Clinician Practice Information Survey Methodology Report

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Submitted to:

Specialty Societies

American Academy of Audiology
American Chiropractic Association
American Association of Oral and Maxillofacial Surgeons
National Association of Social Workers
American Psychological Association Services
American Occupational Therapy Association
American Optometric Association
American Physical Therapy Association
American Podiatric Medical Association
Academy of Nutrition and Dietetics
American Speech-Language-Hearing Association
Advanced Medical Technology Association
College of American Pathologists

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Introduction

An accurate understanding of medical practices' expenses—as well as how much time clinicians spend providing care to patients—is critical to informing Medicare's clinician payment rates. To develop estimates of practices' expenses per hour of patient care from providers at the medical specialty level, the American Medical Association (AMA) contracted with Mathematica to field two large national surveys: a practice-level survey designed to gather data on practices' expenses called the Physician Practice Information (PPI) Survey and a physician-level survey called the Physician Hours Survey designed to gather data on the amount of time physicians spend providing patient care. The PPI Survey also gathers data on qualified health professionals (QHPs) who work in physician practices. QHPs are providers (see text box) who can bill independently for services using their National Provider Identifier (NPI) number. Practices were only eligible for the PPI Survey, however, if they employed physicians from at least one Medicare-defined medical specialty.

Types of qualified health professionals

- Audiologist
- Certified clinical nurse specialist
- Certified nurse midwife
- Certified registered nurse anesthetist
- Chiropractor
- Clinical psychologist/Psychologist
- Dentist
- Oral surgeon
- Licensed clinical social worker
- Nurse practitioner
- Occupational therapist
- Optometrist
- Physical therapist
- Physician assistant
- Podiatrist
- Registered dietitian
- Speech language pathologist

To determine practice expense for practices that primarily employ certain types of QHPs, Mathematica contracted with QHP specialty societies to revise and field the PPI Survey instrument—renamed the Clinician Practice Information (CPI) Survey—to a sample of QHP-focused clinician practices. We also contracted with two specialty groups representing independent clinical laboratories and independent diagnostic testing facilities (IDTFs) to determine practice expenses for these types of organizations. Exhibit 1 lists the 11 specialty societies that represent these QHPs and the two representing independent clinical laboratories and IDTFs. The specialty societies last fielded the CPI survey to collect data on QHPs' practice expenses in 2007.

This document describes the approach Mathematica took to prepare the CPI Survey for fielding to QHP practices, select a national sample of QHP practices, field the survey, and weight and analyze the data.

Exhibit 1. Specialty societies representing qualified health professionals

Specialty societies	Type of qualified health professional represented
American Academy of Audiology	Audiologists
American Chiropractic Association	Chiropractors
American Association of Oral and Maxillofacial Surgeons	Oral and maxillofacial surgeons
National Association of Social Workers	Licensed clinical social workers

Specialty societies	Type of qualified health professional represented
American Psychological Association Services	Clinical psychologists
American Occupational Therapy Association	Occupational therapists
American Optometric Association	Optometrists
American Physical Therapy Association	Physical therapists
American Podiatric Medical Association	Podiatrists
Academy of Nutrition and Dietetics	Dietitians
American Speech-Language-Hearing Association	Speech and language therapists
Advanced Medical Technology Association	Independent diagnostic testing facilities
College of American Pathologists	Independent clinical laboratories

Survey development

Overview

The CPI survey collected four broad categories of information from QHP practices, clinical laboratories, and IDTFs for the fiscal years 2022 or 2023:

- General information about the practices (for example, practice location, specialties at this practice, and practice ownership)
- The number of physicians, QHPs, and other staff in the practices
- The weekly hours physicians and QHPs spent providing direct patient care
- The annual practice expenses and revenue that the practice incurred related to patient care services paid for via physician payment systems

Appendix A includes a copy of the survey instrument.

Survey development

We used the AMA PPI Survey instrument as the starting point for the CPI survey and worked with the 13 specialty societies to revise the instrument. We had two main objectives with the CPI survey revisions:

- To update the survey so that it was relevant to the specialty practices that the 13 specialty societies represent and ensure that the revised survey was consistent with the AMA PPI survey
- To collect all relevant expense data from surveyed practices[1]

We revised and reorganized the survey using an iterative approach through multiple rounds of feedback from the 13 specialty societies. We made the following major changes to the PPI Survey to create the CPI Survey:

- We changed the text throughout the survey to focus on clinician practices rather than physician practices.

[1] Because some practices might employ physicians in addition to QHPs, we retained all questions about physician specialties and expenses.

  - We allowed for practices to report on their finances and expenses from 2022 or 2023, not just 2022, because this survey was fielded later than the PPI Survey.
  - We revised the screener section of the survey to ensure that practices in the sample employed clinicians from at least one QHP specialty represented by the specialty societies we contracted with, were an independent clinical laboratory, or were an IDTF. We also added new questions for maxillofacial surgeons, IDTFs, and independent clinical laboratories to make the screener questions more relevant to them.
  - We changed the order of the survey so that the questions about QHP specialties appear before the questions about physician specialties.
- We added a set of questions about whether practices combine certain QHP types and physician specialty for the purposes of allocating expenses.

Because IDTFs and independent clinical laboratories use organizational (rather than individual provider-level) NPIs to bill Medicare, we also added a new question for these organizations asking which organizational NPIs the respondent completed the survey on behalf of.

Instrument programming and testing

We programmed the instrument as a self-administered online survey in English using the Forsta software platform. We created a document with specifications for how to program the survey instrument and walked through these specifications with a programmer before they began work. To test the program, we used software that generates a large volume of random responses to survey questions to simulate actual responses and manual processes to follow all possible paths through the instrument, testing logic, reviewing data output, and confirming the instrument worked as intended.

Sample frame development and sample selection

Overview

To collect data for the 11 QHP types, independent clinical laboratories, and IDTFs on practices' expense per hour of patient care provided, we created stratified samples of practices. This section provides a summary of how we defined *practice* for the purposes of the sample design. We selected probability samples of practices even though individual providers were the unit of analysis. The section that follows, *Details of sample frame creation and sample selection*, describes each step we took to develop the sample frames and then stratify, allocate, and select the sample of practices. Throughout these sections, we refer to several data sets we used to identify sample frames and select samples. Exhibit 2 lists each of the data sets we used and what we used them for.

Exhibit 2. Data sets used for creating sample frames of clinician practices

Data set	Description	Use
MD-PPAS	This data set assigns Medicare providers to medical practices based on TINs and assigns medical specialties to each provider NPI.	• Identify eligible practices for 10 QHP types, based on TINs • Identify all NPIs for providers that billed Medicare under those TINs
Medicare Part B carrier claims	Medicare carrier claims include Part B fee-for-service claims submitted by professional providers, including physicians, physician assistants, clinical social workers, and nurse practitioners.	• Create an NPI-level file for the practices sampled based on TINs • Create a sample frame for chiropractic practices
OneKey	This data set was created by IQVIA and is available for purchase. The data set provides a wide variety of information about health care organizations operating in the United States as well as the providers those organizations employ.	• Identify contact information for practices sampled based on TINs • Identify practice ownership information for practices sampled based on TINs
Medicare Physician & Other Practitioners – by Provider and Service	This publicly available data set provides information on the services and procedures that practices provided to Medicare Part B beneficiaries.	• Identify organizational NPIs for independent clinical laboratories and IDTFs • Identify characteristics associated with practice size for each eligible organizational NPI
NPPES NPI Registry	The NPPES NPI Registry is publicly available data that provides information about every provider NPI registered in the United States, including a mailing address and the provider's specialty.	• Identify contact information for chiropractors, independent clinical laboratories, and IDTFs in the sample frames

IDTF = independent diagnostic testing facility; MD-PPAS = Medicare Data on Provider Practice and Specialty; NPI = National Provider Identifier; NPPES = National Plan and Provider Enumeration System; QHP = qualified health professional; TIN = Taxpayer Identification Number.

Definition of terms and practice as the sampling unit

In this section, we define the sampling unit for the 11 QHP types, independent clinical laboratories, and IDTFs. As Exhibit 3 shows, for 10 of the 11 QHP types, we defined *practices* according to the predominant QHP specialties that billed Medicare under the organization's TIN, which is the entity to which QHPs assign their rights for billing and collecting payment. It was possible for a physical practice location to consist of multiple TINs, or for a TIN to be associated with multiple practice locations. We used this approach because it aligned with how the Centers for Medicare & Medicaid Services (CMS) (and many studies of practices) identify group practices. The TIN was the sampling unit, which was easily obtained from the Medicare Data on Provider Practice and Specialty (MD-PPAS) file. As such, the list of TINs available from MD-PPAS was limited to those that had QHPs who had billed Medicare. MD-PPAS is available in Mathematica's Data Innovation Lab, an operational hub that supports the development and maintenance of shared data resources and infrastructure within Mathematica.

Exhibit 3. Listing of 11 QHP specialties and two facility types and the way practice was defined for each

QHP specialty or facility type	Organization type	Practice definition
Audiologist	QHP specialty practice	Organization-level TIN
Chiropractor	QHP specialty practice	Organizational NPI
Independent clinical laboratories	Facility	Organizational NPI
Clinical psychologist/Psychologist	QHP specialty practice	Organization-level TIN
IDTF	Facility	Organizational NPI
Licensed clinical social worker	QHP specialty practice	Organization-level TIN
Occupational therapist	QHP specialty practice	Organization-level TIN
Optometrist	QHP specialty practice	Organization-level TIN
Oral surgery	QHP specialty practice	Organization-level TIN
Physical therapist	QHP specialty practice	Organization-level TIN
Podiatrist	QHP specialty practice	Organization-level TIN
Registered dietician/Nutritionist Professional	QHP specialty practice	Organization-level TIN
Speech language pathologist	QHP specialty practice	Organization-level TIN

IDTF = independent diagnostic testing facility; NPI = National Provider Identifier; QHP = qualified health professional; TIN = Taxpayer Identification Number.

Each TIN tracks the expenses of the group's QHPs. Therefore, within each TIN, we expected a practice's representative to provide information on expenses for QHPs within their organization. For individual-ownership practices, this representative might be the clinician who owns the practice or an office administrator (Agency for Healthcare Research and Quality et al. 2020); for practices with more complex ownership, this would commonly be a chief financial officer or vice president of finance.

This framework functioned for most QHP specialties, but MD-PPAS did not have data for chiropractors, independent clinical laboratories, and IDTFs. Chiropractors, independent clinical laboratories, and IDTFs typically bill Medicare using organizational NPIs. Therefore, we defined these types of practices according to the function associated with the organization's NPI. For chiropractors, we created the sample frame using Medicare Part B carrier claims data. For independent clinical laboratories and IDTFs, we constructed the sample frames using the Medicare Physician & Other Practitioners by Provider data set, which was publicly available on the CMS website.

Creation of practice sample frames

We created four sample frames, one of TINs for the 10 MD-PPAS-derived specialties and one each for chiropractors, independent clinical laboratories, and IDTFs.

Practices defined as TINs in an MD-PPAS-derived frame

For the 10 QHP specialties in practices that we defined based on TINs, we derived the sample frame from the MD-PPAS data set. To be eligible, TINs had to have at least one individual NPI located in the 50 United States or the District of Columbia and must have submitted a Medicare claim in 2020, as recorded in the MD-PPAS data set.

To create a frame for the 10 MD-PPAS-defined practices, we implemented the following steps:

1. Created an (individual) NPI-level file using 2020 Medicare Carrier claims[2]
2. Created a TIN-level file using the NPI-level file from Step 1 and MD-PPAS
3. Assigned specialty labels to TINs using MD-PPAS
4. Appended practice ownership information from IQVIA's OneKey data set, described in Exhibit 2
5. Created the following variables to define explicit strata, identified through conversations with specialty societies about which variables were the most important to the eventual weighting and analysis:
    a. Whether the MD-PPAS data set included the practice's name
    b. Group specialty (10 individual specialty categories, plus three multispecialty categories with combined specialties, described below)
    c. TIN size (the number of NPIs billing to the TIN: 1, 2, 3 or 4, 5 to 10, or 11+)
    d. Type of Core Base Statistical Area (CBSA), which is a census-defined metropolitan or micropolitan statistical area defined for our purposes in terms of cost of living (high cost CBSA versus low cost CBSA or non-CBSA)[3]

The Details of sample frame creation and sample selection section more fully describes these steps below.

Practices defined as organizational NPIs in non-MD-PPAS-derived frames

For each of the remaining practice types (chiropractors, independent clinical laboratories, and IDTFs), creating the sample frame was a simpler process that did not involve matching with OneKey. As noted earlier, all three frames were constructed at the organizational NPI level: for chiropractors, we created the sample frame using Medicare Part B carrier claims data, and for independent clinical laboratories and IDTFs, we constructed the sample frames using the Medicare Physician & Other Practitioners by Provider data set. We supplemented each file with contact information from the National Plan & Provider Enumeration System (NPPES).

The variables used for stratification differed for each practice type. We identified stratification variables based on conversations with the specialty societies, again aiming to identify the variables that were most important to the eventual weighting and analysis. As with the MD-PPAS-derived frame, more details on the sample frame creation and how we created strata from the variables listed are in the Details of sample frame creation and sample selection section.

[2] Medicare carrier claims include fee-for-service claims submitted by professional providers, including physicians, physician assistants, clinical social workers, and nurse practitioners. We accessed them through ResDAC, Research Data Assistance Center (CMS n.d.[a]).

[3] Details about CBSAs and how the high-cost versus lower-cost CBSAs were defined are provided in Step 5 of the Details of sample frame creation and sample selection section.

The strata for the chiropractor sample included the following:

- Organizational NPI size (the number of providers billing under the organizational NPI: 1, 2 or 3, 4+)
- High-cost state (or equivalent) versus lower-cost state[4]

For independent clinical laboratories, after discussions with the specialty society, we removed laboratories in the bottom 5 percent in terms of service volume as well as those coded as individual or not coded as 88305.[5] For the remainder, we defined strata based on the following variables:

- Whether the laboratory was identified as a Quest, Ameripath, or Labcorp laboratory or none of these
- Whether the laboratory was among the largest one-third in terms of service volume, as defined by the client
- Size terciles in terms of overall Medicare charges

Finally, strata for IDTFs were defined based on the following variables:

- Eight cardiology-based IDTFs were selected with certainty
- Four groups based on the plurality of their billing (35 percent or greater): Radiology/Imaging, Cardiology, Sleep/Neurology, or Other.
- Size terciles in terms of overall Medicare charges

Sample selection of practices

For each frame, we selected an augmented sample (a sample larger than we thought we might need) for which we could determine the appropriate contact information in case the sample cases were released.[6] From the augmented sample, we selected a single release and a reserve sample. An overview of the steps we took to select samples of practices from the four frames follows:

1. Created strata for sample selection of practices
2. To prepare to select the augmented sample for each frame, allocated projected completed practice-level surveys and number of augmented sample cases to strata assuming a completion rate of 3 percent
3. Using equal probability sampling within the explicit strata, selected an augmented sample of practices
4. Selected a release sample of practices from augmented sample of Step 3

[4] Although the frame of chiropractors provided city and state of the practice, it did not associate these locations with CBSAs. Although it was possible to assign chiropractor practices to CBSAs using this information, we elected to simply assign the high-cost indicator based on the state of the practice location.

[5] Limiting the code to 88305 assures that we are sampling labs that bill on the Physician Fee Schedule rather than on the Clinical Laboratory Fee Schedule.

[6] For frames obtained from CMS-sourced Excel spreadsheets (IDTFs and clinical labs), the contact information was available on the spreadsheets.

These steps are the same for all four frames.[7] The Details of sample frame creation and sample selection section provides details about these steps.

Details of sample frame creation and sample selection

Sample frame creation

This section provides details on the five steps for creating the MD-PPAS-derived sample frame for the 10 practices defined as TINs that we outlined in the introduction, followed by details on the non-MD-PPAS-derived sample frame creation for chiropractors, independent clinical laboratories, and IDTFs. We use ***bold italics*** to identify each step and follow it with the description for that step.

Created an NPI-level file using 2020 Medicare Carrier claims for 10 MD-PPAS-defined practitioner groups of interest (Step 1)

AMA provided Mathematica with the specialty mapping spreadsheet with the 11 practitioner CMS specialty codes of interest in Exhibit 4, which in turn mapped to the 10 QHP-defined practices (the codes for clinical psychologist and psychologist both mapped to psychologist). We used the 2020 version of the claims data to coincide with the latest version of MD-PPAS ('MD-PPAS_V24_2020') that was available at the time we created the sampling frame. Both the 2020 Carrier claims data and the 2020 version of MD-PPAS were available through Mathematica's Data Innovation Lab's access to the Chronic Conditions Data Warehouse's Virtual Research Data Center. We limited the file to NPIs billing under TINs in the 50 United States plus the District of Columbia.

Exhibit 4. Description of 11 CMS specialty codes used for sampling and practitioner group assignment

CMS specialty code	Code description	QHP-type practice specialty
64	Audiologist	Audiologist
68	Clinical Psychologist	Psychologist
80	Licensed Clinical Social Worker	Licensed clinical social worker
67	Occupational Therapist	Occupational therapist
41	Optometrist	Optometrist
19	Oral Surgery	Oral surgery
65	Physical Therapist	Physical therapist
48	Podiatrist	Podiatrist
62	Psychologist	Psychologist
71	Registered Dietician/Nutrition Professional	Registered dietician/Nutrition professional
15	Speech Language Pathologist	Speech language pathologist

CMS = Centers for Medicare & Medicaid Services; QHP = qualified health professional.

We mapped the specialty codes available in the MD-PPAS variable primary specialty of NPIs ('spec_prim_1') to one of these 11 practitioner specialties.

[7] For the three non-MDPPAS frames, not all of Steps 1 to 5 were necessary.

Created a TIN-level file using the NPI-level file from Step 1 and MD-PPAS (Step 2)

We gathered all TINs from the file in Step 1 and linked them to TINs in MD-PPAS. This was the practice-level TIN frame. MD-PPAS defines 'TIN1'—a "pseudoTIN"—for practitioners based on the majority of their charges. Only NPIs with an associated pseudoTIN derived from the TIN1 field were retained. We then assigned an internal random string called 'RANDOM' on the Chronic Conditions Data Warehouse to allow for pseudoTIN-level extracts. We used RANDOM as our identifier for each practice as defined by the TIN1 field. Finally, we excluded all TINs for which their constituent NPIs were not found in the IQVIA's OneKey data set (described in Exhibit 2) as well as TINs that were in the sample frame for the PPI survey as they would already have a chance of selection.

Assigned specialty labels to TINs using MD-PPAS (Step 3)

We were interested in the estimates of practice expenses. Because we sampled practices instead of providers, we needed a way to identify the distribution of the specialties of the providers within the practices. Even though we sampled practices, knowing the distribution of provider specialties enabled us to allocate the sample of practices in such a way that we could anticipate how many practitioners within each specialty would be in the sample. We assigned specialty labels to TINs based on the preponderance of NPI specialties in the TIN. For the purposes of this study, using our sample frame data, we defined *single-specialty practices* as those in which at least 75 percent of providers identified as members of a single specialty. The remaining practices were categorized as one of three types of multispecialty practices:[8]

- The audio group, which included audiologists and speech pathologists
- The occupational/physical therapy group, which included occupational and physical therapists
- The psych group, which included psychologists, psychiatrists, and licensed clinical social workers[9]

Other multispecialty practices were excluded from the sample frame.

Appended practice ownership information from OneKey (Step 4)

The only information that MD-PPAS provides about a TIN's location is the state, and it provides no information about practice ownership. Because of this, we needed to obtain this information from OneKey. There was no common merging variable between OneKey and the file generated using Carrier claims and MD-PPAS at the TIN level, so we completed this merge using NPI at the provider level. We linked TINs from the TIN frame to OneKey's unique practice identifier IMS_ORG_IDs by determining which IMS_ORG_ID shared the greatest number of NPIs with each TIN.

[8] If at least 75 percent of the practitioners identified as members of at least one of two or three related specialties, the practice was classified accordingly.

[9] We investigated adding registered dieticians/nutritionists into this group but found that the number of practices that included registered dieticians/nutritionists and psychologists, psychiatrists, or licensed clinical social workers was very small.

We used ownership categories from the OneKey business table to assign organizations at the IMS_ORG_ID level and associated pseudoTINs to one of three ownership categories. We did this because specialty societies felt that ownership type may be an important variable to use in weighting and analysis. The following ownership fields were available from OneKey:

- corp_parent_ims_org_id – identifier used to associate OneKey level organizations with parent corporations
- primary_cot_id – this was the numeric code for primary class of trade

If the primary_cot_id value indicated "Corporate Parent – Integrated Delivery Network," then the associated IMS_ORG_ID and mapped pseudoTIN were assigned an ownership category of "Parent: Integrated Delivery Network." If this value did not indicate "Corporate Parent – Integrated Delivery Network," but there was an associated parent corporation identifier, then the ownership category was "Parent: Other Corporate." If there was no associated parent corporation identifier, then the ownership category was assigned to "Independent: practitioner-owned."[10]

Steps 1 to 4 resulted in a sample frame with 79,903 unique TINs.

Created variables to define explicit strata (Step 5)

As part of developing the sample frame, we created the following practice-level variables used for explicit stratification:

1. **Whether the MD-PPAS data set includes the practice's name:** TINs without a practice name in the MD-PPAS data set had less of a chance of being selected for the sample. We included this variable because it was difficult to perform web-based locating to find contact information for practices without a practice name.
2. **Group specialty:** The levels of this variable matched the specialty labels assigned in Step 3. This variable included the single-specialty-designated TINs, for which at least 75 percent of NPIs belonged to that specialty, plus TINs for which 75 percent of NPIs were (i) psychologists, psychiatrists, or social workers (the psych group), (ii) audiologists or speech pathologists (the audio group), or (iii) occupational or physical therapists (the occupational/physical therapy group). For stratification purposes, audiologists and audiology/speech pathology TINs were collapsed because of the small number of dual audiology/speech pathology TINs and because most NPIs in those dual TINs were audiologists. For TINs without a practice name, occupational/physical therapy groups were collapsed with physical-therapy-only TINs, and psychology group practices were collapsed with psychologist-only TINs. These multiple specialty practices were rare among the TINs without a practice name.
3. **TIN size:** TIN size was defined as the number of NPIs billing under the TIN in the MD-PPAS data, including NPIs for specialties that we were not interested in. The maximum number of TIN size categories was 5: 1, 2, 3 or 4, 5 to 10, and 11+. In most cases, however, these categories were collapsed even further for sampling.

[10] Source: OneKey Reference Data Integrated Prescriber and Organization Reference Data OneKey Relational (ICADM) Data Dictionary Version 2.14

4. **Type of CBSA in terms of cost of living:** CBSAs are census-defined metropolitan and micropolitan statistical areas.[11] This variable had two levels: (1) high-cost CBSA and (2) low-cost CBSA or non-CBSA. The high-cost CBSAs were defined according to whether the practice was located in a metropolitan area that was within a list of the 34 metropolitan areas, almost entirely on the West Coast or in the Northeast, with the highest cost of living (as provided by the Pew Research Center). A listing of the 34 metropolitan areas is available in Appendix B.

Chiropractor frame

Chiropractor representation was nearly nonexistent in the 2020 MD-PPAS at the individual NPI level because chiropractors generally billed under organizational NPIs. As a result, we identified chiropractic organizations based only on 2020 Medicare Part B carrier claims where hcpcs_cd was equal to 98940, 98941, or 98942 based on publicly available billing guidance for covered chiropractic manipulative treatment (CMS 2024). We joined any unique organization NPIs charging at least $100 to these codes in 2020 to NPPES to identify organization name, mailing address, business address, mailing phone number, and business phone number. This process resulted in a sample frame of 22,872 chiropractor organizational NPIs.

We developed two variables for explicit stratification in the chiropractor frame:

1. **Organizational NPI size:** Organizational NPI size was defined as the number of NPIs billing under the organizational NPI in the Medicare Part B carrier claims data, including NPIs for specialties that we were not interested in. We created three organizational NPI size categories: 1, 2 or 3, and 4+. We did not collapse this variable further.
2. **Type of state in terms of cost of living:** This variable had two levels: high-cost state (or equivalent) and low-cost state. The high-cost states are Alaska, California, Hawaii, Massachusetts, and New York and includes the District of Columbia.[12] The lower-cost states are all remaining states.

Independent clinical laboratory frame

We identified independent clinical laboratories using the Medicare Physician & Other Practitioners by Provider data set. We identified organizational NPIs that were active in 2021 with a Rndrng_Prvdr_Type value equal to 'Clinical Laboratory.' These were restricted to those charging to hcpcs_cd 88305 (Level IV - Surgical pathology, gross and microscopic examination) with an organization ('O') value for Rndrng_Prvdr_Ent_Cd. We assigned laboratories to terciles based on overall charges with these restrictions. These NPIs were joined to NPPES to identify organization name, mailing address, business

[11] CBSAs are sets of counties corresponding to urbanized areas in the United States, as defined by the Office of Management and Budget. There are two types of CBSAs: metropolitan statistical areas, consisting of an urbanized area (a principal city or cities with contiguous developed areas) with a combined population of 50,000 or greater, and micropolitan statistical areas, consisting of urbanized areas with a combined population of 10,000 or greater but less than 50,000. MD-PPAS assigned individual practices to CBSAs.

[12] These are states for which the 2024 cost-of-living index exceeded 120. Most of the high-cost CBSAs in the MD-PPAS-derived frame are in these states.

address, mailing phone number, and business phone number. There were 529 distinct organizational NPIs available for sampling.

The main concern for stratification of independent clinical laboratories was to ensure that we controlled for the proportion of laboratories that were large versus those that were small. The variables we used for stratification reflected this concern, with all three variables used for explicit stratification measuring size in some way:

1. Whether the laboratory was identified as a Quest, Ameripath, or Labcorp laboratory or none of these
2. Whether the laboratory was among the largest one-third in terms of service volume, as defined by the client
3. Size terciles in terms of overall Medicare charges

The largest laboratory corporations were Quest, Ameripath, and Labcorp. Because laboratories representing these corporations were well represented in the frame, we wanted to ensure that these laboratories did not dominate the proportion in the sample. The client also provided a list of large laboratories in terms of service volume, so we created a variable that accounted for these labs. Finally, as described above, we split the frame into terciles based on their charges in Medicare Part B claims data.

IDTF frame

We identified IDTFs using the Medicare Physician & Other Practitioners by Provider data set. We identified organizational NPIs that were active in 2021 with a Rndrng_Prvdr_Type value equal to 'Independent Diagnostic Testing Facility (IDTF)' (CMS n.d.[b]). Based on client input, we then merged these NPIs to 2021 claims data to flag these IDTFs into one of four categories: Radiology/Imaging, Cardiology, Sleep/Neurology, or Other. We assigned an IDTF to one of the first three categories if its spending by hcpcs_cd was greater than or equal to 35 percent of the groups shown in the final column of Exhibit 5. We assigned all other IDTFs to the 'Other' flag.

Exhibit 5. Description of IDTF groups by CPT code ranges

CPT codes	Code description	Group
7000-7999	Radiology Services	Radiology / Imaging
95782	Polysom <6 yrs 4/> paramtrs	Sleep/Neurology
95783	Polysom <6 yrs cpap/bilvl	Sleep/Neurology
95807	Sleep study attended	Sleep/Neurology
95808	Polysom any age 1-3> param	Sleep/Neurology
95810	Polysom 6/> yrs 4/> param	Sleep/Neurology
95811	Polysom 6/>yrs cpap 4/>	Sleep/Neurology
95805	Multiple sleep latency test	Sleep/Neurology
95800 95800	Slp stdy unattended	Sleep/Neurology
95801	Slp stdy unatnd w/anal	Sleep/Neurology
95806	Sleep study unatt&resp efft	Sleep/Neurology

CPT codes	Code description	Group
G0398	Home sleep test/type 2 porta	Sleep/Neurology
G0399	Home sleep test/type 3 porta	Sleep/Neurology
G0400	Home sleep test/type 4 porta	Sleep/Neurology
51785, 92265, 95860, 95861, 95863, 95864, 95865, 95866, 95867, 95868, 95869, 95870, 95872, 95873, 95874, 95885, 95886, 95887, 95905, 95907, 95909, 95910, 95911, 95912, 95913, 95933, 95937, 95999, G0255	Nerve Conduction Studies and Electromyography	Sleep/Neurology
93268, 93270, 93271, 93272	Electrocardiographic (EKG or ECG) Monitoring: Memory Loop Recordings	Cardiology
93224, 93225, 93226, 93227, 93228, 93229	Electrocardiographic (EKG or ECG) Monitoring: Other up to 48-Hour Recordings	Cardiology
93241, 93242, 93243, 93244, 93245, 93246, 93247, 93248	External electrocardiographic recording for greater than 48 hours and up to 7 days or for greater than 7 days up to 15 days.	Cardiology

Sources: https://www.cms.gov/files/document/ncci-policy-manual-2017-chapter-9.pdf
https://www.cms.gov/medicare-coverage-database/view/article.aspx?articleId=57496&ver=11
https://www.cms.gov/medicare-coverage-database/view/article.aspx?articleId=54992
https://www.cms.gov/medicare-coverage-database/view/article.aspx?articleId=57476&ver=17

CPT = Current Procedural Terminology; IDTF = independent diagnostic testing facility.

We then joined all unique organizational NPIs with at least $100 in charges for 2021 to NPPES to identify organization name, mailing address, business address, mailing phone number, and business phone number. There were 2,131 distinct organizational NPIs available for sampling.

We selected eight cardiology-based IDTFs with certainty because the client and the companies representing these IDTFs had a shared interest in determining practice expense per hour of patient care provided for cardiology-based IDTFs. For the remaining IDTF organizational NPIs, we created the explicit stratification variables based on the four groups described above (more than 35 percent of spending on Radiology/Imaging, Cardiology, Sleep/Neurology, or Other), and terciles we developed in the same way as those used in the stratification for independent clinical laboratories, except they were based on Medicare charges by IDTFs.

Selected samples of practices

This section describes the selection of the four samples of practices, one sample of TINs for the MD-PPAS-defined practices from 10 of the QHP types as well as three additional samples of organizational NPIs for chiropractors, independent clinical laboratories, and IDTFs, respectively. Initially, we selected more practices than we expected to need to account for expected differential response and eligibility rates in the sampling strata. We separated these large samples, called augmented samples, into two parts: (1) samples that we definitely intended to release, which we referred to as the release samples, and (2) reserve samples, with a random number affixed to each reserve case that we used to identify supplemental cases for release in case the initial release was not large enough. Steps 6 to 9 describe the selection of this sample for the practices for all 13 facility types.

Created strata for sample selection of practices (Step 6)

For practices identified by TINs, each stratum required collapsing levels with at least some of the variables listed earlier (whether MD-PPAS included the practice name, specialty group, TIN size [1, 2, 3 or 4, 5 to 10, 11+], and high- versus lower-cost CBSA) so that each stratum had at least 100 TINs in the frame. We created 55 strata for the TIN-defined practices, of which 45 were strictly single-specialty TINs, and 10 strata involved multiple-specialty TINs either as two- or three-specialty groups or as combinations of single-specialty TINs and groups. Most of the TINs were small; 43,861 of the 79,903 TINs in the frame were in strata defined as having only one clinician billing to a TIN. Appendix C provides a detailed list of the 55 strata for the MD-PPAS-defined frame, with the counts of practices in the population within each stratum, and the projected number of completed surveys.

For chiropractors, explicit strata were defined based on a straight cross-classification of the two variables discussed earlier (practice size [1, 2 or 3, 4+] and high-cost state or low-cost state). Therefore, the chiropractor sample came from six strata. As with the TIN-based practices, most chiropractor practices were small: 6,692 of the 22,872 were practices for which only one clinician was billing under the organizational NPI.

We created 10 explicit strata for independent clinical laboratories, including three distinct strata each for Quest, Ameripath, and Labcorp labs, and seven strata for the remaining labs from the cross-classification of the two size variables (the largest one-third versus lowest two-thirds of labs in terms of service volume, and the three terciles of Medicare charges).

Finally, we created 13 IDTF sample strata from three variables:

- Eight cardiology-based IDTFs to be selected with certainty
- Flags indicating which IDTFs had at least 35 percent of their expenses as
  - cardiology expenses,
  - radiology/imaging,
  - sleep/neurology, or
  - other (no specialty had at least 35 percent of the expenses in the IDTF)
- Terciles of total Medicare charges

After accounting for the eight cardiology-based IDTFs, 12 strata were based on the cross-classification of the four flags and the three terciles.

Appendix C provides a detailed list of the six chiropractic strata, the 12 independent clinical laboratory strata, and the 13 IDTF strata, with the counts of practices in the population within each stratum, and the projected number of completed surveys.

Prepared to select the augmented sample for each frame by allocating projected completed practice-level surveys and number of augmented sample cases to strata assuming a completion rate of 3 percent (Step 7)

We selected an augmented sample for each frame and selected a sample for release in each case. We intended the augmented samples to be large enough that we would not release all cases, no matter how low the response rate might eventually be.

We planned the sample design with the intention of obtaining more than 100 completed surveys for each specialty and for the two facility types, for a total of 1,300 completed surveys. When allocating the planned completed surveys to strata, we wanted to ensure we had enough completed surveys for subgroups of interest and minimal unequal weighting across strata to reduce the design effect because of unequal weighting. Therefore, we tried to keep as close as possible to a proportional allocation, though some of the smaller strata had an allocation that was necessarily higher than what we would have obtained in a proportional allocation. We obtained the number of augmented sample cases for each frame by dividing the planned number of completed surveys by 0.03, which reflected an assumed worst-case scenario of an approximate completion rate of 3 percent. For the practices based on TINs, this resulted in an augmented sample of 22,256 TINs; in the chiropractor sample, we selected 3,333 organizational NPIs. Because the frames for independent clinical laboratories and IDTFs were so small, the augmented sample consisted of the entire frame for those populations: 529 and 2,131 practices for independent clinical laboratories and IDTFs, respectively.

For the 10 specialties in the frame based on TIN-based practices, we knew that specialties would not all be concentrated in single-specialty practices. For specialties that were targeted in multispecialty practices (psychologists/clinical psychologists, licensed clinical social workers, physical therapists, occupational therapists, audiologists, and speech language pathologists), we observed how many practices were found in the multispecialty practices in the target population and estimated, based on proportions of these specialties in the population, what proportion would be observed in the associated single-specialty and multispecialty practices. Then, in order to obtain an estimated 100 completed surveys per specialty, we used these estimated proportions to inform the sample allocation to each type of practice. In Exhibit 6, we present the sample frame counts and the allocated number of augmented sample cases, released sample cases, and anticipated number of completed interviews by group specialty practices.[13]

Exhibit 6. Sample allocation to group specialty practices for 10 specialties with TIN-based practices: sample frame counts, augmented sample allocation, release sample allocation, and anticipated completed interviews

Group specialty practices (single-specialty practices unless otherwise specified)	Sample frame count	Augmented sample allocation	Release sample allocation	Anticipated completed interviews
TOTAL	79,903	22,256	3,333	1,000
Audiologist single-specialty and audiologist/ speech pathologist multispecialty practices[a]	1,621	1,621	334	100
Licensed clinical social worker	20,883	3,167	317	95

[13] Group specialty practices are defined in Step 5, in which we describe the variables used to create explicit strata.

Group specialty practices (single-specialty practices unless otherwise specified)	Sample frame count	Augmented sample allocation	Release sample allocation	Anticipated completed interviews
Occupational therapist	861	861	266	80
Occupational therapist/physical therapist (multispecialty practices)	1,015	802	80	24
Optometrist	15,642	3,764	335	100
Oral surgeon	1,022	1,022	333	100
Physical therapist	12,350	3,198	321	96
Podiatrist	8,593	3,333	333	100
Psychologist/licensed clinical social worker/psychiatrist (multispecialty practices)	693	345	35	10
Psychologist/clinical psychologist	15,824	3,154	314	95
Registered dietitian	827	827	333	100
Speech language pathologist	592	592	333	100

[a] Because audiologist/speech pathologist multispecialty practices only had 72 practices in the population, we decided to combine this group specialty with the audiologist single-specialty practices.

The tables in Appendix D provide the counts for the allocated number of sample cases for all strata and all practice types in the augmented sample, the number of cases released, the anticipated number of completed surveys allocated to each explicit stratum, and the actual number of completed interviews.

Selected an augmented sample of practices from each frame using equal probability sampling within the explicit strata (Step 8)

We created each stratum based on collapsed versions of the variables listed in Step 5. For some specialties, we collapsed variables so they did not contribute to the explicit stratification at all. For the frame based on TINs, we sorted TINs within each stratum according to the following variables, which, in many cases, were more granular forms of the variables used for explicit stratification:

1. Census division (nine census divisions throughout the United States)
2. Type of CBSA in terms of cost of living (high-cost CBSA versus lower-cost CBSA or non-CBSA)
3. Practice size (number of NPIs billing to a TIN)

We selected, with equal probability, the augmented sample of 22,256 TINs. We sorted the variables listed above within explicit strata ensuring that the distribution of TINs for these variables mirrored that of the population as much as possible. This process, called implicit stratification, was most effective with the sorting variables highest in the list given above.

The process for selecting 3,333 chiropractor organizational NPIs was basically the same but with a slightly different list of implicit stratification variables:

1. Census division (nine census divisions throughout the United States)
2. Type of state in terms of cost of living (high-cost state versus lower-cost state)
3. Practice size (number of chiropractors in organizational NPI)

For the two facility types, no augmented sampling was required because all cases in each frame were part of the augmented sample.

Selected release samples of practices from each augmented samples (Step 9)

For the release sample, we assumed a completion rate of 30 percent, so we obtained the release sample allocation by dividing the projected number of completed interviews by 0.3. We selected an equal probability sample of 3,333 TINs from the selected augmented sample cases within the 55 strata in the TIN-derived frame. Exhibit 6 breaks down the number of released cases for each of the group specialties, one of the variables used to define those strata in the 10 TIN-derived frame. For the other three augmented samples (chiropractors, clinical laboratories, and IDTFs), we selected 333 organizational NPIs from each of them for a total of 4,332 released practices. As noted above, the distribution of the 4,332 released practices by stratum is available in Appendix D.

Survey administration

Overview

We launched the CPI Survey in February 2024 and fielded it through August 2024. The survey sample was released in two waves. Wave 1 included 581 practices and was released in February 2024. Wave 2 included 3,751 practices and was released in March 2024. Here, we describe the procedures for preparing and fielding the survey along with challenges we encountered and solutions we implemented.

Preparing to field the CPI Survey

Obtaining institutional review board (IRB) approval

Before fielding the CPI survey, we prepared and submitted our materials to the Health Media Lab IRB. We received IRB exemption from ongoing review in accordance with the requirements of the US Code of Federal Regulations for the Protection of Human Subjects, 45CFR46.104(2). As we implemented changes during the field period (described below in this report), we submitted amendments to the Health Media Lab IRB and received additional approvals.

Obtaining medical specialty society endorsements

Before fielding the PPI and CPI Surveys, the AMA solicited endorsements from state medical organizations and medical organizations that represented all the physician specialties and QHPs. In total, 172 state and specialty medical organizations endorsed this study. We compiled these endorsements in a document to share with practices in our invitation letters. See Appendix E for the survey invitations and the full endorsement letter.

Updating practice contact information

Practices identified by TINs

Mathematica obtained practice contact information from the OneKey data set for all specialty practiced identified by TINs (meaning all practice types except chiropractors, independent clinical laboratories, and IDTFs). The contact information we obtained from OneKey, however, was often incomplete or incorrect.

Before fielding the CPI Survey, we searched the internet to confirm or collect practice contact information for the practices in our sample. We searched for the practice by legal name, CBSA, and state, and we reviewed practice websites to confirm and collect contact information when possible. If we were not able to find a practice website, we searched for the practice in the NPPES NPI Registry. We confirmed and collected the practice address and phone number, the name of the practice owner or practice manager, and an email address in cases in which we were able to find a practice website or information on the NPPES NPI Registry.

Among the sample, there were 315 practices that did not have a legal name associated with the TIN. We first conducted web locating for these practices using the clinician's name, CBSA, and state for the search. If we were not able to identify a practice name and website through this approach, we called the practice once. We dialed the phone number we received for the practice from the OneKey data set with the goal of confirming or collecting the practice's name and address, the name of the practice owner or manager, and an email address. We conducted phone locating for 93 percent of these practices (292 out of 315) and confirmed or collected contact information for 10 percent of them (30 out of 292).

Practices identified by organizational NPIs

We obtained contact information for chiropractors, independent clinical laboratories, and IDTFs from the Medicare Physician & Other Practitioners by Provider data set. The contact information included practices' mailing address and phone number. In addition, for independent clinical laboratories, staff from the College of American Pathologists provided a file with the names and email addresses of independent clinical laboratory administrators or managers for many laboratories in the sample. We used the file to update independent clinical laboratories in the sample with this contact information. We conducted internet searches for 999 cases in which we were not able to identify a match in either file, using the locating approach described above, and focusing on collecting the name of the practice owner or practice manager and an email address. For those we could not locate using internet searches, we conducted phone locating using the same approach described above for the main sample. We conducted phone locating for 39 percent of these practices (389 out of 999).

Fielding the CPI Survey

We fielded the CPI Survey online in two releases. Release 1 included 581 practices and came out in February 2024. Release 2 included 3,751 additional practices and came out in March 2024. We continued fielding both releases through August 31, 2024.

The target respondent for the CPI Survey was the person at each practice most knowledgeable about the practice's finances and expenses. For clinician practices and IDTFs, this person was usually the practice owner or practice manager because most of the practices in the sample were small. For independent clinical labs, this person was usually the laboratory administrator or director.

Mathematica sent practices invitation and reminder emails and letters that detailed the purpose of the survey and the reasons practices should consider participating as well as other information about the survey and who at the practice should complete it. The specialty society or societies most relevant for the sampled practice signed the letters and emails. For example, audiology practices received letters and

emails signed by designated leaders from the American Academy of Audiology and the American Speech-Language-Hearing Association. The notifications also offered practices that completed the survey a report that showed how their practice's data compared with other similar practices to be sent to practices after data analysis was complete and included the endorsement letter listing all the societies that had endorsed the survey (Appendix E).

Letters and emails included the survey's web address and a unique username and password to access the survey. Emails also included a link so that respondents could click and open their individual survey directly. An outside vendor printed and then mailed the invitation and reminder letters.

We planned for each practice to receive one invitation email and one invitation letter, followed by four reminder emails and three reminder letters on an alternating schedule, although we ended up sending additional reminders as described in the challenges and solutions section below. This meant that practices received at least one email and one letter every month throughout the field period.

In addition to the reminder emails and letters, Mathematica conducted two rounds of reminder calls from May to July 2024, calling 60 percent of practices (2,580) up to two times. We called all practices that started the survey but had not completed it as well as a random subset of the remaining practices within each specialty group.

Challenges and solutions

Response to the CPI Survey was lower than expected. Because of this, Mathematica and the specialty societies made several changes to increase response. The types of changes we made included (1) adding volunteer practices; and (2) increasing outreach to sampled practices from specialty societies and Mathematica.

Added volunteer practices to the sample

Occasionally during the field period, practices that were not a part of our sample reached out to our help desk or to specialty societies requesting to participate in the survey. These practices typically learned about the survey from communications released by their specialty society. We allowed these practices to participate, loading their information into our systems and sharing a survey link with them. In total, we added 27 practices that requested to participate but were not a part of our initial sample.

Specialty society locating and outreach

Twelve specialty societies conducted additional locating of practices within their respective specialties to try to obtain better contact information from them. After receiving IRB approval, Mathematica securely shared a list of sampled practices within that society's specialty. If the specialty society was able to find new contact information for a practice and shared it with us, we replaced the contact information we had for the practice with this new information and ensured future communications with the practices used the new information.

Several specialty societies also emailed their members that were part of the survey sample directly and asked them to participate in the study and included information about the survey in member newsletters or communications.

Increased reminder outreach

In addition to engaging specialty societies, we revised our procedures to send two additional reminder emails and two additional reminder letters to practices that had not yet completed the survey. This increased the total number of communications with respondents to six reminder emails and five reminder letters during the six-month field period.

Summary of help desk comments

Mathematica ran a help desk to field questions from practices throughout data collection. On all our communications, we provided a toll-free phone number and email address at which we could be reached. We also shared that toll-free phone number and email address on the web survey. In total, we received 156 inquiries from practices.

- The most common type of contact we received were refusals to participate (24 percent of contacts) and automatic unsubscribe requests (15 percent of contacts), which were automatic emails that were sent to our project inbox when the respondent clicked the unsubscribe link on one of our email notifications.
- Other common help desk inquiries included survey content-related questions (15 percent), requests for extensions (12 percent), and help logging into the survey (10 percent).
- Another 10 percent of cases were inquiries about a specific practice's eligibility.
- We also received requests to participate in the survey, contact-related updates (for example, from people at a practice letting us know to send our notifications to someone else at the practice), and some inquiries about the survey deadline.

Response rates and weighting

Here, we describe two response rate calculations and the weighting methodology. When calculating the response rate and the weights, there was some question about how to define *eligibility*. We considered practices that were closed, merged, or duplicates to be ineligible, and we considered practices we located via web searches or phone calls that refused to respond or otherwise did not respond to the survey to be nonrespondents. There were other practices that never clicked on the survey link and we did not conduct any web searches or phone calls. In these cases, we could not be sure whether the practice was still open or a physical practice location existed.

In this study, we calculated the weights by assuming that, unless we determined the practices had closed, merged, or were duplicates and therefore ineligible, those that refused to respond or did not respond to the survey were nonrespondents. We calculated the response rates in two ways. The first method matches the assumption used when calculating weights: we categorized practices that never clicked on the link as nonrespondents. The other method assumes practices that never clicked on the link were outside our focal population and, therefore, were ineligible. For both response rate calculations, the calculation of the

eligibility rate did not consider practices that never clicked on the link as ineligible; it relied only on practices that were clearly eligible or ineligible because of a closure, merger, or duplication.[14]

Response rates

Response rates for the survey were based only on practices selected as part of the released probability sample. They did not include responses from the volunteer practices or physician practices that reported QHP expenses in the PPI Survey that were added to the CPI analytic sample. Probability sample cases included 3,333 practices in the release sample from the frame of TIN-based practices and 333 practices each from the chiropractor, clinical laboratory, and IDTF frames, for a total of 4,332 practices.[15] The response rate calculations did not include an additional 12 volunteer practices. Moreover, from the PPI Survey, 30 practices submitted expense information about QHPs in specialties that were the focus of the CPI Survey, which we also excluded from the response rate calculations.

Exhibit 7 provides the various statuses for the 4,332 probability sample cases with the associated response rates, broken out by each of the four frames and overall. We also present both the weighted (using the sampling weight) and unweighted response rates as well as eligibility rates (the estimated proportion of practices that are eligible for the survey). Because the sample did not have clustering and we selected practices with equal probability, any differences between the weighted and unweighted response rates were because of different sampling rates from stratum to stratum.[16] The numbers of actual completed interviews by strata are provided in Appendix D.

[14] In both response rate calculations, the denominator is the sum of completes, eligible nonrespondents, and the estimated number of eligible nonrespondents among the nonrespondents with unknown eligibility. The latter term is the product of the eligibility rate and the number of nonrespondents with unknown eligibility. In both calculations, the estimated eligibility rate is the same. In the first calculation, however, the number of nonrespondents with unknown eligibility includes those who clicked on the link and those who did not. In the second calculation, the number of nonrespondents with unknown eligibility includes only those who clicked on the link.

[15] As noted in the sample methodology section, the TIN-derived frame includes all TINs that had NPIs that submitted Medicare claims in 2020 and were therefore in the MD-PPAS 2020 data; the chiropractor frame was obtained directly from Medicare Part B carrier claims data. For independent clinical laboratories and IDTFs, we constructed the sample frames using the Medicare Physician & Other Practitioners by Provider data set. We supplemented each of these three files with contact information from the NPPES.

[16] The response rate that we calculated in Exhibit 7 was equivalent to the American Association of Public Opinion Research (AAPOR) standard response rate calculation (Response Rate #3, where we considered partials that completed a sufficient portion of the survey as completed interviews): RR AAPOR = number of completed interviews/(number of cases in the sample - estimated number of ineligible cases). We calculated this response rate by assuming that the released practices that did not click on the link for the survey were ineligible because we learned that some of these practices were closed or ineligible for other reasons. (We surmised that, for the other practices that we had no information for, a large proportion of these practices could also have been ineligible.) For the purposes of weighting, however, we assumed the practices that did not click on the link for the survey had unknown eligibility because we could not confirm that they all were ineligible. Using this assumption in the calculation of the response rates, the weighted response rates were as follows: 8.0 percent for the TIN-derived frame, 5.7 percent for the chiropractor frame, 6.2 percent for the clinical lab frame, 1.4 percent for the IDTF frame, and 7.4 percent overall. This version includes those who did not click on the link in the denominator, whereas the version in Exhibit 7 does not. The unweighted response rates using this assumption differed little from the weighted version.

Exhibit 7. Dispositions and response rates, by frame and overall

Dispositions	TIN-derived frame[a]	Chiropractor frame	Clinical lab frame	IDTF frame	Overall
Total probability sample	3,333	333	333	333	4,332
Complete	217	17	12	7	253[b]
Ineligible	95	4	20	6	125
Eligible nonrespondent	193	21	12	8	234
Nonrespondent with eligibility unknown, clicked on link	2,162	265	183	210	2,820
Nonrespondents with eligibility unknown, did not click on link	666	26	106	102	900
Eligibility rate, unweighted	81.2%	90.5%	54.5%	71.4%	79.6%
Eligibility rate, weighted	84.2	90.6%	55.0	62.0%	85.2%
Response rate, unweighted	10.0%	6.1%	9.7%	4.2%	9.3%
Response rate, weighted	**10.3%**	**6.2%**	**9.3%**	**2.1%**	**9.1%**

[a]This column includes specialties for which the sample frame of practices were derived from TINs, and include the following specialties: audiologists, licensed clinical social workers, occupational therapists, optometrists, oral surgeons, physical therapists, podiatrists, psychologists/clinical psychologists, registered dietitians, and speech language pathologists.

[b]We included a total of 295 practice respondents in the survey analysis. In addition to the 253 practice respondents that were sampled and completed the survey, the analysis also included 42 practices that were not part of the release sample: 12 practices that volunteered to complete the survey (and did so) and 30 practices that were part of the PPI sample.

IDTF = independent diagnostic testing facility; PPI = Physician Practice Information; TIN = Taxpayer Identification Number.

Weighting

We used six steps to calculate the weights:

1. Calculate practice-level sampling weights
2. Incorporate responding practices that were not part of the probability sample as certainty selections
3. Adjust the practice-level sampling weights for two types of nonresponse (eligibility determination and cooperation among those with known eligibility)
4. Take the product of the practice-level nonresponse-adjusted weight among responding practices and the number of QHPs per specialty within practice (not applied to IDTFs)
5. Calibrate the department-level weights to ensure weighted marginal totals match frame totals for key specialties and number of QHPs per practice (not applied to IDTFs)
6. Trim the weights to reduce the influence of outlier weights (not applied to IDTFs)

Calculate practice-level sampling weights (Step 1)

As described in the sampling methodology section, the sampling unit for the CPI Survey was the practice (the TIN for TIN-derived frame and organizational NPI for each of the remaining frames—chiropractors, clinical labs, and IDTFs), so the initial probability weights were the inverse of the probability of selection and release for each practice.

Augmented practice sampling weight. As noted in the section on sampling methodology, we first selected an augmented sample of practices—a larger sample than we would likely need to release. Because this is an equal probability sample without clustering, the augmented sampling weight is the total number of practices within each stratum in the population divided by the number of practices selected in the augmented sample within that stratum. (Appendix C provides listings of the strata and their population counts.) We selected 28,249 practices in the augmented sample (22,256 TINs from the TIN-derived frame, 3,333 organizational NPIs from the chiropractor frame, and all clinical labs and IDTFs that were available in their respective populations—529 clinical labs and 2,131 IDTFs), of which 4,332 were in the release probability sample. We also identified another 15 as part of the frame and released them as volunteer cases, leaving 23,902 that we never released for data collection. The total numbers of practices in the TIN-derived and chiropractor frames were 79,903 and 22,872 practices, respectively. When also considering the 529 clinical labs and 2,131 IDTFs, the total number of practices across frames was 105,435 practices, in which the definition of *practice* depended on the frame. The sum of the augmented sampling weights necessarily was equal to this total number.

Release practice sampling weight. The initial release sampling weight was the weight applied to augmented sample practices that we initially released for data collection. It had two components: the augmented sampling weight and an adjustment to the augmented sampling weight to account for cases released from the augmented sample. The number of TINs (for the TIN-derived frame) and organizational NPIs (for the other three frames) in the initial release sample depended on an anticipated completion rate of 30 percent. We considered TINs and organizational NPIs that were not part of the initial release sample part of the reserve sample. The release sampling weights had to account for all chances of selection from the augmented sample, so the sum of the final release weights added up to 105,435.

In the CPI Survey, we did not release any of the reserve sample cases for data collection.

Incorporate responding practices that were not part of the probability sample as certainty selections (Step 2)

As stated in the sample methodology section, several responding practices included in the final analytic sample were not part of the release sample. The low completion rate in the release sample persuaded us to incorporate as many of these non-sampled responding practices as feasible. Additional practices in the final analytic sample included 15 volunteer practices and 30 QHPs from the PPI sample practices, all of which completed the survey, giving us a total of 295 completed surveys. Details for each of these extra completes follow.

Volunteer practices. In addition to sampled practices, another 15 practices contacted the specialty societies or Mathematica to volunteer to complete the survey even though they might not have been part of the original sample. We tried to match them to the existing frames, adding respondents to the sample (and frame) that were not matched to the frame and dropping nonresponding volunteers. Adding the four practices that did not match to the frame to the original frame total of 105,435 gave us a new total of 105,439. Exhibit 8 summarizes the status of each of the volunteers.

PPI sample practices. All 30 practices that provided useable information about QHPs in the PPI Survey did not match with any practices in any of the CPI frames, and we added them as certainty cases. Adding these to the frame total gave us a new total of 105,469.

Exhibit 8. Status of volunteer practices

Volunteer type	Number of cases	Resolution	Instrument statuses	Sampling weight of volunteer type
Total volunteers	15	.	.	
Matched with TIN in TIN-derived sample	11	Added to release sample	10 completes, 1 nonrespondent, eligibility unknown	1
Did not match with either sample frame	4	Added to release sample	2 completes, 2 eligible nonrespondents	1

Adjust the practice-level sampling weights for two types of nonresponse (eligibility determination and cooperation among those eligible) (Step 3)

We used weighting classes to adjust the practice weights for nonresponse. We accomplished this by adjusting for two types of nonresponse: ability or inability to determine whether a practice is an eligible nonrespondent among practices known to be eligible. We calculated each adjustment by forming classes of practices with similar characteristics and then using the inverse of the class response rate as the adjustment factor in that class. The adjusted weight is the product of the base weight and the adjustment factors. We treated ineligible practices as eligibility known in the first stage of adjustment and then dropped them before computing adjustments in the second response stage. We constructed weighting classes with sufficient counts in each class to make the adjustment more stable (that is, to minimize their variability). When forming the weighting classes, it was important to conduct the nonresponse adjustments within practice sampling specialty, whether individual specialties or combinations of specialties, as much as possible.

Eligibility determination step. Exhibit 9 shows the 27 weighting classes used in the eligibility determination step, complete with the number of practices in each weighting class, the number of practices with eligibility known, and the maximum adjustment in each class. If we had not created weighting classes and did only a straight ratio adjustment across all practices, the size of the adjustment would be 7.15; we tried to constrain the size of the adjustment to twice this number. Only one of the 27 classes exceeded this threshold: the maximum adjustment overall was 19.2 in the weighting class of IDTFs. We also attempted to require at least 10 responding and 20 total practices in a weighting class, and we met this goal in all the 27 weighting classes. The two variables used to create weighting classes for the 11 QHP types were the QHP specialty and, for the specialties with TIN-based practices, a binary indicator of whether the practice was located in a high-cost CBSA, and for chiropractors, an indicator of whether the practice was located in a high-cost state. For clinical labs, the second variable was an indicator of whether the lab was in the largest third with regard to service volume; for IDTFs, there were not enough cases to meet the listed criteria to add a second variable. These high-cost variables are described in Step 5 of the Sample frame creation section.

Exhibit 9. Weighting classes for eligibility determination step, with number of practices in each class and number of practices with eligibility known

Weighting class	Count of practices	Count of practices with known eligibility	Maximum weighting adjustment
Audiology TINs and Audiology/Speech Pathology combination TINs, low-cost CBSAs	239	35	6.83
Audiology TINs and Audiology/Speech Pathology combination TINs, high-cost CBSAs	95	14	6.80
Chiropractor organizational NPIs, higher-cost states	93	14	6.66
Chiropractor organizational NPIs, low-cost states	241	29	8.55
Clinical Lab organizational NPIs, lower two thirds of labs in terms of service volume	228	32	7.14
Clinical Lab organizational NPIs, largest third of labs in terms of service volume	105	12	10.44
Independent Diagnostic Testing Facilities	333	21	19.52
Licensed Clinical Social Worker TINs, low-cost CBSAs	217	41	5.11
Licensed Clinical Social Worker TINs, high-cost CBSAs	103	17	6.09
Multiple specialty TINs (from PPI survey)	9	9	1.00
Occupational Therapist/Physical Therapist combination TINs	82	12	7.77
Occupational Therapist TINs, low-cost CBSAs	168	31	5.66
Occupational Therapist TINs, high-cost CBSAs	99	15	7.18
Optometrist TINs, low-cost CBSAs	260	34	9.18
Optometrist TINs, high-cost CBSAs	84	10	10.12
Oral Surgeon TINs, low-cost CBSAs	157	12	14.83
Oral Surgeon TINs, high-cost CBSAs	176	22	7.43
Physical Therapist TINs, low-cost CBSAs	220	43	6.12
Physical Therapist TINs, high-cost CBSAs	116	20	6.38
Podiatrist TINs, low-cost CBSAs	197	26	7.93
Podiatrist TINs, high-cost CBSAs	137	15	9.73
Clinical Psychologist/Psychologist TINs and Clinical Psychologist/Psychologist/ Licensed Clinical Social Worker combination TINs, low-cost CBSAs	215	38	6.12
Clinical Psychologist/Psychologist TINs and Clinical Psychologist/Psychologist/ Licensed Clinical Social Worker combination TINs, high-cost CBSAs	135	18	8.97
Registered Dietitian TINs, low-cost CBSAs	183	47	3.79
Registered Dietitian TINs, high-cost CBSAs	153	31	5.76
Speech Language Pathologist TINs, low-cost CBSAs	240	45	5.38
Speech Language Pathologist TINs, high-cost CBSAs	92	13	8.50
TOTAL/MAXIMUM	**4,377**	**295**	**19.52**

CBSA = Core-Based Statistical Area; NPI = National Provider Identifier; TIN = Taxpayer Identification Number.

Response among the eligible step. Next, we dropped ineligible practices and calculated another adjustment to account for respondents among those known to be eligible. Exhibit 10 shows the 15 weighting classes used in this step, complete with the number of practices in each weighting class, the number of responding practices, and the maximum adjustment in each class. If we had not created weighting classes and did only a straight ratio adjustment across all practices, the size of the adjustment would be 1.91; we tried to constrain the size of the adjustment to twice this number. None of the 15 classes exceeded this threshold: the maximum adjustment overall was 3.58 in the IDTFs weighting class. We tried to maximize the number of practices in each weighting class but had only seven responding practices in IDTF weighting class. For IDTFs, this is the final step in the creation of analysis weights, as the practice is also the unit of analysis for these facilities. After removing estimated ineligibles in the frame, the total number of eligible practices across the four frames is estimated to be 88,876 (a reduction from the original total—before removing the estimated count of ineligible practices—of 105,469).

Exhibit 10. Weighting classes for response among eligible practices step, with number of practices in each class and number of responding practices

Weighting class	Count of eligible practices	Count of responding practices	Maximum weighting adjustment	Estimate of eligible practices in population
Audiology TINs and Audiology/Speech Pathology combination TINs	38	20	1.89	1255
Chiropractor organizational NPIs	39	18	2.18	20,797
Clinical Lab organizational NPIs	24	12	1.97	305
Clinical Psychologist/Psychologist TINs and Clinical Psychologist/Psychologist/ Licensed Clinical Social Worker combination TINs	52	25	1.85	15,728
Independent Diagnostic Testing Facilities	15	7	3.58	1,321
Licensed Clinical Social Worker TINs	51	31	1.57	18,020
Multiple specialty TINs (from PPI survey)	9	9	1.00	9
Occupational Therapist TINs and Occupational Therapist/Physical Therapist combination TINs	44	26	1.56	1,374
Optometrist TINs	36	21	2.35	11,567
Oral Surgeon TINs	21	10	2.15	714
Physical Therapist TINs	57	36	1.87	10,554
Podiatrist TINs	30	18	1.68	6,011
Registered Dietitian TINs, low-cost CBSAs	35	22	1.81	315
Registered Dietitian TINs, high-cost CBSAs	24	12	2.16	348
Speech Language Pathologist TINs	56	28	2.14	561
TOTAL/MAXIMUM	**531**	**295**	**3.58**	**88,876**

CBSA = Core-Based Statistical Area; NPI = National Provider Identifier; TIN = Taxpayer Identification Number.

Take the product of the practice-level nonresponse-adjusted weight among responding practices and the number of QHPs per specialty within each practice (Step 4)

Although the sampling unit is the practice, the unit of analysis (for all but IDTFs) is QHP-level expenses per hour. From the survey, we obtained expenses by QHP specialty within each practice. Each line of the resulting data set corresponded to a practice–specialty combination (a "department") in the responding practice. To create a weight for each line of data that accounted for QHP-level expenses, we took the product of the number of survey-reported QHPs and the nonresponse-adjusted practice weight for each specialty recorded for a responding practice. When summing this department-level weight across all departments, the total number of QHPs was estimated to be 382,171, somewhat larger than the total number of QHPs from the three sample frames (excluding IDTFs), which was 309,426.[17]

A review of these data indicated a large potential for measurement error in this estimate. For example, some practices entered a value for the number of QHPs per specialty that was likely much higher than the actual value. One of the responding practices (corresponding to a TIN from MD-PPAS) reported that they had 25 occupational therapists, even though the sample frame (MD-PPAS) indicated that it only had one occupational therapist. The result was that the responses corresponding to this practice had enormous weights, and the counts of reported QHPs for practices with a similar discrepancy with the sample frame counts are dubious. To alleviate this source of error, we flagged practices that reported at least 10 QHPs in their practice and when that count was more than double the number of QHPs recorded in the sample frame.[18] This occurred in 31 of the 380 responding practices and in 42 of the 348 departments. In these cases, we replaced the total count entered by the responding practice with the sample frame value and then performed a ratio adjustment of the department-level weights for each department to add up to the frame total. When summing this adjusted department-level weight across all departments, the total number of QHPs was estimated to be 169,233.

Henceforth, we will describe the processing of two sets of department-level weights, one that does not adjust for the differences between the respondents' number of QHPs per specialty and the frame, and the other which does include this frame-correction adjustment. The frame-corrected adjusted weights will be referred to as "adjusted weights" and the department-level weights that were not corrected for frame deviations will be referred to as "unadjusted weights."

[17] Occasionally respondents defined "departments" with more than one specialty. If the combination entry included a specialty considered for this study and a specialty not under consideration, such as nurse practitioners, then these departments were assigned the specialty that was considered for this study. However, in nine instances, the department entry from the respondent included two or more specialties considered in this study. In that case, we assigned the specialty to the department corresponding the specialty assigned to the practice that the respondent was answering for in the survey.

[18] We used the minimum of 10 because it is not uncommon for the sample frame to indicate, for example, one QHP in the practice but for the survey report to indicate two QHPs. For these small differences, it seemed better to believe the survey report, and any adjustment would have little impact on the overall estimate of the total number of QHPs. We used the minimum of double the number in the sample frame because, again, it was not uncommon for there to be small differences even for larger TINs for which believing the survey report was defensible.

The sum of the department-level weights described in this step provided an estimate of the total number of QHPs but had high variance because of the low response rate. We therefore performed a ratio adjustment of both versions of the department-level weights described here so that they summed to 309,426, the total number of QHPs in the three frames.

Calibrate the department-level weights to ensure the weighted marginal totals match frame totals for key specialties, number of QHPs per practice, and other key variables when possible (Step 5)

For some specialties, the sum of the department-level weights still deviated substantially from the frame totals, particularly when the department-level weight did not include the extra frame-correction adjustment, indicating a potential for bias if these weights are not further adjusted. To alleviate potential biases in the count of providers for each specialty, we ratio adjusted the weights to ensure the weighted sum of the number of QHPs per specialty matched the totals from MD-PPAS. We did this for both versions of the department-level weights (with and without the frame correction adjustment) that we created in Step 4.

Exhibit 11 presents the *specialty categories* we used for this ratio adjustment, and the distribution of weighted totals for both versions of the department-level weights (with and without the frame-correction adjustment) within each specialty. The adjustments presented in columns G and H show how the weighted totals vary from the population *before* conducting the ratio adjustments to the totals for each specialty.

We aimed to include at least 15 departments per category, but this was not possible for all categories.

Although this step involved raking for specialty totals and size totals in the PPI Survey, the department-level counts were too small in the CPI survey to use more than one variable for raking.

We did not have weights at the department level for IDTFs. Although this step involved raking for specialty totals and size totals in the PPI survey, the department-level counts were too small in this survey to use more than one variable for raking.

Trim the weights to reduce the influence of outlier weights (Step 6)

After we made the ratio adjustments to match the MD-PPAS totals for the count of specialists in each category, we assessed the distribution of the adjusted weights for unusually high values, which could make the survey estimates less precise. We used the design effect attributed to the variation in the sampling weights as a statistical measure to determine the need for and amount of trimming. The design effect attributed to weighting is a measure of the potential loss in precision caused by the variation in the sampling weights relative to a sample of the same size with equal weights. We also wanted to minimize the extent of trimming to avoid the potential for bias in the survey estimates. Therefore, the decision to trim required us to balance increasing bias and decreasing variance.

We conducted the trimming within 12 trimming classes defined by the 12 specialty groups shown in Exhibit 11. Exhibit 12 shows the design effects attributable to unequal weights before and after trimming, within trimming classes defined by those 12 specialty groups for both the unadjusted and adjusted weights.

Trimming substantially reduced the design effect for some of the trimming classes, particularly for the unadjusted weights. For example, for the trimming class Clinical Psychologists/Psychologists, the design effect from unequal weighting among the unadjusted weights was reduced from 7.47 to 4.19. The adjusted weights had fewer outliers, so much less trimming was required. The maximum reduction in the design effect for the adjusted weights was with Occupational Therapists (2.90 to 2.00).

Exhibit 11. Calibration of counts of QHPs by specialty

Specialty	Count of specialty–practice combinations (departments) among responding practices	Count of QHPs among responding practices[a]	Summed total of QHP-level unadjusted specialty weights	Summed total of QHP-level specialty weights, adjusted for frame-survey differences	Population total of QHPs from frame to be matched	Ratio of population total and summed unadjusted specialty weight	Ratio of population total and summed adjusted specialty weight
Total	348	3,271	309,426	309,426	309,426		
Audiologists	27	108	2,446.7	5,474.8	8,069	3.30	1.47
Chiropractors	18	32	31,349.0	70,794.0	79,015	2.51	1.12
Clinical Lab Pathologists	12	121	2,315.4	5,228.8	2,359	1.02	0.45
Clinical Psych-ologists/Psych-ologists	33	221	82,919.1	32,664.5	29,430	0.35	0.90
Licensed Clinical Social Workers	43	639	92,222.3	48,346.0	49,449	0.54	1.02
Occupational Therapists	31	275	4,517.4	6,306.3	10,199	2.26	1.62
Optometrists	27	70	15,896.1	35,846.9	34,575	2.18	0.96
Oral Surgeons	11	106	7,286.5	2,300.4	1,968	0.27	0.86
Physical Therapists	50	1,083	43,646.1	81,432.3	70,674	1.62	0.87
Podiatrists	23	101	20,648.8	13,793.0	15,878	0.77	1.15
Registered Dietitians	38	268	2,448.1	3,028.6	4,127	1.69	1.36
Speech Language Pathologists	35	247	3,733.6	4,120.5	3,687	0.99	0.89

[a] The count of QHPs in the sample is based on the respondents' entries of the count of QHPs per specialty. It does not include the adjustment that reduces the count of QHPs because of large deviations from the frame.

QHP = qualified health professional.

Exhibit 12. Design effects before and after trimming within the 12 specialty groups

Specialty	Count of specialty–practice combinations (departments) among responding practices	Number of cases trimmed, unadjusted weights	Design effect attributed to unequal unadjusted weights		Number of cases trimmed, adjusted weights	Design effect attributed to unequal adjusted weights	
			Before trimming	After trimming		Before trimming	After trimming
Total	348	13			6		
Audiologists	27	1	2.41	2.32	1	2.46	2.36
Chiropractors	18	1	1.83	1.49	1	1.83	1.49
Clinical Lab Pathologists	12	1	2.06	1.84	1	2.06	1.84
Clinical Psych-ologists/Psych-ologists	33	2	7.47	4.19	0	2.03	2.03
Licensed Clinical Social Workers	43	1	6.19	3.49	1	2.32	2.01
Occupational Therapists	31	1	5.12	2.31	1	2.86	2.04
Optometrists	27	0	2.65	2.65	0	2.66	2.66
Oral Surgeons	11	1	4.83	3.66	0	1.78	1.78
Physical Therapists	50	0	1.92	1.92	0	2.07	2.07
Podiatrists	23	2	6.47	3.06	0	1.64	1.64
Registered Dietitians	38	2	3.44	2.89	0	2.03	2.03
Speech Language Pathologists	35	1	3.84	2.24	1	2.68	1.80

[a] The count of QHPs in the sample is based on the respondents' entries of the count of QHPs per specialty. It does not include the adjustment that reduces the count of QHPs because of large deviations from the frame.

QHP = qualified health professional.

Analysis

Overview

Our goal was to calculate average practice expense per hour of patient care provided at the specialty level. Using the data provided by respondents who completed the CPI Survey, we calculated practice expense and the annual number of patient care hours provided by different clinician specialties. In this section, we describe the steps we took to identify survey observations with useable data, clean the data, and calculate mean practice expense per hour of patient care provided by specialty.

Identify survey observations for the analysis

As a first step, we identified all observations that we could use in the analysis by doing the following:

Created total compensation variables (Step 1). We created two total compensation variables at the specialty level. The first combined the monetary compensation and benefits data for clinicians from Table A of the CPI Survey, and the second combined the monetary compensation and benefits data for administrative/clerical staff and clinical staff from Table B of the survey. We did this for cases with no missing values for total compensation in both tables.

Created flags for unusable data (Step 2). We created two flags to exclude unusable data. The first flag was for the number of reported clinicians, and the second flag was for reported compensation and expenses.

The first flag examined the number of clinicians reported for each specialty. We generated a flag if the numbers of part-time and full-time clinicians were both missing or equal to zero or if one of the two was equal to 40 or unusually large. We flagged practices that entered 40 because this suggested that the respondent mistakenly read the question as number of hours worked rather than number of clinicians in total. For those, we further investigated the other data reported and the practices' websites to determine whether the 40 was likely an error.

The second flag examined how the practice reported compensation and expenses at the specialty level. If a practice specialty had missing or zero values (or a combination of missing and zero values) for all the compensation and expense categories listed below, we flagged it as unusable data. The expense categories included the following:

a. Administrative/clerical staff and clinical staff compensation (combined)
b. QHP compensation
c. Overhead expense
d. Medical supplies
e. Medical equipment
f. Non-billable drugs
g. Other expenses
h. Professional liability insurance
i. Information technology

We used these two flags to determine whether a specific observation (that is, data from a practice at the specialty level) could likely be used in the analysis. If all observations from a responding practice received a flag for the number of clinicians reported (after resolving whether 40 was a mistake) or a flag for not reporting information for any expense category, we dropped those observations from the analysis.

In total, there were 295 practices that had at least one usable observation for analysis. There were 348 observations across the 295 practices that completed the survey. Together, these practices reported 2,800 clinicians in Table A of the survey.

Data cleaning and analysis

After determining which observations we could use in the analysis, we completed Steps 3 to 8, described below, to identify unrealistic values for time spent providing patient care and for each of the expense categories as well as for imputing missing data. We then calculated mean practice expense per hour of patient care, as described in Step 9.

Identify unrealistic values for hours and weeks spent providing patient care (Step 3). We identified unrealistic values entered for the number of weeks per year worked by the average clinician within a specialty department at a practice as well as unrealistic values entered for the number of hours all clinicians within a specialty department spent providing patient care per week. Unrealistic values for weeks worked included anything over 52 and values of zero if the respondent reported any nonzero value for the number of hours of patient care clinicians provide per week. Unrealistic values for hours of patient care clinicians provided within a specialty department included values that averaged more than 70 hours per week per clinician and values that averaged to less than 15 hours per week per clinician if the practice reported employing full-time clinicians and reported that, to be considered a full-time employee, clinicians needed to work 30 or more hours per week.

Fix unrealistic values for hours spent providing patient care, when feasible, or set values to missing (Step 4). If it was clear that a respondent misinterpreted the question when entering the number of hours clinicians spent providing patient care in a week, we updated the data. For example, if it was clear that a respondent entered the number of hours clinicians within a specialty spent providing patient care for an entire year instead of for a week, we divided the value entered by the number of weeks worked per year (as reported by the respondent) and replaced the original value with the quotient. If it was not clear why the respondent entered an unrealistic value, we set the value to missing.

Identified cases where respondents entered the same values for clinical staff compensation and provider compensation (Step 5). In cases where a respondent entered the same values for provider compensation and clinical staff compensation and reported the same number of providers and clinical staff, we assumed that the respondent misunderstood the survey instructions. The survey defines clinical staff as "registered nurses (RNs), licensed practical nurses (LPNs), medical assistants, medical physicists, laboratory technologists, imaging technologists, physical therapy assistants, and other clinical personnel not allowed to have an NPI number or to enroll in Medicare as a provider and who work under the supervision of a physician or other qualified health care professional (QHP)" (Appendix A). We would not expect practices from these specialties to have clinical staff that receive the same compensation as providers. However, because it was unclear whether these responding practices

employed clinical staff, we set the values of clinical staff full time equivalents (FTE) and clinical staff compensation to missing for these cases.

Generated values of expense per hour of patient care provided for each observation (Step 6). For each specialty department observation we included in the analysis, we generated values of expense per hour of patient care provided for each expense category by dividing the value in each expense category by the product of weeks worked and weekly hours clinicians spent providing care.

Trimmed outliers for each expense category (Step 7). We trimmed outliers for expenses per hour of patient care provided that were unreasonably low or high in the following categories: administrative compensation, clinical compensation, information technology, liability, medical equipment, medical expenses, overhead expenses, other expenses, and provider compensation.

Imputed missing values for weeks worked and weekly hours providing patient care, and for each expense category (Step 8). We imputed values based on the specialty mean. Before imputing based on the specialty mean, we considered alternative approaches for imputation. Specifically, for specialties with few observations, we compared the specialty-specific mean for weeks worked and weekly hours of patient care provided with the overall mean of observations in the sample. Because the means were similar, we decided to use the specialty-specific mean to remain consistent with the approach we used for the other specialties. For the expense categories, we considered imputing missing values based on the specialty and cost area (whether the practice is in a high- or low-cost area) mean. Because of the limited number of observations on which to base the mean for imputation, however, it was not feasible to create different means across multiple variables. For clinical staff compensation and administrative staff compensation, we imputed values for observations where the respondent indicated that there were clinical or administrative FTE but did not enter a compensation amount.

Created estimates of practice expense per hour of patient care provided by specialty (Step 9). We calculated the mean practice expense per hour of patient care provided for each of the expense categories for each specialty.

Lessons learned

Through the process of sampling, fielding, and weighting the CPI Survey, we learned several lessons that could improve future iterations of the survey. We have grouped these lessons into three thematic areas: identifying practice contact information, engaging specialty societies in practice outreach, and considering the survey length and complexity. We believe that addressing these lessons will improve the CPI Survey and result in a higher overall response rate.

Identifying practice contact information

Although we hoped that the data sets we used for the sample frame would provide useful contact information for most practices in the sample, we discovered that the contact information was at times incorrect, missing, or not available for the targeted people within a practice most likely to have access to the practice's expense information. We are not aware of any alternative sources of practice contact information. If the specialty societies field the CPI Survey again, it would be useful to seek out other sources of practice contact information. If there are alternative sources, before using them, the survey

team should confirm that the contact information is accurate. If there are no other sources, the survey timeline must allow ample time and resources to support extensive locating efforts before fielding, including internet searches, outreach and communication with medical specialty societies, and phone calls to practices.

Engaging the specialty societies in practice outreach

Before fielding the CPI Survey, the AMA reached out to specialty and state medical societies to obtain their support for the survey. As a result of this effort, more than 170 societies endorsed the survey, including those representing QHPs. The invitation to participate in the survey noted the high volume of societies that endorsed the survey, mentioned the specific societies that were relevant to where the practice was located and the types of specialties the practice had, and provided an endorsement letter with the complete list of societies that supported the survey effort. Some societies also included information in their newsletter about the CPI Survey to encourage participation. We believe this was beneficial, but the overall response rate was still low. To boost response, we received IRB approval to share lists of sampled practices with willing specialty societies through a secure transfer site so they could send targeted emails to the practices for which they had contact information, asking them to speak with their practice finance or administrative staff about completing the survey. We believe this step was helpful in increasing the overall response rate and recommend repeating this step earlier in the fielding period.

Considering the survey length and complexity

The effort to collect the required expense information in the survey was substantial and likely deterred practices from completing the survey. Overall, 633 practice respondents clicked on the survey link but never completed the screening questions, and 293 practice respondents who completed the screener and were eligible for the survey never finished and submitted it. At least some percentage of these practices likely did not complete the survey because of the high burden associated with collecting all the relevant information.

If the specialty societies field the CPI Survey again, it will be important to consider approaches to simplify the survey and potentially collect relevant information through alternative means. With respect to collecting information through alternative means, the specialty societies could consider interviewing a few practices to understand whether there are sources of information with expense data, such as tax returns, that practices would be willing to share confidentially to enable them to calculate overall practice expense information. They could then share the calculated information with the practice so respondents could confirm that they entered the data accurately.

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