APPENDIX

# No One Can See You Now

## Five Reasons Why Access to Primary Care Is Getting Worse (and What Needs to Change)



Milbank Memorial Fund
645 Madison Avenue
New York, NY 10022
www.milbank.org

# CONTENTS

# OVERVIEW

The first section of this appendix briefly summarizes the data sources used to create the Scorecard measures in Year 2. The second section presents a detailed discussion of how each of the measures were operationalized. The third section includes supplemental tables.

# DATA SOURCES

## Survey Data

**The Medical Expenditure Panel Survey (MEPS, 2010–2021)** is overseen by the Agency for Healthcare Research and Quality (AHRQ). MEPS currently has two major components: the Household Component (HC) and the Insurance Component (IC). MEPS–HC is a set of population-level longitudinal surveys of nonmilitary and noninstitutionalized individuals and families across the United States.[1,2] These data are collected through respondents' reports for themselves and their family members. The data are enriched with follow-up verification with physician offices for expenditures, diagnoses, and events. MEPS-HC was used for primary care spending (Measures 1.1–1.3), capitation (Measure 1.4), and usual source of care (Measures 2.1 and 2.2). Data were used from 2010 to 2021, with samples sizes ranging from 26,847 (in 2020) to 37,182 (in 2012). The response rates varied from 21.8% (in 2021) to 56.3% (2012). While MEPS-HC is invaluable for national studies, it does not have sufficient sample sizes to produce state-level estimates nationwide. For reasons of confidentiality, state-level estimates can only be produced for 29 larger states, through AHRQ's research data center. Even for these states, small sample sizes are a problem when the data set is further stratified by age (adults and children) and by payer type (private, Medicare, and Medicaid).

**The American Community Survey (ACS, 2012–2021)** is a population-level survey that contains updated US Census estimates of the US population at an annual level. The five-year ACS summary files were used to obtain ZIP Code Tabulation Area (ZCTA)–level populations from 2012 to 2021.

**The Area Health Resources Files (AHRF, 2012–2021)** compile information from more than 50 databases and other sources to provide comprehensive county-level information on a variety of health care utilization, health professions and facilities, environmental, and socio-demographic topics. The files are maintained by the Health Resources and Services Administration (HRSA) at an annual level. The AHRF data were used to obtain state- and national-level population estimates (derived from the five-year ACS summary files) from 2012 to 2021 (Measure 3.4).

## Workforce Data

**The American Medical Association (AMA) Physician Masterfile (AMA Masterfile, 2012–2021)** was used for Measures 2.3 and 2.4 (primary care physicians [PCPs] in areas above and below median Social Deprivation Index [SDI]) and Measure 3.3 (percentage of new physician workforce entering primary care each year). The AMA Masterfile is a proprietary data set maintained by the American Medical Association that includes a nearly complete listing of all physicians in the US. The AMA Masterfile includes detailed information about each physician,

including their age, gender, specialty, practice address, type of medical degree (doctor of medicine [MD] or doctor of osteopathic medicine [DO]), practice type, specialty, and home address. The Robert Graham Center (RGC) holds AMA Masterfile data for each year between 2000 and 2022 with the exception of 2003. The RGC geocodes the addresses in the file (98% match rate) and can readily match the addresses with other geographic data. The AMA Masterfile also includes a crosswalk between its physician identifier (MENUM, for medical education number) and the National Provider Identifier (NPI).

**Provider Enrollment, Chain, and Ownership System (PECOS, 2016–2021)** data were used to estimate the number of nurse practitioners (NPs) and physician assistants (PAs) in primary care (Measures 2.3, 2.4, and 3.2). This data set was also used to create an alternative measure of physicians in primary care (Measure 3.2). PECOS is a list of all providers enrolled in Medicare, including physicians, NPs, and PAs. Importantly, it allows linking of individual providers to the organizations to which they reassigned their billing rights. The PECOS data set also allows for multiple enrollments at any given time. Providers and organizations are required to validate their information in PECOS every five years.

This data set has been publicly available since 2016 and released on a quarterly basis at no cost. Comparing the composition of PECOS data to that of other sources, it does appear that providers of types that would have few, if any, Medicare patients, such as pediatricians, nevertheless are enrolled in Medicare. Finally, as noted above, the PECOS system captures simultaneous enrollments in multiple positions, making it difficult to determine the allocation of effort across different settings.

**The National Plan and Provider Enumeration System (NPPES, 2016–2021)** was used, along with other data sources, for Measures 2.3, 2.4, and 3.2 to identify NPs and PAs in primary care practice. Available since 2006, the NPPES is an administrative data set that captures all individuals and organizations with an NPI. Included are basic attributes of the provider, such as gender, provider type, specialty, and location of practice (street, city, state, and zip code). One of the strengths of the NPPES data set is that it includes information on all providers required to have an NPI, including NPs and PAs. Another feature of the NPPES is that it includes training type for NPs (including family health, adult health, and mental health). While tempting, this information should not be used to identify NPs and PAs practicing in primary care, since many NPs with generalist training often work in specialist offices.[3,4] A new publicly available data set is currently available for download every month. Recent data are available at **https://download.cms.gov/nppes/NPI_Files.html**. The National Bureau of Economic Research has also maintained an archive of these files, from 2008 through 2019, at **http://data.nber.org/data/nppes**.

A major limitation of NPPES data is the lack of an effective mechanism for validating activity status or updating critical information such as specialty and addresses. Year over year, only about 0.5% of physician NPIs are deactivated. These low rates are cumulative, so over time the quality of NPPES data has deteriorated.

**Centers for Medicare and Medicaid Services Physician and Other Practitioners Public Use File (Medicare PartB PUF, 2012–2021)** data were used to identify PCPs working as hospitalists and those billing mainly from emergency departments for Measures 2.3, 2.4, 3.2, and 3.3. It was also used for Measures 2.3, 2.4, and 3.2 to identify NPs and PAs billing from non-office settings. The data include information on use, payments, and submitted charges organized by NPI, Healthcare Common Procedure Coding System (HCPCS) code, and place of service.

The data are available annually from CMS at **https://data.cms.gov/provider-summary-by-type-of-service/medicare-physician-other-practitioners/medicare-physician-other-practitioners-by-provider-and-service/data**. The Medicare PartB PUF data sets from 2012 to 2021 were used for this analysis.

**The Accreditation Council of Graduate Medical Education (ACGME, 2012–2021)** has several databases relevant to this report. First, as part of the AMA Masterfile held by the RGC, the Historical Residency File provides detailed information regarding physicians' graduate medical education, including start and end dates of their residencies and fellowships. This information is used to construct Measure 3.3 (percentage of new physician workforce entering primary care each year). In addition, ACGME makes public information about sponsoring institutions, residency programs, and participating sites of residency programs (**https://apps.acgme.org/ads/Public/Request/PublicDataRequest**) for academic years 2012–2013 to 2021–2022. The residency program file includes the number of positions filled, thereby providing a count of residents nationwide and across states used for Measure 3.1 (percentage of all and primary care residents trained in rural areas and medically underserved areas [MUAs]) and Measure 3.4 (all and primary care residents per 100,000 population by state). The full street addresses of participating sites of ACGME-accredited residency programs were geocoded down to the census block level and used to identify sites located in either rural areas or MUAs for Measure 3.1.

**The American Medical Association FRIEDA™ database (AMA-FREIDA, 2013–2021)** allows searching for a residency or fellowship from more than 13,000 ACGME-accredited programs. The data provide information on whether the program in which training takes place is university-based, community-based but university affiliated, community-based, military-based, or other. This information is used to construct Measure 3.1 (percentage of primary care residents trained in community-based settings in the broad definition, i.e., the majority of training does not take place in a university academic medical center, or a hospital with a medical school affiliation) for academic years 2013–2014 to 2021–2022.

**The RTT Collaborative (RTT, 2013–2021)** provides a list of rural residency programs that includes the location for the rural community, rural hospitals, and rural family medicine/internal medicine/pediatrics practice where residents acquire more than 50% of their training (**https://rttcollaborative.net/rural-https://rttcollaborative.net/rttc-participating-programs**). This information is used to construct Measure 3.1 (percentage of primary care residents trained in community-based settings in the narrow definition, i.e., more than 50% of their training in a rural place) for academic years 2013–2014 to 2021–2022.

**The Health Resources and Services Administration Teaching Health Center Graduate Medical Education (THCGME, 2013–2021)** program dashboards (**https://data.hrsa.gov/tools/find-grants**) were used to construct Measure 3.1 (percentage of primary care residents trained in community-based settings in the narrow definition, i.e., HRSA THGME grant programs) for academic years 2013–2014 to 2021–2022.

## Other Data

**The National Institutes of Health Research Portfolio Online Reporting Tools Expenditures and Results (NIH RePORTER, 2017–2022)** module was used for Measure 5.1 (federal investment in primary care research). NIH RePORTER is a data tool that was used to query the publicly available database of all federally funded research projects. Data collected include grantee name and location (including state), department affiliation, type of grant, and dollar amounts. Data were available from fiscal year 2017 to 2022.

**Rural-Urban Continuum Codes (RUCC, 2013)**, developed and maintained by the United States Department of Agriculture (USDA) Economic Research Service, distinguish metropolitan counties by population size (50,000–249,999; 250,000–999,999; and 1,000,000 and up) and nonmetropolitan counties by their size (0–2,499; 2,500–19,999; and 20,000–49,999) and adjacency to metropolitan counties. For Measure 3.1 (percentage of all and primary care residents trained in rural areas and MUAs), we defined rural as nonmetropolitan counties (RUCC 4 through RUCC 9).

**The Health Resources and Services Administration Data Warehouse Medically Underserved Area (HRSA MUA, 2012–2021)** data were used for Measure 3.1 (percentage of all and primary care residents trained in rural areas and MUAs). The data used for this analysis were obtained from the HRSA Data Warehouse in CSV format, accessed September 20, 2022, at **https://data.hrsa.gov//DataDownload/DD_Files/MUA_DET.csv**. To construct trends, we used designation dates and withdrawal dates of MUAs to determine whether a particular area was designated as an MUA at a particular point in time from 2012 to 2021.

**The Robert Graham Center Social Deprivation Index (RGC SDI, 2012–2021)** is a composite measure developed and maintained by the RGC. It is based on factor analysis of the seven demographic characteristics collected in the ACS: percent living in poverty, percent with less than 12 years of education, percent single-parent households, the percentage living in rented housing units, the percentage living in the overcrowded housing unit, percent of households without a car, and percentage nonemployed adults under 65 years of age (**https://www.graham-center.org/maps-data-tools/social-deprivation-index.html**). The SDI measure is calculated annually at the four geographic areas: county, census tract, aggregated Zip Code Tabulation Area (ZCTA), and Primary Care Service Area (PCSA, v 3.1). For Measures 2.3 and 2.4 (PCPs, NPs, and PAs in areas above and below median SDI), we used the ZCTA-level SDI from 2012 to 2021.

**National Uniform Claim Committee Taxonomy Code (NUCC)** is a crosswalk between taxonomy codes used in NPPES data. It organizes taxonomy codes into groupings (e.g., "Allopathic & Osteopathic Physicians" or "Physician Assistants & Advanced Practice Nursing Providers"). Within groupings, the codes are further refined into classifications (e.g., "Family Medicine" or "Nurse Practitioner"), and, within classifications, taxonomies are differentiated by specialty (e.g., "Internal Medicine – Cardiology" or "Physician Assistant – Surgical"). This data file is updated frequently to reflect the addition and (rarely) the elimination of certain taxonomies. For this report, we used Version 5.0, accessed September 15, 2022, at **https://nucc.org/images/stories/CSV/nucc_taxonomy_221.csv**.

# OPERATIONALIZATIONS OF MEASURES

The measures described in this section are organized according to the five recommendations outlined in the National Academies of Sciences, Engineering, and Medicine (NASEM) report **Implementing High-Quality Primary Care: Rebuilding the Foundation of Health Care**. The measures were predefined by the NASEM committee in Appendix E of their report and were operationalized by the RGC research team. Most measures were calculated using the same method developed in Year 1 and were updated with more recent data (see Supplemental Table 1). In Year 2, some measures were refined to better address the NASEM committee's recommendations. Changes made in Year 2 are summarized in Supplemental Table 2. Because the NASEM committee did not define specific measures for Recommendation 4, that recommendation is not addressed in the methodology section. Instead, we explored potential measures and data sources, and summarized limitations and opportunities to strengthen the measures for Recommendation 4 in Supplemental Table 3.

## Recommendation 1: Pay for Primary Care Teams to Care for People, Not Doctors to Deliver Services

### Measure 1.1: Percentage of total spending going to primary care: commercial insurance

### Measure 1.2: Percentage of total spending going to primary care: Medicare

### Measure 1.3: Percentage of total spending going to primary care: Medicaid

These three measures were constructed using data from the 2010–2021 MEPS. We calculated the amount spent for primary care using the office-based and outpatient event files. For each visit reported in these files, there is detailed information about the provider of care and how the services were billed. Consistent with prior work, we use both a narrow definition and a broad definition of primary care. Narrowly, primary care includes physicians practicing in family medicine, general practice, geriatrics, internal medicine, pediatrics, and osteopathy. Please note that osteopathy is available as a separate category but no further differentiation is available in the MEPS data. The broader definition also includes mental health providers – psychiatrists, social workers, and psychologists – nurses/NPs, and PAs as well as obstetricians/gynecologists. In MEPS, PCPs were identified using DRSPLTY and nonphysicians using MEDPTYPE.

With each definition and each payer type, we calculated our numerator – national or state total primary care spending – by summing spending across all visits. We used OPDPVXXX, OPFPVXXX (outpatient), and OBPVXXX (office-based) to identify commercial insurance spending; OPDMRXXX, OPFMDXXX (outpatient), and OBMRXXX (office-based) for Medicare; and OPDMDXXX, OPFMDXXX (outpatient), and OBMDXXX (office-based) for Medicaid.

The denominator is the total spending for each payer type aggregated to either the state or national level. These measures were calculated by MEPS for each individual surveyed and are in the consolidated files: commercial spending is measured by TOTPRVXX, Medicare insurance by TOTMCRXX, and Medicaid by TOTMCDXX.

All our analyses were weighted using the person weight (PERWT), and standard errors were adjusted for the complex survey design using VARPSU for primary sampling units and VARSTR for the stratum. To obtain state estimates using MEPS data requires access to a secure and restricted data center. Because of concerns about confidentiality, such estimates can only be obtained for 29 states.

### Measures 1.1, 1.2, and 1.3: Percentage of Primary Care Spending by Payer Type, 2010–2021

| | Narrow | | | | Broad | | | |
|---|---|---|---|---|---|---|---|---|
| Year | All Insurance | Commercial | Medicare | Medicaid | All Insurance | Commercial | Medicare | Medicaid |
| 2010 | 5.8 | 6.9 | 4.0 | 5.1 | 10.0 | 11.7 | 7.4 | 9.0 |
| 2011 | 5.7 | 6.5 | 4.4 | 5.0 | 9.7 | 11.4 | 6.2 | 9.4 |
| 2012 | 5.4 | 6.1 | 3.9 | 4.8 | 9.4 | 11.1 | 6.0 | 9.0 |
| 2013 | 6.2 | 8.0 | 4.2 | 5.1 | 10.9 | 13.8 | 7.0 | 9.7 |
| 2014 | 5.7 | 7.1 | 4.1 | 5.3 | 10.9 | 13.1 | 7.3 | 13.3 |
| 2015 | 5.1 | 5.7 | 3.8 | 5.2 | 9.7 | 11.0 | 6.4 | 12.4 |
| 2016 | 5.4 | 6.3 | 4.3 | 4.8 | 10.5 | 12.1 | 7.7 | 12.1 |
| 2017 | 5.3 | 6.1 | 4.1 | 4.9 | 10.8 | 12.2 | 8.0 | 11.7 |
| 2018 | 5.5 | 6.5 | 4.2 | 4.8 | 11.6 | 14.1 | 7.4 | 12.0 |
| 2019 | 5.3 | 6.0 | 4.6 | 4.8 | 11.6 | 13.3 | 8.0 | 12.7 |
| 2020 | 4.6 | 5.6 | 3.5 | 4.2 | 12.1 | 15.1 | 7.4 | 12.7 |
| 2021 | 4.7 | 5.6 | 3.9 | 4.7 | 13.5 | 16.1 | 8.9 | 14.5 |

Data Source: Analyses of Medical Expenditure Panel Survey data, 2010–2021.

## Measure 1.4: Percentage of primary care patient care revenue from capitation

This measure was constructed using data from the 2010–2021 MEPS, which has been used in previous research on capitation.[5] This year, we intended to fully replicate the measure developed in Dr. Zuvekas' paper published in *Health Affairs* (2016) using confidential data available through AHRQ's research data center to calculate state-level data for this measure.

We contacted Dr. Zuvekas to request a detailed methodology for calculating the percentage of revenue from capitation, which he and his coauthor used in their 2016 study. In his communication, Dr. Zuvekas used data from the Medical Provider Component files (MPC) available through the AHRQ's research data center. However, he indicated that researchers could estimate the percentage of revenue for fully capitated visits using a variable called IMPFLAG in the HC public-use office-based and outpatient event files. The MEPS uses the capitation imputation procedure to complete event-level expenditures for persons in non-fee-for-service managed care plans. The IMPFLAG is a six-category measure and includes sources of the expenditure data on the event file. It indicates whether the data contain complete HC or MPC data and whether they are fully or partially imputed. IMPFLAG=1 are complete fee-for-service events from the HC data. IMPFLAG=2 are complete fee-for-service events from the MPC data, IMPFLAG=3 are the fully imputed data, IMPFLAG=4 are the partially imputed data, and IMPFLAG=5 are complete capitated events from the MPC data. The detailed capitation imputation methodology is described elsewhere: **https://www.meps.ahrq.gov/data_stats/download_data/pufs/h220g/h220gdoc.pdf** (pages C12–C14).

Dr. Zuvekas indicated that using the ratio of IMPFLAG=5/(IMPFLAG=2+IMPFLAG=5) would yield a percentage of fully capitated visits, which approximates the indicator that he and his coauthor used in their 2016 study. Explaining why the estimates differ when using restricted MPC data versus public-use HC (office-based and outpatient) event files, Dr. Zuvekas said, "It's an approximation because there is a small set of MPC events with partial payment/

charge data but a valid FEEORCAP value that you cannot see in the public-use files directly but are distributed in the other IMPFLAG categories. These partial cases are more likely to be reported in the MPC as fee-for-service, so this approximation gives a 10% higher estimate of capitation than the internal variable we use. That is, where we calculated 5% using FEEORCAP, the approximation gives something like 5.5%."

Based on our communication with Dr. Zuvekas and our own exploration, we prefer the public-use event files with the imputation flag because of the small number of events for which there were matching MPC data (not everyone signs permission forms, so small sample sizes are still a problem) to calculate state-level data for this measure. As noted for the primary care spending measures, we used DRSPLTY in the outpatient and office-based event files to differentiate visits to PCPs and non-PCPs. For this measure, we use a narrow definition only. Primary care includes family medicine, general practice, geriatrics, internal medicine, pediatrics, and osteopathy. The unit of analysis is a visit with a physician (SEEDOC_M18), seen at the location (DOCATLOC). We calculated the percentage of visits to PCPs that are fully capitated. So, the numerator is the total number of visits to PCPs where the imputation flag indicates that the visit was completely capitated (IMPFLAG=5) and the denominator is equal to the sum of fee-for-service visits and capitated visits to PCPs (IMPFLAG=2+IMPFLAG=5).

**Measure 1.4: Percentage of Fully Capitated Physician Visits, 2010–2021**

| Year | All Physician Visits | PCP Visits | Non-PCP Visits |
|---|---|---|---|
| 2010 | 6.4 | 8.7 | 4.4 |
| 2011 | 7.0 | 9.9 | 4.6 |
| 2012 | 5.5 | 8.1 | 3.5 |
| 2013 | 5.5 | 7.7 | 4.0 |
| 2014 | 5.1 | 7.4 | 3.5 |
| 2015 | 7.1 | 8.9 | 5.0 |
| 2016 | 6.8 | 8.6 | 4.7 |
| 2017 | 6.7 | 9.3 | 4.9 |
| 2018 | 6.5 | 9.6 | 4.4 |
| 2019 | 5.7 | 7.7 | 4.4 |
| 2020 | 6.2 | 7.6 | 5.3 |
| 2021 | 4.8 | 7.4 | 3.3 |

Data Source: Analyses of Medical Expenditure Panel Survey data, 2010–2021.

## Recommendation 2: Ensure That High-Quality Primary Care Is Available to Every Individual and Family in Every Community

### Measure 2.1: Percentage of adults without a usual source of health care

### Measure 2.2: Percentage of children without a usual source of health care

For these two measures, we used the 2010–2021 MEPS. The percentage of adults and children without a usual source of care is defined by report by the respondent who answered the question "Is there a particular doctor's office, clinic, health center or other place that {you/{PERSON}} usually {go/goes} if {you/he/she} {are/is} sick or {need/needs} advice about {your/his/her} health?" In addition, we categorized individuals as not having a usual source of care

if they first answered "yes" to the previous question , but on a subsequent question reported that such location was the emergency room. Note that respondents answered this question for themselves as well as for other family members. Adults were defined as 18 years or older; children were defined as less than 18 years old.

Again, our analyses are weighted using the person weight (PERWT), and standard errors were adjusted for the complex survey design using VARPSU for primary sampling units and VARSTR for the stratum. State estimates were possible for 29 states with access to AHRQ's research data center. For reasons of confidentiality, AHRQ does not allow estimates to be calculated for smaller states.

### Measures 2.1 and 2.2: Percentage of Adults and Children without a Usual Source of Care, 2010–2021

| Year | Adults | Children |
|---|---|---|
| 2010 | 23.6 | 10.0 |
| 2011 | 23.6 | 8.4 |
| 2012 | 24.4 | 9.4 |
| 2013 | 24.8 | 7.8 |
| 2014 | 24.0 | 8.0 |
| 2015 | 23.9 | 7.1 |
| 2016 | 24.2 | 8.0 |
| 2017 | 24.4 | 6.9 |
| 2018 | 27.4 | 9.0 |
| 2019 | 29.0 | 10.8 |
| 2020 | 27.1 | 10.3 |
| 2021 | 28.7 | 13.6 |

Data Source: Analyses of Medical Expenditure Panel Survey data, 2010–2021.

### Measure 2.3: Primary care physicians, nurse practitioners, and physician assistants (and combined) per 100,000 population in areas above median Social Deprivation Index

### Measure 2.4: Primary care physicians, nurse practitioners, and physician assistants (and combined) per 100,000 population in areas below median Social Deprivation Index

This year, we refined these two measures. First, we used an alternative definition of medically underserved communities, by shifting from county-level MUA designations to ZCTA-level SDIs. MUAs are widely used in multiple federal programs to identify a shortage of primary care professional health services. However, besides poverty, there are no other indicators covering the multiple domains of social need that impact health. (See **Scoring Shortage Designations | Bureau of Health Workforce ([hrsa.gov])**. It is also important to note that MUA designation areas are determined by applications to state primary care offices, which can be cumbersome and therefore not updated on a regular basis. This means that the designation of areas in need depends on their identification by local or state officials, is updated upon submission only, and can lag for many years. The SDI, on the other hand, is not subject to this "application bias" as it is based on the American Communities Survey, which is updated on a

regular basis. Second, we included NPs and PAs as key primary care clinicians who often work in underserved areas and care for vulnerable populations. In the following pages we explain how to create these measures.

**Identify PCPs:**

For each year from 2012 to 2021, we started with data from the AMA Masterfile to identify PCPs in direct patient care. PCPs in direct patient care (AMA Practice Type 020) exclude residents and retirees. We also adjusted status based on age to adjust for the likelihood that physicians listed as being in direct contact with patients have actually retired.[6,7] Primary care includes physicians (doctor of medicine [MD] or doctor of osteopathic medicine [DO]) in family medicine (AMA specialty code FM), general practice (GP), geriatrics (IMG and FPG), internal medicine (IM), pediatrics (PD), and combined internal medicine and pediatrics (MPD).

A growing number of physicians listing a primary care specialty are working as hospitalists or in emergency departments. To identify these physicians, we used the Medicare PartB PUF from 2012 to 2021, which includes the volume of services rendered by provider and service. These data were then linked to the AMA Masterfile using the MENUM-NPI crosswalk. Physicians identified as primary care in the AMA Masterfile were reclassified as non-primary care if they billed 90% or more of their evaluation and management (E&M) services from either a hospital or an emergency department rather than an office setting. We applied a commonly used 90% threshold from prior literature. In the absence of more formal identification of hospitalists, researchers established approaches to identify hospitalists using thresholds of inpatient services billed, typically 90%, in claims data.[8-10]

We also used the Medicare PartB PUF to identify physicians with unspecified specialty (AMA specialty code US) and unknown practice type (AMA Practice Type 100). Specifically, if the AMA specialty was unknown, we used specialty information listed in the Medicare PartB PUF data. We also inferred that if a physician was billing Medicare, they were in direct patient care.

**Identify NPs and PAs in primary care:**

Since there is not a national workforce database comparable to the AMA Masterfile for NPs and PAs, we used the PECOS in conjunction with the Medicare PartB PUF and the NPPES data to identify NPs and PAs working in primary care. The approach used in this analysis builds on our earlier attempts to identify NPs and PAs working in primary care.[11]

PECOS is a system of records detailing providers enrolled in Medicare. It is relatively unusual in that it is possible to link most individual providers to a particular organization to which they reassigned their billing rights. Using the PECOS data from 2016 to 2021, NPs and PAs in primary care were identified based on the relative share of PCPs in the same practice with the assumption that the characteristics of the physicians in a practice can be used to infer the likely specialty of NPs and PAs in the same practice. We assumed that NPs and PAs working alongside PCPs specialized in primary care, while those in practices with no PCPs were not in primary care. For multispecialty practices, we assumed that the relative share of PCPs in the practice was equal to the relative composition of NPs and PAs. NPs and PAs working in rural health clinics and federally qualified health centers were classified as primary care. NPs and PAs working primarily with social workers and psychologists were reclassified to non-primary care. Furthermore, based on the "organization type" information in PECOS, we classified NPs

and PAs working in retail clinics, critical access hospitals, and skilled nursing facilities as non-primary care.

The Medicare PartB PUF provides information regarding services and procedures performed on Medicare beneficiaries, which allowed us to further elucidate the type of practice based on billing code information. The Medicare PartB PUF was also used to identify NPs and PAs in non-primary care settings such as hospitals, emergency departments, nursing homes, assisted living facilities, home health, and mental health facilities based on billing codes.

In cases where NPs and PAs were not in a practice with physicians (mainly because they did not reassign their billing rights if their Medicare enrollment status was "order and referring" only), we used the x-y coordinates of their NPPES address to determine whether they were collocated with physicians. Lastly, we assumed that NPs and PAs working in practices not composed of physicians or other health care providers work in primary care if there was insufficient data to reclassify them as non-primary care.

**Link workforce to the ZCTA-level SDI data:**

Finally, we linked the ZCTA-level SDI data and population data with the geocoded PCP, NP, and PA files described earlier in this appendix. We first created a binary measure of SDI based on the population-weighted median as the cutoff. For every state and the District of Columbia, we then determined the total population and the number of PCPs, NPs, PAs, and total primary care clinicians in both above median (high SDI – more disadvantaged) and below median (low SDI – less disadvantaged) SDI areas. With these totals, we then calculated the number of PCPs, NPs, PAs, and total primary care clinicians per 100,000 population in areas above median SDI (Measure 2.3) and in areas below median SDI (Measure 2.4).

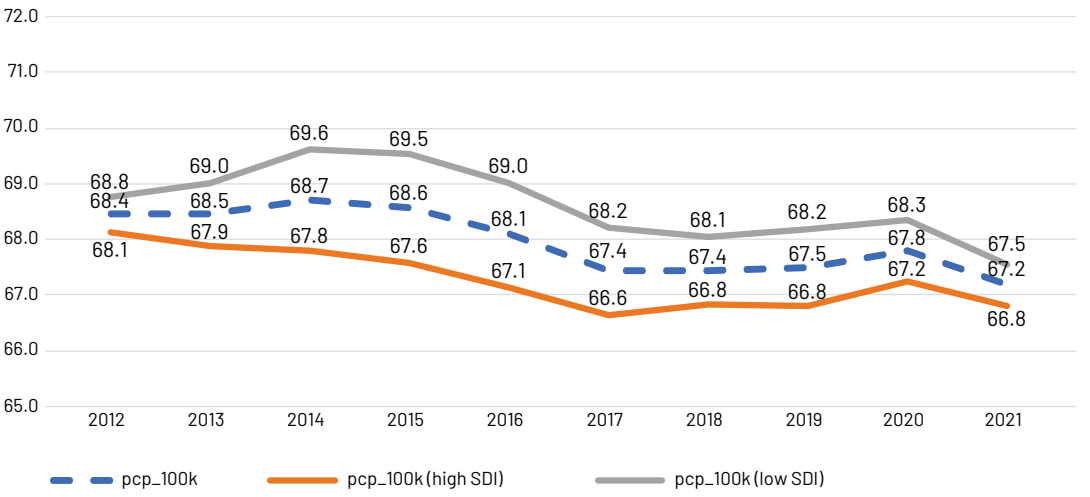
**Measures 2.3 and 2.4: Primary Care Clinicians in High vs. Low SDI Areas, 2012–2021**

| | | High SDI (SDI ≥ Median) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | N | | | | Rate per 100,000 | | | |
| Year | Population | PCPs | PCNPs | PCPAs | PCCs | PCPs | PCNPs | PCPAs | PCCs |
| 2012 | 152,706,658 | 104,042 | | | | 68.1 | | | |
| 2013 | 153,926,612 | 104,502 | | | | 67.9 | | | |
| 2014 | 155,241,673 | 105,247 | | | | 67.8 | | | |
| 2015 | 156,475,046 | 105,749 | | | | 67.6 | | | |
| 2016 | 157,508,983 | 105,757 | 28,287 | 13,712 | 147,756 | 67.1 | 18.0 | 8.7 | 93.8 |
| 2017 | 158,745,052 | 105,803 | 31,420 | 14,307 | 151,531 | 66.6 | 19.8 | 9.0 | 95.5 |
| 2018 | 159,757,297 | 106,771 | 35,015 | 15,437 | 157,222 | 66.8 | 21.9 | 9.7 | 98.4 |
| 2019 | 160,638,634 | 107,326 | 38,989 | 16,231 | 162,546 | 66.8 | 24.3 | 10.1 | 101.2 |
| 2020 | 161,642,549 | 108,689 | 44,150 | 18,140 | 170,979 | 67.2 | 27.3 | 11.2 | 105.8 |
| 2021 | 163,206,906 | 109,041 | 52,514 | 20,813 | 182,367 | 66.8 | 32.2 | 12.8 | 111.7 |

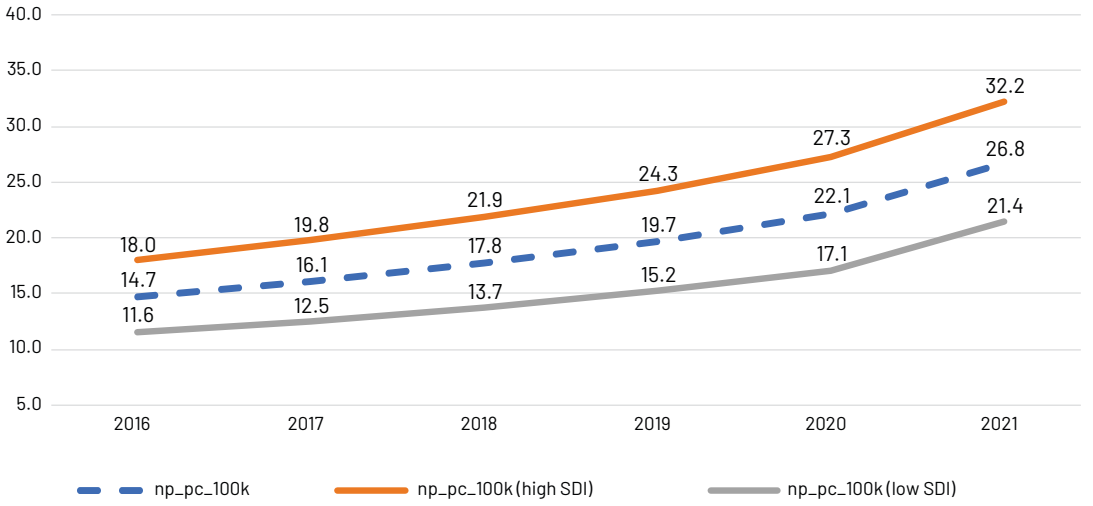
| | | Low SDI (SDI < Median) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | N | | | | Rate per 100,000 | | | |
| Year | Population | PCPs | PCNPs | PCPAs | PCCs | PCPs | PCNPs | PCPAs | PCCs |
| 2012 | 156,415,911 | 107,543 | | | | 68.8 | | | |
| 2013 | 157,594,369 | 108,758 | | | | 69.0 | | | |
| 2014 | 158,850,817 | 110,590 | | | | 69.6 | | | |
| 2015 | 160,028,249 | 111,256 | | | | 69.5 | | | |
| 2016 | 161,036,370 | 111,133 | 18,618 | 10,667 | 140,418 | 69.0 | 11.6 | 6.6 | 87.2 |
| 2017 | 162,246,172 | 110,685 | 20,267 | 10,892 | 141,844 | 68.2 | 12.5 | 6.7 | 87.4 |
| 2018 | 163,132,280 | 111,013 | 22,417 | 11,454 | 144,884 | 68.1 | 13.7 | 7.0 | 88.8 |
| 2019 | 164,043,778 | 111,850 | 24,931 | 12,074 | 148,855 | 68.2 | 15.2 | 7.4 | 90.7 |
| 2020 | 164,907,066 | 112,696 | 28,179 | 14,650 | 155,526 | 68.3 | 17.1 | 8.9 | 94.3 |
| 2021 | 166,514,754 | 112,469 | 35,697 | 17,555 | 165,721 | 67.5 | 21.4 | 10.5 | 99.5 |

Data Source: Analyses of American Medical Association Masterfile (2012–2021), Centers for Medicare and Medicaid Services Medicare Provider Enrollment, Chain, and Ownership System data (2016–2021), National Plan and Provider Enumeration System data (2016–2021), Centers for Medicare and Medicaid Services Physician and Other Practitioners data (2012–2021), Robert Graham Center Social Deprivation Index (2012–2021), and the American Community Survey Five-Year Summary Files (2012–2021).

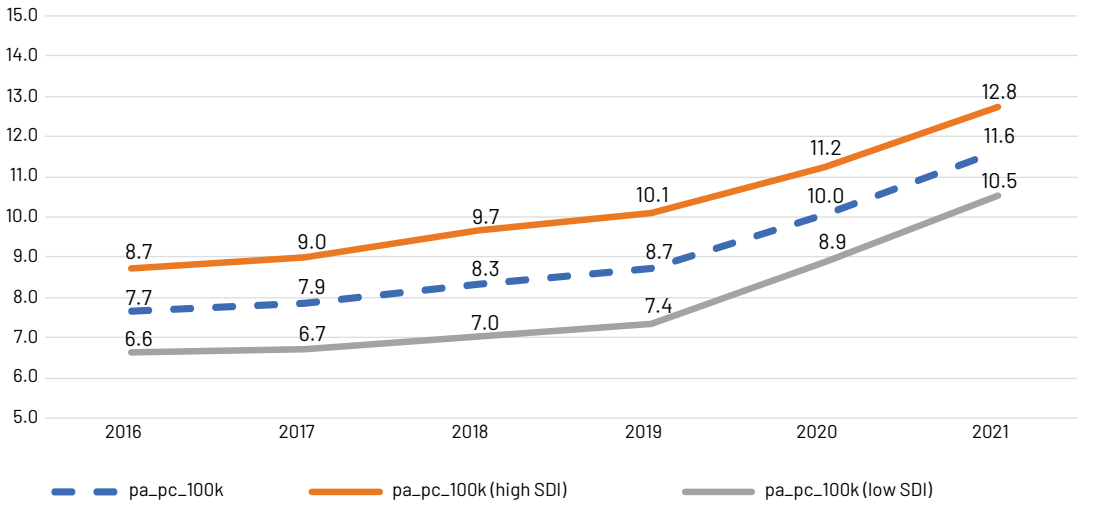
## Primary Care Physicians per 100,000 Population, by SDI



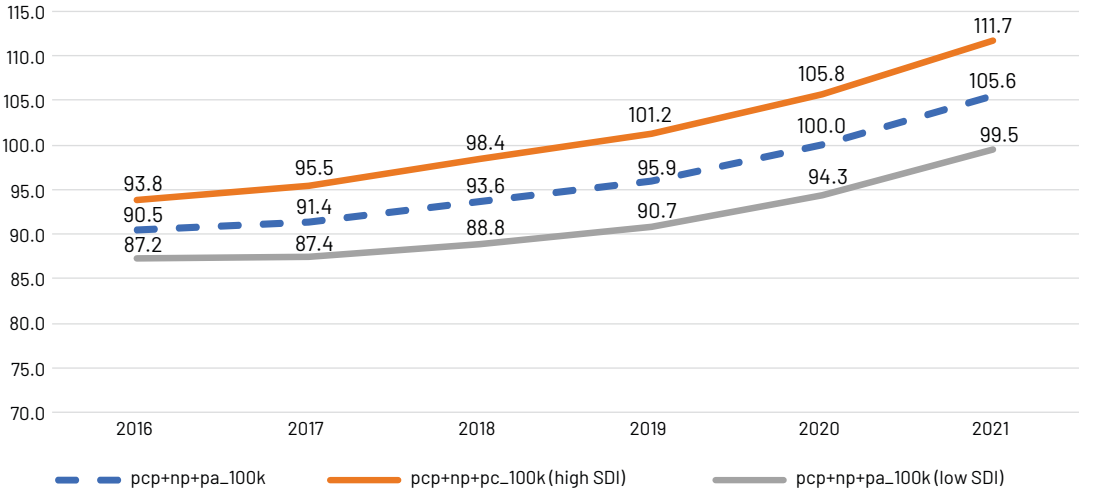
## Primary Care Nurse Practitioners per 100,000 Population, by SDI




## Primary Care Physician Assistants per 100,000 Population, by SDI




## Primary Care Clinicians per 100,000 Population, by SDI



# Recommendation 3: Train Primary Care Teams Where People Live and Work

## Measure 3.1:

## Percentage of all and primary care residents trained in rural areas and medically underserved areas

## Percentage of primary care residents trained in community-based settings

For this measure, we used site-level residency program data from academic years 2012–2013 to 2021–2022 publicly available from ACGME (**https://apps.acgme.org/ads/Public/Request/PublicDataRequest**). The full street addresses of participating sites of ACGME-accredited residency programs were geocoded down to the census block level and linked to our MUA file at the census block level. We used the Geocorr engine at the Missouri Census Data Center to identify all blocks in ZCTAs. We classified a ZCTA as an MUA if more than 25% of its population was also in an MUA. We used the same approach to determine whether a ZCTA was rural.

In the ACGME program-level data, we used the "number of positions filled" field to obtain a count of the number of residents from academic years 2012–2013 to 2021–2022 in each program. The denominators of the measure are the total number of residents in an ACGME-accredited program for each year and each state. The numerators represent those residents in programs that included at least one site that was in a rural county and located in an MUA.

We also calculated the percentage of primary care residents trained in rural areas and MUAs using the same approach. The denominators are total number of primary care residents aggregated to either the state or national level. The numerators represent those primary care residents trained in rural areas and MUAs. Primary care specialties included family medicine, internal medicine, geriatrics, and pediatrics. Please note that historically, the ACGME counts are restricted to counts of residents in the ACGME-accredited programs, thus excluding residents in programs accredited by the American Osteopathic Association.

**New definition of community-based training:**

This year, we further elucidated the type of training in community-based settings. We adopted two definitions. In the broad definition, community-based training was identified if the majority of training did not take place in a university academic medical center or a hospital with a medical school affiliation, according to the American Medical Association's FRIEDA database. In the narrow definition, community-based training was identified if the training utilized programs with a rural training track, where residents spend more than 50% of their training in a rural place (according to at least two federal definitions), or a program supported by a Health Resources and Services Administration Teaching Health Center Graduate Medical Education grant.

With each definition, we used the "number of positions filled" field in the ACGME program-level data to obtain a count of the number of residents from academic years 2013–2014 to 2021–2022 in each program. The denominators are total number of primary care residents aggregated to either the state or national level. The numerators represent those primary care residents in programs with each definition of community-based training. Primary care specialties included family medicine, internal medicine, geriatrics, and pediatrics.

### Measure 3.1: Primary Care Residents Trained in Rural Settings, MUAs, and Community-Based Settings, 2012–2021

| | N | | | | | | % | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Academic Year | Total PC Residents | Rural | MUA | Both | Community (Broad) | Community (Narrow) | Rural | MUA | Both | Community (Broad) | Community (Narrow) |
| 2012–2013 | 43,668 | 2,894 | 27,194 | 27,811 | | | 6.6 | 62.3 | 63.7 | | |
| 2013–2014 | 44,393 | 3,046 | 27,738 | 28,356 | 3,988 | 965 | 6.9 | 62.5 | 63.9 | 9.0 | 2.2 |
| 2014–2015 | 44,954 | 2,986 | 27,825 | 28,483 | 4,185 | 1,034 | 6.6 | 61.9 | 63.4 | 9.3 | 2.3 |
| 2015–2016 | 46,006 | 3,086 | 28,183 | 28,859 | 4,391 | 1,160 | 6.7 | 61.3 | 62.7 | 9.5 | 2.5 |
| 2016–2017 | 47,963 | 3,490 | 29,496 | 30,247 | 4,617 | 1,309 | 7.3 | 61.5 | 63.1 | 9.6 | 2.7 |
| 2017–2018 | 50,308 | 3,877 | 30,448 | 31,245 | 5,836 | 1,670 | 7.7 | 60.5 | 62.1 | 11.6 | 3.3 |
| 2018–2019 | 52,068 | 4,250 | 31,543 | 32,380 | 6,243 | 2,012 | 8.2 | 60.6 | 62.2 | 12.0 | 3.9 |
| 2019–2020 | 53,656 | 4,713 | 32,565 | 33,452 | 7,424 | 2,155 | 8.8 | 60.7 | 62.3 | 13.8 | 4.0 |
| 2020–2021 | 54,825 | 4,557 | 32,883 | 33,993 | 7,970 | 2,427 | 8.3 | 60.0 | 62.0 | 14.5 | 4.4 |
| 2021–2022 | 56,215 | 4,846 | 33,529 | 34,751 | 8,603 | 2,578 | 8.6 | 59.6 | 61.8 | 15.2 | 4.6 |

Abbreviation: MUA, medically underserved area.
Data Sources: Analyses of Accredited Council of Graduate Medical Education (2012–2021); American Medical Association FRIEDA database (2013–2021); a rural residency program list from the RTT Collaborative (2013–2021); Health Resources and Services Administration Teaching Health Center Graduate Medical Education program dashboards (2013–2021); Rural-Urban Continuum Codes (2013); and Health Resources and Services Administration Data Warehouse Medically Underserved Area (2012–2021).

## Measure 3.2: Percentage of physicians, nurse practitioners, and physician assistants (and combined) working in primary care

For this measure, we identified NPs and PAs working in primary care using the same method and the same data described in Measures 2.3 and 2.4. As for physicians in primary care, instead of using the AMA Masterfile, we used the PECOS in conjunction with the Medicare PartB PUF to create an alternative measure of physicians in primary care from 2016 to 2021. PCPs were identified using the provider type description measure that includes information about the provider enrollment and enrollment specialty type description in the PECOS data. Primary care specialties included family medicine, family practice, general practice, internal medicine, and pediatric medicine. All other specialties were considered non-primary care. In calculating the percentage of physicians, NPs, and PAs (and combined) working in primary care, we used the total number of clinicians (each clinician type and combined) aggregated to either the state or national level as the denominators. The numerators represent those clinicians working in primary care.

### Measure 3.2: Percentage of Clinicians Working in Primary Care, 2016–2021

| Year | Physicians | PCPs | % | NPs | PCNPs | % | PAs | PCPAs | % | Clinicians | PCCs | % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 709,687 | 197,977 | 27.9 | 147,697 | 46,905 | 31.8 | 89,718 | 24,379 | 27.2 | 947,102 | 269,261 | 28.4 |
| 2017 | 722,718 | 198,697 | 27.5 | 164,497 | 51,687 | 31.4 | 96,214 | 25,199 | 26.2 | 983,429 | 275,583 | 28.0 |
| 2018 | 740,817 | 201,945 | 27.3 | 185,425 | 57,432 | 31.0 | 104,034 | 26,891 | 25.8 | 1,030,276 | 286,268 | 27.8 |
| 2019 | 759,185 | 205,685 | 27.1 | 208,847 | 63,920 | 30.6 | 112,160 | 28,305 | 25.2 | 1,080,192 | 297,910 | 27.6 |
| 2020 | 781,680 | 211,684 | 27.1 | 235,491 | 72,329 | 30.7 | 120,865 | 32,790 | 27.1 | 1,138,036 | 316,803 | 27.8 |
| 2021 | 801,834 | 213,625 | 26.6 | 259,456 | 88,211 | 34.0 | 129,028 | 38,368 | 29.7 | 1,190,318 | 340,204 | 28.6 |

Abbreviations: NP, nurse practitioner; PA, physician assistant; PCC, primary care clinician; PCNP, primary care nurse practitioner; PCP, primary care physician; PCPA, primary care physician assistant.
Data Sources: Analyses of Centers for Medicare and Medicaid Services Medicare Provider Enrollment, Chain, and Ownership System data, National Plan and Provider Enumeration System data, and Centers for Medicare and Medicaid Services Physician and Other Practitioners data, 2016–2021.

## Measure 3.3: Percentage of new physician workforce entering primary care each year

For this measure, we used the 2023 AMA Historical Residency File, the 2023 AMA Masterfile, and the 2012–2021 Medicare PartB PUF data. The Historical Residency File allowed us to identify the end years of primary care physicians' training as a proxy for when they entered the workforce (end year + 1). We examined trends using end years from 2011 to 2020. Because we used the 2023 AMA data instead of 2021 data, we are relatively confident that nearly all had actually finished their training by 2021.[12, 13] Primary care includes physicians in family medicine (AMA specialty code FM), general practice (GP), geriatrics (IMG and FPG), internal medicine (IM), pediatrics (PD), and med-peds (MPD). The Medicare PartB PUF data were used to identify hospitalists with a primary care specialty and reclassify them as non-primary care.

In calculating the percentage of new physicians entering primary care, we used as the denominator the number of physicians who completed their training each year and as the numerator, the number of non-hospitalist PCPs. Note that the AMA Masterfile includes "preferred" and "alternative" addresses. The preferred address was used when it was the physician's office address, and the alternative address was used when the preferred address was their home address.

### Measure 3.3: Percent of New Physician Workforce Entering Primary Care, 2012–2021

| Year | New Entrants | PC Specialty | PC Hospitalists | % PCP | % PCP (Excl. Hospitalists) |
|---|---|---|---|---|---|
| 2012 | 24,381 | 5,288 | 1,875 | 21.7 | 14.0 |
| 2013 | 24,113 | 5,167 | 1,921 | 21.4 | 13.5 |
| 2014 | 24,725 | 5,193 | 2,052 | 21.0 | 12.7 |
| 2015 | 25,464 | 5,399 | 2,132 | 21.2 | 12.8 |
| 2016 | 25,377 | 5,459 | 2,080 | 21.5 | 13.3 |
| 2017 | 25,624 | 5,194 | 2,159 | 20.3 | 11.8 |
| 2018 | 25,854 | 5,298 | 2,269 | 20.5 | 11.7 |
| 2019 | 26,649 | 5,417 | 2,296 | 20.3 | 11.7 |
| 2020 | 26,922 | 5,559 | 2,236 | 20.6 | 12.3 |
| 2021 | 27,707 | 5,993 | 1,686 | 21.6 | 15.5 |

Abbreviations: PC, primary care; PCP, primary care physicians.
Data Sources: Analyses of the 2023 American Medical Association Historical Residency File, the 2023 American Medical Association Masterfile, and the 2012–2021 Center for Medicare and Medicaid Services Physician and Other Practitioners data

Also, it is important to note that the Historical Residency File used for this measure provides information on physicians' graduate medical education from the ACGME, but it does not include the AOA-accredited residency programs. The rates of DOs in the AMA Masterfile without training information varied from 35.0% (in 2011) to 44.6% (2023). It is likely to be an underestimate than actual numbers.

### Rates of "Unlinkage" between the AMA Masterfile and the Historical Residency File, by Type of Medical Degree

| Year | Doctor of Medicine [MD] | Doctor of Osteopathic Medicine [DO] |
|---|---|---|
| 2011 | 5.60% | 35.00% |
| 2012 | 5.60% | 34.90% |
| 2013 | 5.90% | 34.70% |
| 2014 | 5.80% | 35.00% |
| 2015 | 4.10% | 35.80% |
| 2016 | 4.80% | 35.40% |
| 2017 | 3.90% | 35.10% |
| 2018 | 11.80% | 43.20% |
| 2019 | 12.70% | 44.40% |
| 2020 | 12.80% | 43.40% |
| 2021 | 10.90% | 41.10% |
| 2022 | 11.10% | 42.50% |
| 2023 | 12.10% | 44.60% |

Data Sources: Analyses of the 2023 American Medical Association Historical Residency File and the 2011–2023 American Medical Association Masterfile.

## Measure 3.4: All and primary care residents per 100,000 population by state

We used publicly available ACGME program-level data for academic years 2012–2013 to 2021–2022. Residents per program are defined as the number of filled positions in an academic year. State counts were obtained by rolling up program counts to the state level. We used census population estimates for 2012–2019 and 2021, and actual census counts for 2020 available from the AHRF. Primary care specialties included family medicine, internal medicine, geriatrics, and pediatrics. Because the data we used for this measure are from the ACGME, we did not include the AOA-accredited residency programs.

### Measure 3.4: All Residents and Primary Care Residents per 100,000 Population, 2012–2021

| | | N | | Rate per 100,000 | |
|---|---|---|---|---|---|
| Academic Year | Population | All Medical | Primary Care | All Medical | Primary Care |
| 2012–2013 | 313,914,040 | 116,847 | 43,668 | 37.2 | 13.9 |
| 2013–2014 | 316,128,839 | 119,163 | 44,393 | 37.7 | 14.0 |
| 2014–2015 | 318,857,056 | 120,643 | 44,954 | 37.9 | 14.1 |
| 2015–2016 | 321,418,820 | 123,449 | 46,006 | 38.4 | 14.3 |
| 2016–2017 | 323,127,513 | 128,706 | 47,963 | 39.9 | 14.9 |
| 2017–2018 | 325,719,178 | 134,293 | 50,308 | 41.3 | 15.5 |
| 2018–2019 | 327,167,434 | 139,235 | 52,068 | 42.6 | 15.9 |
| 2019–2020 | 328,239,523 | 144,019 | 53,656 | 43.9 | 16.3 |
| 2020–2021 | 329,484,123 | 147,199 | 54,825 | 45.0 | 16.7 |
| 2021–2022 | 331,893,745 | 151,629 | 56,215 | 46.0 | 17.0 |

Data Sources: Analyses of Accredited Council of Graduate Medical Education program-level data to get counts for medical residents and Area Health Resource File for the population data, 2012–2021.

# Recommendation 5: Ensure That High-Quality Primary Care Is Implemented in the United States

## Measure 5.1: Investment in primary care research by federal agencies in dollars spent and percentage of total projects funded

In measuring investment in primary care research, our focus was to capture grant funding given to departments of family medicine at US medical schools because these institutions have traditionally housed such researchers and their staff, thereby serving as the research infrastructure of primary care.

Furthermore, family physicians have clinical practices that treat disparate populations, and their resultant community ties make them suited for not only providing quality primary care, but also translating research into practice. Hence, we treated federal research grant funding for departments of family medicine as a proxy for primary care research. Federal agencies in this measure included theAHRQ, the CDC, FDA, and NIH.

We began by benchmarking results from the downloaded database to available statistics stated in a study by Lucan and colleagues that analyzed data on all grants to departments of family medicine in 2006.[14] The researchers found not only that NIH grants to family medicine accounted for 0.2% of all awards in the period of analysis, but also that family medicine was underrepresented on NIH advisory committees, indicating underrepresentation in funding and in shaping NIH direction. We found concordance in the funding for family medicine, as well as the share of overall NIH grant funding.

Secondary data from the NIH RePORTER tool were collected for use in this analysis. This online tool provides users access to reports and raw data of the entire set of grant-awarded projects for a given fiscal year, going back to 1985. Using the **ExPORTER** feature, we downloaded information from 2017 to 2022, where each observation is a funded proposal, with identifying detail. It was then possible to calculate total funding (direct costs, indirect costs, subproject costs) across all grant types, for allprimary investigator–affiliated academic departments of family medicine located in the US, and to calculate what proportion this accounts for across total funding for each fiscal year. Note that these dollar figures are not adjusted for inflation.

One limitation is the risk of misclassification of research by errors of either omission or commission. Other entities or departments outside of family medicine may also have funded research that aligns with the tenets of primary care but was excluded from this measure. Another limitation is that the current measure does not capture research affiliated with national organizations for primary care or family medicine (such as the North American Primary Care Research Group) that also aim to build research capacity, especially as it relates to practice-based research.[15]

In future iterations of this Scorecard, this metric may incorporate methods that can better identify projects relating to primary care that are housed outside departments of family medicine or funded by these national primary care organizations, which are becoming well established in the primary care research infrastructure.

## Measure 5.1: Federal Funding by Agency, 2017–2022

| | Dollars | | | | | | Percentages | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Federal Agency** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** |
| AHRQ | $16,808,518 | $7,738,123 | $5,053,796 | $5,315,667 | $4,405,180 | $3,604,556 | 21.3% | 9.7% | 5.7% | 5.2% | 4.1% | 3.0% |
| CDC | $5,995,126 | $8,127,993 | $9,925,083 | $7,423,114 | $4,475,820 | $6,843,952 | 7.6% | 10.2% | 11.2% | 7.2% | 4.1% | 5.8% |
| FDA | 0 | 0 | 0 | 0 | 0 | $300,000 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.3% |
| NIH | $56,196,639 | $63,713,823 | $73,698,022 | $90,025,198 | $99,563,986 | $107,569,027 | 71.1% | 80.1% | 83.1% | 87.6% | 91.8% | 90.9% |
| | **$79,000,283** | **$79,579,939** | **$88,676,901** | **$102,763,979** | **$108,444,986** | **$118,317,535** | **100.0%** | **100.0%** | **100.0%** | **100.0%** | **100.0%** | **100.0%** |

Abbreviations: AHRQ, Agency for Healthcare Research and Quality; CDC, the Centers for Disease Control and Prevention; FDA, Food and Drug Administration; NIH, National Institutes of Health.
Data Source: NIH RePORTER, 2017–2022.

# SUPPLEMENTAL TABLES

## Supplemental Table 1: Measures and Data Sources in Year 2 Scorecard

**Recommendation 1: Pay for Primary Care Teams to Care for People, Not Doctors to Deliver Services**

| | Measure | Operationalization | Data Source |
|---|---|---|---|
| 1.1–1.3 | Percentage of total spending going to primary care—commercial insurance/Medicare/Medicaid | $PC\ Spend = \frac{Total\ PC\ Expenditures}{Total\ Health\ Care\ Expenditures}$<br>• Numerator: All billed expenses for office-based and outpatient visits to primary care physicians including family medicine, general practice, geriatrics, internal medicine, pediatrics, and osteopathy (narrow) *or* primary care physicians plus nurses/nurse practitioners, physician assistants, behavioral health providers, and obstetricians/gynecologists (broad), by payer type – commercial insurance/Medicare/Medicaid<br>• Denominator: Sum of billed expenditures for total health care | MEPS 2010–2021 |
| 1.4 | Percentage of primary care patient care revenue from capitation | $PC\ Capitation = \frac{Total\ Fully\ Capitated\ PCP\ Visits}{Total\ PCP\ Visits}$<br>• Numerator: Total number of office-based and outpatient visits to primary care physicians (narrow) that were completely capitated<br>• Denominator: Sum of fee-for-service visits and capitated visits to primary care physicians (narrow) | MEPS 2010–2021 |

| Recommendation 2: Ensure That High-Quality Primary Care Is Available to Every Individual and Family in Every Community | | | |
|---|---|---|---|
| 2.1–2.2 | Percentage of adults/children without a usual source of health care (USC) | $No\ USC = \frac{Total\ Respondents\ without\ a\ USC}{Total\ Respondents}$<br>• Numerator: Total number of adults (≥18yrs) and children (<18yrs) reporting no usual source of care and those who reported emergency rooms as the usual source of care<br>• Denominator: Total number of adults (≥18yrs) and children (<18yrs) respondents | MEPS 2010–2021 |
| 2.3–2.4 | Primary care physicians, nurse practitioners, and physician assistants (and combined) per 100,000 population in areas above and below median Social Deprivation Index | • Identify PCPs: The AMA Masterfile was used to identify primary care physicians providing direct patient care (excluding residents and retirees). Primary care specialty includes family medicine, general practice, geriatrics, internal medicine, pediatrics, and med-peds. Physicians identified as primary care in the AMA Masterfile were reclassified as non-primary care if they billed 90% or more of their evaluation and management (E&M) services from a hospital or an emergency department rather than an office setting based on CMS Physician and Other Practitioners data (hereafter Medicare PartB PUF).<br>• Identify NPs and PAs in primary care: Since there is not a national workforce database comparable to the AMA Masterfile for NPs and PAs, we used the PECOS in conjunction with the Medicare PartB PUF and the NPPES data to identify NPs and PAs working in primary care.<br>  • Using the PECOS data, NPs and PAs in primary care were identified based on the relative share of PCPs in the same practice with the assumption that the characteristics of the physicians in a practice can be used to infer the likely specialty of NPs and PAs in the same practice. NPs and PAs working in rural health clinics and federally qualified health centers were reclassified as primary care, while those working primarily with social workers and psychologists or working in retail clinics, critical access hospitals, and skilled nursing facilities were reclassified as non-primary care.<br>  • The Medicare PartB PUF was used to identify NPs and PAs in non-primary care settings such as hospitals, emergency departments, nursing homes, assisted living facilities, home health, and mental health facilities based on billing codes.<br>  • In cases where NPs and PAs were not in a practice with physicians (mainly because they did not reassign their billing rights if their Medicare enrollment status was "order and referring" only), we used the x-y coordinates of their NPPES address to determine whether they were collocated with physicians.<br>• We linked the ZCTA-level SDI data and population data with the geocoded PCP, NP, and PA files created above.<br>• For each state, we then determined the total population and the number of PCPs, NPs, PAs, and total primary care clinicians in both above- and below-median SDI areas. With these totals, we then calculated the number of PCPs, NPs, PAs, and total primary care clinicians per 100,000 population in areas above median SDI (more disadvantaged areas) and in areas below median SDI (less disadvantaged areas). | AMA Masterfile 2012–2021<br>PECOS 2016–2021<br>NPPES 2016–2021<br>Medicare PartB PUF 2012–2021<br>ACS 2012–2021<br>RGC SDI 2012–2021 |

| | | | |
|---|---|---|---|
| **Recommendation 3: Train Primary Care Teams Where People Live and Work** | | | |
| 3.1 | Percentage of all residents and primary care residents trained in rural areas and medically underserved areas<br>Percentage of primary care residents trained in community-based settings | $\text{Residents in Rural and MUA} = \frac{\text{Total Residents in Rural and MUA}}{\text{Total Residents}}$<br>• Numerator: All ACGME-accredited program participating site addresses were geocoded to the census block level to identify sites located in rural areas and MUAs. Counts of all residents and primary care residents in programs with at least one rural or MUA site were obtained for each state where program was located.<br>• Denominator: Total number of all and primary care residents in an ACGME-accredited program for each state<br>$\text{PC Residents in Community} = \frac{\text{Total PC Residents in Community}}{\text{Total PC Residents}}$<br>• Refined definition of community-based training: We further identified community-based training if the majority of training (1) did not take place in a university academic medical center or a hospital with a medical school affiliation (broad) or (2) included programs with rural training track or THCGME (narrow). | ACGME 2012–2021<br>AMA-FREIDA 2013–2021<br>RTT 2013–2021<br>THCGME 2013–2021<br>RUCC 2013<br>HRSA MUA 2012–2021 |
| 3.2 | Percentage of physicians, nurse practitioners, and physician assistants (and combined) working in primary care | $\text{Clinicians in PC} = \frac{\text{Total Clinicians in PC}}{\text{Total Clinicians}}$<br>• Numerator: Total number of PCPs, NPs, PAs, and total primary care clinicians for each state<br>  • Identify PCPs: PCPs were identified using a provider type description measure that includes information about the provider enrollment and enrollment specialty type description in the PECOS data. Primary care specialties included family medicine, family practice, general practice, internal medicine, and pediatric medicine.<br>  • Identify NPs and PAs in primary care: see Measures 2.3 and 2.4 for details<br>• Denominator: Total number of clinicians (physicians, NPs, and PAs) for each state | PECOS 2016–2021<br>NPPES 2016–2021<br>Medicare PartB PUF 2016–2021 |
| 3.3 | Percentage of new physician workforce entering primary care each year | $\text{New Entrants in PC} = \frac{\text{Total New Entrants in PC}}{\text{Total New Entrants}}$<br>• Numerator: Counts of all new primary care physicians (excluding hospitalists) for all states (using AMA practice address state)<br>• Denominator: Total number of physicians who completed their training each year | AMA Masterfile 2023<br>AMA Historical Residency File 2023<br>Medicare PartB PUF 2012–2021 |
| 3.4 | All residents and primary care residents per 100,000 population by state | • Residents in an ACGME-accredited program were defined as the number of filled positions in an academic year. State counts were obtained by rolling up program counts to the state level.<br>• We used census populations for 2012–2021 to calculate the number of all and primary care residents per 100,000 population by state. | ACGME 2012–2021<br>AHRF 2012–2021 |
| **Recommendation 4: Design Information Technology That Serves the Patient, Family, and Interprofessional Care Team** | | | |
| | N/A | | |

| Recommendation 5: Ensure That High-Quality Primary Care Is Implemented in the United States | | | |
|---|---|---|---|
| 5.1 | Investment in primary care research by federal agencies in dollars spent and percentage of total projects funded | $PC\ Funding = \frac{Total\ Federal\ Funding\ in\ FM}{Total\ Federal\ Funding}$<br>• Using the NIH RePORTER tool, we calculated total funding (direct costs, indirect costs, subproject costs) across all grant types, for all PI-affiliated academic departments of family medicine located in the US.<br>• We calculated what proportion this accounts for across total funding for each fiscal year. | NIH RePORTER 2017–2022 |

## Supplemental Table 2: Changes in Year 2 Scorecard

| Measure | Year 1 | Year 2 |
|---|---|---|
| 2.3–2.4 | Primary care physicians per 100,000 population in MUAs vs. non-MUAs | Primary care physicians, nurse practitioners, and physician assistants (and combined) per 100,000 population in areas above and below median Social Deprivation Index<br>• Instead of MUA vs. non-MUA, we calculated workforce measures at the ZCTA-level SDI (high vs. low).<br>• We included NPs and PAs as well. |
| 3.1 | Percentage of physicians trained in rural areas and MUAs | Percentage of all residents and primary care residents trained in rural areas and MUAs<br>• We also calculated primary care residents.<br>Refined definition of community-based training: Percentage of primary care residents trained in community-based settings<br>• We further identified community-based training if the majority of training did not take place in a university academic medical center or a hospital with a medical school affiliation (broad) or included programs with rural training track or THCGME (narrow). |
| 3.2 | Percentage of physicians, nurse practitioners, and physician assistants working in primary care | Percentage of physicians, nurse practitioners, and physician assistants (and combined) working in primary care<br>• We also reported all primary care clinicians. |
| 3.4 | Residents per 100,000 population by state | All and primary care residents per 100,000 population by state<br>• We also calculated primary care residents. |

## Supplemental Table 3: Limitations of HIT Measures/Data Explored

| Data Source | Description | Potential Measure | Pros | Cons |
|---|---|---|---|---|
| National Electronic Health Records Survey (NEHRS) | The NEHRS is an annual source of information on the adoption and use of electronic health record (EHR) systems by office-based physicians and their practices in the United States (**https://www.cdc.gov/nchs/nehrs/about.htm**).<br>Prior to 2012, NEHRS was a supplement to the National Ambulatory Medical Care Survey (NAMCS), referred to as the NAMCS Electronic Medical Records Supplement. The annual data collected was similar to NEHRS and may be analyzed as a distinct data set.<br>Data from NEHRS can be used to produce state and national estimates of EHR adoption and capabilities, burden associated with EHRs, and progress physicians have made toward meeting the policy goals of the HITECH Act.<br>In more recent years, survey questions have also asked about Promoting Interoperability programs. | Percentage of primary care physicians engaging in electronically sending, receiving, searching/querying, and integrating any health information (4 domains of interoperability) | Since 2010, data from NEHRS can be used to make statistical estimates for each of the 50 US states and the District of Columbia (except 2018). | Only provider-level<br>As for state estimates, restricted data access via the NCHS RDC with fees<br>State-level estimates by physician specialty are unreliable due to small sample sizes.<br>National estimates by primary care are doable, but the NEHRS definition of primary care is different (general and family practice, internal medicine, OB/GYN, and pediatrics). |
| Health Information National Trends Survey (HINTS) | The HINTS is a biennial, cross-sectional survey of a nationally representative sample of American adults that is used to assess the impact of the health information environment (**https://hints.cancer.gov**).<br>Specifically, HINTS measures how people access and use health information; how people use information technology to manage health and health information; and the degree to which people are engaged in healthy behaviors. | Percentage of individuals who access a practice patient portal in the past year | Consumer use of a patient portal trend over time, by using publicly available data (2014, 2017–2020) | Only patient-level<br>No state estimates, but available at rural-urban MSAs, census regions and divisions |

| | | | | |
|---|---|---|---|---|
| Uniform Data System (UDS) | The UDS is an annual reporting system that provides standardized information about the performance and operation of health centers delivering health care services to underserved communities and vulnerable populations (**https://data.hrsa.gov/tools/data-reporting/program-data**). | Patient engagement via portals, kiosks, secure messaging, others (yes/no)<br>Exchange with hospitals/ERs, specialty providers, other primary providers, labs or imaging, health information exchange (HIE), others (yes/no)<br>Primary care virtual visits at community health centers, 2019–2021<br>Center's use of EHR, exchange information with, modes, collection of social determinants of health, integration with prescription drug monitoring program, 2010–2021 | Both patient- and provider-level<br>State-level summary can be downloaded directly from **http://data.hrsa.gov**.<br>Focuses on primary care serving underserved populations (addresses health equity) | Only at center-level aggregated rates, not site-level; sites can be across state borders<br>Freedom of Information Act (FOIA) request required for center-level data (**https://www.hrsa.gov/foia/index.html**), but some measures such as primary care virtual visits to provider by specialty are not available to the public (confidential information). |
| American Board of Family Medicine (ABFM) Continuing Certification Questionnaire (CCQ) Survey | ABFM recently added interoperability questions to the recertification survey in 2022, in collaboration with the Office of the National Coordinator for Health Information Technology, in order to create an interoperability index | Patient-generated EHR data: capability and frequency<br>EHR usability: ease of entering information, readability of information, amount of information on screen, workflow alignment, ease of finding relevant information, usefulness of alerts<br>Overall EHR satisfaction<br>Hours per day: EHR documentation outside of office hours | Currently best source of information<br>Away from the 4 technical domains of interoperability, instead moving toward more of an experiential measure i.e., how it works<br>A unique survey mechanism with a 100% response rate | Patient-generated health data is still physician-reported<br>Only family physicians are included<br>Data are available only for 2022 |

Notes: To address Recommendation 4, we have identified four main points to consider:
1. Reported on a national and state level
2. Specific to primary care
3. Incorporated patient and provider outcomes
4. Longitudinal data available

# NOTES


1 Cohen SB. Sample design of the 1997 Medical Expenditure Panel Survey, Household Component. Agency for Healthcare Research and Quality. http://meps.ahrq.gov/data_files/publications/mr11/mr11.pdf. Published 2000.

2 Cohen JW, Cohen SB, Banthin JS. The Medical Expenditure Panel Survey: a national information resource to support healthcare cost research and inform policy and practice. *Med Care*. 2009;47(Suppl):S44-S50. doi:10.1097/MLR.0b013e3181a23e3a.

3 Spetz J, Fraher E, Li Y, Bates T. How many nurse practitioners provide primary care? It depends on how you count them. *Med Care Res Rev*. 2015;72(3):359-375. doi:10.1177/1077558715579868.

4 Harrison JM, Germack HD, Poghosyan L, Martsolf GR. Surveying primary care nurse practitioners: an overview of national sampling frames. *Policy Polit Nurs Pract*. 2021;22(1):6-16. doi:10.1177/1527154420976081.

5 Zuvekas SH, Cohen JW. Fee-for-service, while much maligned, remains the dominant payment method for physician visits. *Health Aff (Millwood).* 2016;35(3):411-414. doi:10.1377/hlthaff.2015.1291.

6 Petterson SM, Rayburn WF, Liaw WR. When do primary care physicians retire? Implications for workforce projections. *Ann Fam Med*. 2016;14(4):344-349.

7 Petterson SM, Liaw WR, Phillips RL, Rabin DL, Meyers DS, Bazemore AW. Projecting US primary care physician workforce needs: 2010–2025. *Ann Fam Med*. 2012;10(6):503-509. doi:10.1370/afm.1431.

8 Kuo YF, Goodwin JS. Association of hospitalist care with medical utilization after discharge: evidence of cost shift from a cohort study. *Ann Intern Med*. 2011;155(3):152-159. doi: 10.7326/0003-4819-155-3-201108020-00005.

9 Welch WP, Stearns SC, Cuellar AE, Bindman AB. Use of hospitalists by Medicare beneficiaries: a national picture. *Medicare Medicaid Res Rev*. 2014;4(2):E1-E8.

10 Lapps J, Flansbaum B, Leykum LK, Bischoff H, Howell E. Growth trends of the adult hospitalist workforce between 2012 and 2019. *J Hosp Med*. 2022;17(11):888-892. doi:10.1002/jhm.12954.

11 Blanchard J, Petterson S, Bazemore A, Watkins K, Mullan F. Characteristics and distribution of graduate medical education training sites: are we missing opportunities to meet US health workforce needs? *Acad Med*. 2016;91(10):1416-1422. doi:10.1097/ACM.0000000000001184.

12 Petterson SM, Burke MT, Phillips RL, Teevan B. Accounting for graduate medical education production of primary care physicians and general surgeons: timing of measurement matters. *Acad Med*. 2011;86(5):605-608. doi:10.1097/ACM.0b013e3182134634.

13 Chen C, Petterson S, Phillips RL, Mullan F, Bazemore A, O'Donnell SD. Toward graduate medical education (GME) accountability: measuring the outcomes of GME institutions. *Acad Med*. 2013;88(9):1267-1280. doi:10.1097/ACM.0b013e31829a3ce9.

14 Lucan SC, Phillips RL, Bazemore AW. Off the roadmap? Family medicine's grant funding and committee representation at NIH. *Ann Fam Med*. 2008;6(6):534-542. doi:10.1370/afm.911.

15 Hester CM, Jiang V, Bartlett-Esquilant G, et al. Supporting family medicine research capacity: the critical role and current contributions of US family medicine organizations. *Fam Med*. 2019;51(2):120-128. doi:10.22454/FamMed.2019.318583.