

Improving Provider Directory Accuracy: Can Machine-Readable Directories Help?

Michael Adelberg, MA, MPP; Austin Frakt, PhD; Daniel Polsky, PhD; and Michelle Kitchman Strollo, DrPH, MHS

Enrollees in managed care plans expect reasonable access to healthcare providers, yet “reasonable access”—a standard mandated by the Affordable Care Act—is a vague term never defined in federal regulation. Regulators measure access differently, from national standards in Medicare Advantage (MA) plans to individualistic network access plans in several states. Once a provider network is judged adequate by the regulator, the plan’s provider directory is the document that enrollees use to find providers. However, information in provider directories is often incorrect. There are 3 types of errors: a listed “in-network” provider has errant information, a provider listed as in network is not, and a provider that is in network is omitted.

A recent report from CMS found that 52% of providers in MA provider directories included at least 1 inaccuracy.¹ This MA error rate is consistent with those in exchange and California Medicaid directories.² In the last few years, significant regulatory actions have been taken against a handful of health plans with patterns of inaccurate provider information. In the last year, lawsuits were filed against 3 health plans by consumers who allege that they selected their health plan based on false provider network information.³⁻⁷

Health plans struggle with provider network accuracy for a number of reasons. Providers are frequently indifferent to keeping directories current: The unglamorous task of notifying health plans of changes is often delegated to junior office staff or no one at all. The patchwork of regulatory definitions and standards for directories is another problem. Although some promising state- and vendor-led initiatives are now underway (see **eAppendix A** [eAppendices available at ajmc.com]), regulators are uncoordinated on definitions, requirements, and oversight approaches.

Machine-Readable Provider Directories

Provider directories are commonly posted on the internet in PDF or other “flat file” formats that defy easy downloading, aggregation, or analysis. In 2013, the state of California began requiring machine-readable (MR) health information. A number of newly established state-run health insurance exchanges required the

ABSTRACT

OBJECTIVES: To examine inaccuracies in health plan provider directories and consider whether the machine-readable (MR) formats required of provider directories in the health insurance exchanges are more accurate than conventional directories and have the potential to improve directory accuracy in the future.

STUDY DESIGN: The descriptive study design included qualitative data collection through stakeholder interviews and quantitative data analysis and verification of provider data source accuracy from multiple sources.

METHODS: Four separate sources of provider data from 5 counties were captured and aggregated into an analytic database. Provider data were analyzed through text matching techniques and provider practice phone interviews. Additionally, we interviewed 21 stakeholders.

RESULTS: In quantitative analysis, we found widespread inaccuracy in provider information across directory types. Provider directory phone numbers were more likely to align with Google data than with the directory for the same company’s health plans in other markets. It is vastly less expensive to aggregate data from MR files than from conventional directories, which suggests that MR files have potential to be cost-effectively leveraged for data quality improvements. In qualitative analysis, we found that interviewees perceived provider directories as inaccurate, but they differed in their perceptions of the severity of the problem. Interviewees who were familiar with MR directories understood their advantages over conventional directories.

CONCLUSIONS: The MR provider directories are not more accurate than the conventional provider directories. However, there is strong reason to believe that MR technology can be leveraged to increase accuracy. Promising state- and vendor-led initiatives also have the potential to correct widespread provider directory inaccuracy.

Am J Manag Care. 2019;25(5):241-245

TAKEAWAY POINTS

Provider directories are widely inaccurate. Conventional Medicare Advantage directories are currently slightly more accurate than machine-readable (MR) health insurance exchange directories, and Google is more accurate than either directory type. Although MR directories are not more accurate than conventional directories, they can be leveraged to improve directory accuracy. However, this has not yet occurred.

- ▶ The problems with provider information are more complex than the problems specific to directories.
- ▶ Promising state- and vendor-led initiatives are underway and deserve further attention.
- ▶ Without accurate provider information, plan members cannot navigate their plans successfully, regulators cannot ensure plans meet requirements, and researchers have no accurate source of provider information.

TABLE 1. Data Sources

Provider Data Source	Description	Acquisition Mode
NPPES	National system for nearly all providers, including a national provider ID, practice, and county locations	Downloaded entire NPPES file and removed records in studied counties
MA directories	Provider directory files from various plan websites	Various methods: downloaded PDF, manual HTML downloads, etc
Exchange MR directories	Exchange MR files that are provided from each plan in prescribed format	Single download script that automatically downloads each file
Google Places	Information, self-reported, for each doctor and office	Manual download for study; can be called from API

API indicates application programming interface; ID, identifier, MA, Medicare Advantage; MR, machine-readable; NPPES, National Plan and Provider Enumeration System.

use of MR provider directories in 2014, and CMS picked up the requirement for the federally facilitated exchanges in 2016.^{8,9} By requiring health plans to post their provider directories in a common MR format, directories can be easily downloaded to assess network adequacy against regulatory standards or network breadth among competing plans. In addition, MR directories can also populate physician finder consumer tools and improve provider data accuracy by flagging cases in which a provider is inconsistently listed across data sources. Here, we present data on the accuracy of MR directories in comparison with other sources of provider information.

METHODS

The study was conducted using quantitative and qualitative analyses. Data were collected and analyzed through quantitative research to compare accuracy among MR provider directories on the exchanges, traditional flat file provider directories in MA plans, and additional sources of provider information. Interviews were simultaneously conducted with relevant federal and state officials and key industry stakeholders to capture their knowledge of and experience using both types of provider directories. This study did not require institutional review board review and approval.

Quantitative Analysis

Quantitative research questions. Our quantitative research questions were (1) “How do electronically available data sources vary? Are the same data reported across sources?” and (2) “How consistent are the provider data found in electronic sources with information gathered from phone validations conducted with provider offices?”

A secondary research question (“What are the differences in level of effort [time and cost] to aggregate MR files versus other data types to conduct analyses of provider networks?”) is discussed in [eAppendix B](#).

Sampling methodology. We selected 5 US counties across the country with insurance carriers that offer both MA and exchange health plans. We selected these counties based on geography, market penetration, and the presence of an insurer serving both the MA and exchange markets.

Data sources. We downloaded and aggregated 4 separate sources of provider data—CMS’ National Plan and Provider Enumeration System (NPPES) file, conventional MA directories found on health plan websites and other online sources, exchange MR directory files, and Google Places—into a single analysis database ([Table 1](#)).

MA file compilation required 5 manual processes to download into the analysis database. Data quality issues such as misspellings and small inconsistencies in addresses were solved manually. The exchange data were in a uniform and standard format, but we still experienced some data challenges, which were solved via code and automation with little manual intervention.

We compiled the data into an analysis database, removing inconsistencies (eg, spacing and capitalization) and assigning each reported element to a category (ie, address or phone number) for validation and analysis across data sources. The analysis database contained all known information.

Summary of analysis methods. Throughout the data aggregation process, we tracked time and effort in order to assess the differences among the data sources by recording the time it took staff to complete each step to move the data into the analysis database (see [eAppendix B](#)).

After all of the data were compiled into a single database, data were analyzed via queries and text matching. For the text matching, human coders examined text similarity and assigned them into categories of like and unlike data. Because providers can practice in multiple locations, our analysis focused on whether 2 data sources reported at least 1 similar value.

Finally, we validated the accuracy of the electronically reported elements based on phone interviews with provider offices. We

drew a random sample of more than 50 unique providers per specialty based on the primary specialty reported in NPPEs. We contacted the provider’s practice address to validate each reported element in the analysis database.

Qualitative Analysis

We conducted phone interviews with representatives of CMS, state regulators, health plans and trade associations, and other experts to determine whether these stakeholders believe that MR directories facilitate more accessible and reliable information than conventional directories. Interviews were conducted with 4 CMS officials from 2 different program components, 5 senior state regulators from 4 states in different regions of the United States, 6 staff from 3 health plans that offer plans in the health insurance exchanges and MA, 3 health plan trade association staff from 2 associations, and 3 vendors of provider data accuracy solutions. These numbers do not include 2 individuals who declined to be interviewed.

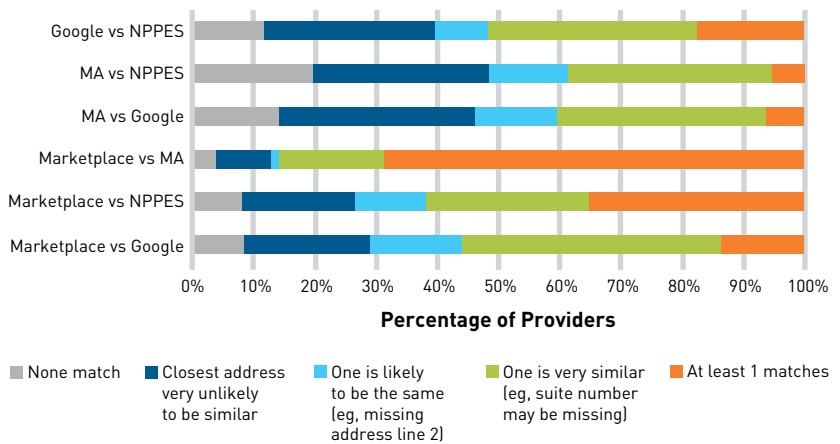
Participants were provided with discussion topics in advance of the interview. Interviewees were offered confidentiality in exchange for their candor but no other compensation for their time.

RESULTS

We found widespread inaccuracy in provider information across directory types. We also found that provider directories from insurers with MA and exchange plans did not report the same phone number 50% of the time and did not list the same address 31% of the time. As displayed in **Figure 1**, provider directory addresses have a 30% inconsistency rate when a common provider is in the same company’s health plan networks across markets.

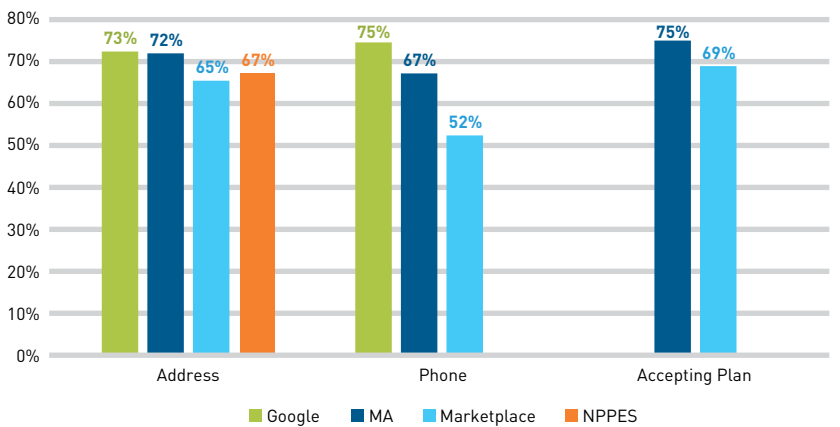
We also analyzed provider information accuracy through phone validation by calling provider offices. During these calls, we successfully validated 80% (2850 of 3562 calls) of information attributes attempted. As summarized in **Figure 2**, although all data sources contained inaccuracies and differences were sometimes slight, 2 findings can be implied: (1) Google is more accurate than provider directories or the federal NPPEs file for name, address, and phone number (statistically significant [$P < .01$]); and (2) despite the advantages of MR directories, exchange provider directories are less accurate than conventional MA directories.

FIGURE 1. Information Reported: Does at Least 1 Reported Address Match?*



MA indicates Medicare Advantage; NPPEs, National Plan and Provider Enumeration System. *The figure illustrates the percentages where at least some information matched from the various sources. The further left in the graph means that data between the 2 sources did not match at all or most likely did not match; further to the right means that at least 1 address matched or was likely to be a match.

FIGURE 2. Accuracy of Reported Information by Source: Percentage of Reported Information Verified as Accurate*



MA indicates Medicare Advantage; NPPEs, National Plan and Provider Enumeration System. *NPPEs provider phone numbers were not analyzed as part of this project. Google and NPPEs do not capture information on whether a provider is accepting a health plan.

The higher inaccuracy rate of exchange provider directories was unexpected given the advantages of MR technology to improve accuracy. This is not necessarily an indictment of MR. The high inaccuracy rate of exchange provider directories is likely because MA plan sponsors (facing oversight from CMS) are investing resources in raising the accuracy of MA directories, whereas there is no equivalent pressure to improve directory accuracy in the exchanges.

Interviewees—whether they were from health plans, government agencies, or provider data vendors—all understood that provider directories are frequently inaccurate, but they differed in their

TABLE 2. Interview Results

Interviewee	Perception of Problem	Perception of Solution	Other Observations
Health plans and trade associations	<ol style="list-style-type: none"> 1. Providers control their data, not health plans 2. There is no “source of truth” for health plans to correct problems 	<ol style="list-style-type: none"> 1. Require providers to keep directories accurate 2. Establish a “source of truth” against which health plans can verify provider information 	<ol style="list-style-type: none"> 1. MR directories are now working better but still labor intensive to upload 2. Technical issues remain
Federal and state officials	<ol style="list-style-type: none"> 1. Directories are not accurate and “needle is not moving” 2. Provider indifference is a factor 3. Lack of common data dictionary is part of the problem 	<ol style="list-style-type: none"> 1. There is a need for a central data hub or a “source of truth” 2. MR directories can be used to improve provider data analysis and accuracy 	<ol style="list-style-type: none"> 1. Difficult rollout of MR directories in exchanges soured opinions, but the platform works well now 2. Regulator solutions to network adequacy are generally not utilizing MR directories
Vendors and provider data experts	<ol style="list-style-type: none"> 1. Directories are inaccurate 2. Conventional directories are not easily converted into formats that permit IT-enabled solutions 	<ol style="list-style-type: none"> 1. MR directories are more easily “scraped” to create national data sets and comparative information 2. MR directories can be used to crowdsource provider directory accuracy 	<ol style="list-style-type: none"> 1. High-value/high-use providers need to be measured differently than other providers 2. Use of claims can eliminate providers who are currently counted but not serving health plan enrollees

IT indicates information technology; MR, machine-readable.

perceptions of the problem and potential solutions. Interviewees who were familiar with MR directories understood their advantages over conventional directories, but only some acknowledged their potential value in improving accuracy. Contrasting responses are offered in [Table 2](#).

DISCUSSION

The information contained in provider directories is inaccurate across information types and markets (ie, the inaccuracy rate of provider addresses ranges from 27% to 35%, and the inaccuracy rate of provider phone numbers ranges from 25% to 48%). Although the facts are straightforward, the reasons behind them are complex: As noted by interviewees, providers often treat maintaining current directory information as a low priority; there is a lack of consistent standards or a common data dictionary for provider information; there is no central, reliable information source (“source of truth”) against which to assert accuracy; and there is no harmonized federal strategy to address the problem. As argued by CMS in its 2020 Call Letter, health plans cannot solve this inaccuracy problem on their own.¹⁰

As noted, promising initiatives are now underway in a few states, and a few vendors are now offering promising accuracy tools (see eAppendix A), but we will not know their results for years. In the interim, MR directories offer great advantages over conventional directories, including crowdsourcing to identify information that is likely erroneous and quick data aggregation for ongoing network analyses. MR directories are mandated in the health insurance exchanges and Medicaid, but not federally enforced. They are recommended as a best practice in MA, but there is no evidence that they are widely used by MA health plans.¹¹ The loose regulation of MA directories contrasts with CMS’ affirmative regulation of this market in most other respects. CMS Deputy Administrator Demetrios Kouzoukas warned MA organizations about the need for

directory accuracy at the May 10, 2018, CMS Medicare Advantage and Part D conference, but without recommending the use of MR directories.¹² The lack of a harmonized position on MR provider directories across markets merits further consideration. CMS’ recent requirement for hospitals to post MR hospital pricing information “to further improve the public accessibility of charge information” demonstrates that it values the technology.¹³

Our analysis focused on whether MR directories can result in more accurate information on network providers. It did not focus on whether MR directories can be used to lessen the instances in which in-network providers are omitted or out-of-network providers are included. More research is needed on these topics.

Recommendations

Fully utilize MR directory advantages. For CMS and other entities requiring MR directories, it is incumbent to utilize the advantages of machine readability. CMS required exchange plans to invest in machine readability and endure a bumpy rollout, but it has not yet leveraged all of the considerable benefits of machine readability. The advantage of the technology can be utilized in a nonpunitive manner by having CMS and health plans partner to improve directory accuracy.

Watch for emerging best practices. Regulators and researchers should analyze state and vendor initiatives to improve provider data accuracy. California’s statewide provider network utility and New Hampshire’s use of claims data to determine actual provider network are particularly interesting initiatives. These and other potential long-term accuracy solutions are summarized in eAppendix A. They may subsume and surpass the advantages provided by MR directories.

Clarify federal role. Federal policy makers should consider benefits of federal leadership in correcting provider directory inaccuracy. Our analysis suggests that Medicare’s NPPES file is less accurate than health plan provider directories. This required Medicare data source

could be reimagined to become a source of provider information accuracy. More broadly, national and transmarket efficiencies could be realized by establishing a national data dictionary and requirements across markets. In this regard, initiatives by HHS' Office of the National Coordinator for Health Information Technology and CMS merit watching, including a recent proposal to require MA and Medicaid health plans to make provider directories available in a common electronic format equivalent to MR.^{14,15}

CONCLUSIONS

MR directories offer significant advantages over conventional directories. As noted in eAppendix B, data can be downloaded at roughly \$0.01 per provider from an MR directory compared with \$2.15 per provider from a conventional directory. This efficiency makes provider network aggregation and comparisons feasible for the first time. This, in turn, powers the potential of MR directories to improve the transparency and accuracy of provider information. However, machine readability does not correct inaccuracies by itself. We found that MR exchange plan directories are slightly less accurate than conventional MA directories. This is likely because MA plans (facing oversight from CMS) are working to raise the accuracy of MA directories, whereas there is no equivalent pressure to improve directory accuracy in the exchanges. ■

Acknowledgments

The authors thank Timothy Riddle, MSMIS, MBA, of NORC; Kacey Stotler, MSW, of Faegre Baker Daniels Consulting; and Tricia Beckmann, JD, of Faegre Baker Daniels Consulting, for their work on this project.

Author Affiliations: Faegre Baker Daniels Consulting (MA), Washington, DC; Department of Veterans Affairs (AF), West Roxbury, MA; Boston University (AF), Boston, MA; Harvard University (AF), Cambridge, MA; Leonard Davis Institute of Health Economics, University of Pennsylvania (DP), Philadelphia, PA; NORC at the University of Chicago (MKS), Bethesda, MD.

Source of Funding: The Commonwealth Fund.

Author Disclosures: Mr Adelberg received grant funding from The Commonwealth Fund and has spoken on this topic at meetings/conferences. The remaining authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (MA, DP, MKS); acquisition of data (MA, MKS); analysis and interpretation of data (MA, AF, DP, MKS); drafting of

the manuscript (MA, AF, MKS); critical revision of the manuscript for important intellectual content (MA, AF, DP, MKS); and obtaining funding (MA).

Address Correspondence to: Michael S. Adelberg, MA, MPP, Faegre Baker Daniels Consulting, 1050 K St, Washington, DC 20001. Email: Michael.Adelberg@faegrebdb.com.

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eAppendix A

Selected State- and Vendor-led Efforts to Improve Provider Directories		
State / Organization	Summary	Link
California	State law that sets directory accuracy requirements on health plans and providers. Established non-profit organization to contact providers and establish a statewide provider data utility to populate directories.	SB 137 ; Directory Initiative
Michigan	Established non-profit to develop a centralized directory tool that will create consumer record to share with their doctors. Will flag incorrect provider information as an intermediate step.	MiHIN
Oregon	Launching a statewide provider directory that leverages data from existing sources such as the state’s common credentialing process. Allow health plans to access data to improve directories.	OHA Provider Directory Overview
Rhode Island	Developed the Statewide Common Provider Directory (SCPD). Multiple state offices feed into the directory.	RI Provider Finder
New Hampshire	Establishing All Claims Payer Database as the state’s “source of truth” for provider information. Will use claims to determine variance between actual and reported network.	NH DOI Press Release
CAQH	Leveraging credentialing platform, provides health plans and providers a tool to update and verify provider information.	CAQH ProView
Quest Analytics	Offers a cloud-based tool that pairs the Betterdoc accuracy solution with plan-to-plan comparison to identify likely provider information inaccuracies.	Quest Cloud Services

eAppendix B

Are Machine Readable Directories More Efficient than Conventional Directories?

We tracked, analyzed, and compared the level of effort necessary to aggregate network directory information. The level of effort associated with extracting and compiling provider information from MR directories is a small fraction of what is necessary for compiling information from conventional directories. This is due to MR having numerous advantages over conventional flat-file directories, including: 1.) uniform file formats, and uniform attributes within file formats, 2.) all information contained in downloadable files, 3.) a National Provider Identifier number for each record, 4.) quality checks by scripted code.

Methods

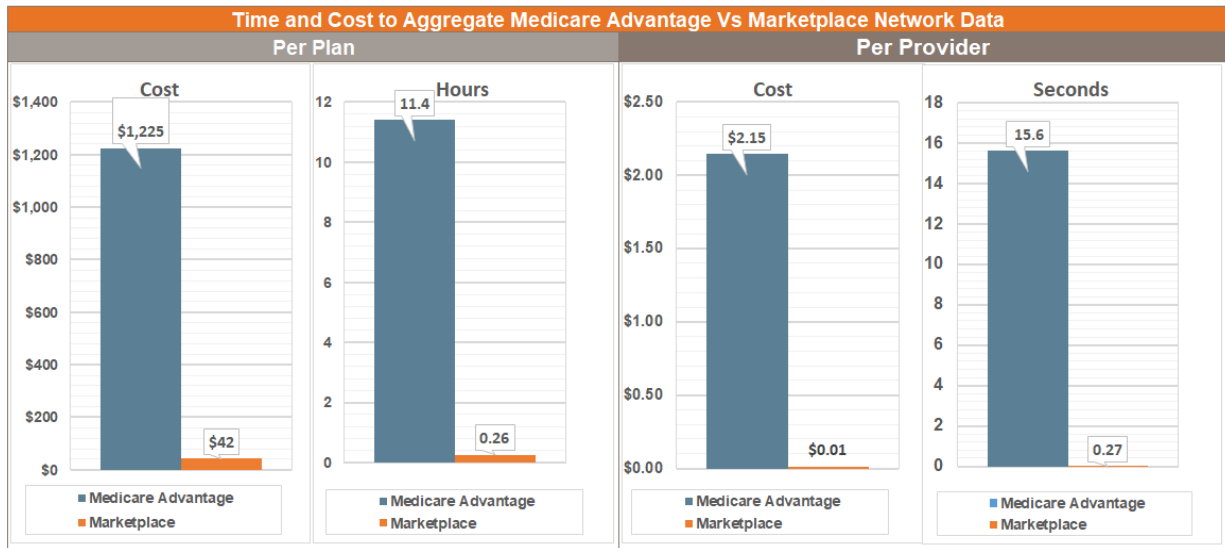
We examined the time it took to get to a final analytical file. MA file compilation required five unique and non-reusable processes. We found that directory columns were not uniform or standard; there was a lack of NPI information and variance among other key information to aggregate. Issues with data quality were solved by human intervention. The Exchange data was in uniform and standard format but we still experienced some data challenges. NPI was present in more than 50% of all records and we were able to solve for via code and automation with some human intervention.

After data download and cleansing, we compiled a database with all known reported addresses, phone numbers, and whether or not the providers were recorded as having been on record as accepting that plan. We validated the accuracy of the reported elements captured in the database through standardized phone interviews to provider offices. A random sample was applied where there were more than 50 unique providers of a specific specialty as the primary practice address and the primary specialty as reported in NNPEs.

Findings

Having the files in a standardized, easy to download and automated format makes it vastly more practical to aggregate provider information. As detailed below, it is 30 to 180 times less expensive to aggregate data from MR files than conventional directories.

Figure 3: Time and Cost to Aggregate MA vs. Exchange Provider Information



The exceptional efficiency of MR directories versus conventional directories permits cost-effective network-to-network comparison, including the easy establishment of national datasets of network providers. From this, an interested health plan or other party could “crowd source” accuracy checks from which aberrant provider information could be distinguished against consistently listed provider information.ⁱ

ⁱ A complication in downloading provider information that is not explored in this paper concerns “Terms of Use” check boxes on health plan websites. Language in these boxes commonly restricts third parties from downloading health plan information. It is unclear whether such language impedes third parties from using machine readable directories when health plans are required to make network information publicly available.