenza vaccine”). The alignment of all the measures in the same direction provides a standard way to analyze the data. However, this effect is most reliable when the original rates are well above 50%. The effect is greatly diminished if the rates are near 50% and can have the opposite effect if the original rates are well below 50%.

The z-score of absolute difference is an additional criterion for statistical reliability. It takes into account the standard errors of the point estimates. That is, if the standard errors are comparatively large, then z-scores provide an additional check on the meaningfulness of the difference and reduce the possibility of labeling the differences as worse or better when those differences are not statistically valid. Therefore, the findings in the NHQDR may be different from other studies that look at the same measures and data due to the increased sensitivity of our methodology.

In some cases, changes in the measures or how to interpret the measures may have an impact on the effectiveness of the methodology used for this report. AHRQ is continually reviewing all aspects of its methodology for determining and reporting disparities and maintaining consistency.

Limitations With Healthcare Cost and Utilization Project Data

In the 2017 NHQDR, all available HCUP measures included in the report and NHQDR database had trend data. Those same measures are not represented in this report due to the limited availability of HCUP data. HCUP converted all measures from International Classification of Diseases, Ninth Revision (ICD-9) to Tenth Revision (ICD-10) codes, thus changing the outcomes of these measures. Therefore, we cannot trend the data at

this time. HCUP trend data are available for opioid measures that use ICD-9 codes and ICD-9 to ICD-10 codes in the last 2 data years (2016-2017).

Historically, the NHQDR and derivative products such as the State Snapshots have included state-specific estimates for selected AHRQ Quality Indicators (QIs) based on HCUP data. The 2019 NHQDR does not include state-specific QI estimates based on 2016-2017 HCUP data. This decision was made in part because the ICD-10 version of the QI software used in this year's report does not include risk adjustment. State-specific QIs may be reported in future NHQDRs when the estimates can be risk adjusted.

In the 2019 NHQDR, no HCUP state data were available due to limited data availability from the data source, except for two HCUP opioid measures.

Limitations With the Medicare Patient Safety Monitoring System Data

For these measures, “hospital patients” refers to a population consisting of a sample of acute myocardial infarction, congestive heart failure, pneumonia, and major surgery patients. More information on the 2014-2017 sample can be found in the AHRQ National Scorecard on Hospital Conditions report (<https://www.ahrq.gov/sites/default/files/wysiwyg/professionals/quality-patient-safety/pfp/Updated-hacreportFInal2017data.pdf>).

The findings for these measure differ from the AHRQ National Scorecard due to different trend methodologies. For more information on the AHRQ National Scorecard on Hospital-Acquired Conditions, visit <https://www.ahrq.gov/hai/pfp/index.html>.

General Limitations

Some common limitations affect analyses of multiple data sources. For example, data are not available for relatively small subpopulations, such as Native Hawaiians, Pacific Islanders, and some rural communities. In addition, while most national surveys conduct data collections annually, not all modules are completed each year. Thus, data are missing for some measures included in the report.

Timeliness of national data for national surveys and data systems are also an issue since it takes time to process and ensure data quality for reporting, resulting in about a 2-year lag between the year the data are collected and the year they can be used.

Finally, for various reasons (e.g., data collection was discontinued), data for all years for all measures are not available. We exclude measures for which data will not available in the future. Lack of data for some measures affects the measure numbers in the summary figures, such as trends in quality.

Reporting Conventions

For ease of reporting, some shorthand is used in presenting results. Unless otherwise specified:

- State maps are usually grouped in quartiles. Data are excluded from territories with a large variation or that looked like outliers.
- Results presented in text or bullets meet our criteria for magnitude and statistical significance.
- Children are ages 0-17, adults are age 18 and over, and older adults are age 65 and over.
- “Blacks” indicates individuals who identify their race as Black or African American.
- “Hispanics” indicates individuals who identify their ethnicity as Hispanic, Latino/a, or Spanish origin and includes all races. The race categories for Hispanic individuals are not specified in the report.
- “Measure improved” indicates performance on the measure improved; “measure got worse” indicates performance on the measure showed worsening.
- “Disparities improved” indicates the disparity narrowed. “Disparities worsened” indicates the disparity widened.

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