



## BRIEF REPORT

# Identifying virtual care modality in electronic health record data

Annie E. Larson<sup>1</sup>  | Kurt C. Stange<sup>2</sup> | John Heintzman<sup>1,3</sup> | Yui Nishiike<sup>4</sup> |  
Brenda M. McGrath<sup>1</sup>  | Melinda M. Davis<sup>5</sup> | S. Marie Harvey<sup>6</sup>

<sup>1</sup>Research Department, OCHIN Inc., Portland, Oregon, USA

<sup>2</sup>Center for Community Health Integration, Case Western Reserve University, Cleveland, Ohio, USA

<sup>3</sup>Department of Family Medicine, Oregon Health & Science University, Portland, Oregon, USA

<sup>4</sup>Administrative Office, LifeLong Medical Center, Berkeley, California, USA

<sup>5</sup>Oregon Rural Practice-based Research Network, Department of Family Medicine, OHSU-PSU School of Public Health, Oregon Health & Science University, Portland, Oregon, USA

<sup>6</sup>College of Public Health and Human Sciences, Oregon State University, Corvallis, Oregon, USA

## Correspondence

Annie E. Larson, OCHIN, Inc., PO Box 5426, Portland, OR 97228-5426, USA.  
Email: [larsona@ochin.org](mailto:larsona@ochin.org)

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## Abstract

**Background:** Virtual care increased dramatically during the COVID-19 pandemic. The specific modality of virtual care (video, audio, eVisits, eConsults, and remote patient monitoring) has important implications for the accessibility and quality of care, but rates of use are relatively unknown. Methods for identifying virtual care modalities, especially in electronic health records (EHR) are inconsistent. This study (a) developed a method to identify virtual care modalities using EHR data and (b) described the distribution of these modalities over a 3-year study period.

**Methods:** EHR data from 316 primary care safety net clinics throughout the study period (4/1/2020-3/31/2023) were included. Visit type (in-person vs virtual) by adults >18 years old were classified. Expert consultation informed the development of two algorithms to classify virtual care visit modalities; these algorithms prioritized different EHR data elements. We conducted descriptive analyses comparing algorithms and the frequency of virtual care modalities.

**Results:** Agreement between the algorithms was 96.5% for all visits and 89.3% for virtual care visits. The majority of disagreement between the algorithms was among encounters scheduled as audio-only but billed as a video visit. Restricting to visits where the algorithms agreed on visit modality, there were 2-fold more audio-only than video visits.

**Conclusion:** Visit modality classification varies depending upon which data in the EHR are prioritized. Regardless of which algorithm is utilized, safety net clinics rely on audio-only and video visits to provide care in virtual visits. Elimination of reimbursement for audio visits may exacerbate existing inequities in care for low-income patients.

## KEYWORDS

electronic health record data, safety net clinics, virtual care modality

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## 1 | INTRODUCTION

Virtual care is an integral part of healthcare, but how to measure the modality of virtual care using electronic health record (EHR) systems is varied. Virtual care, used to refer to synchronous (audio-only or video visits) and asynchronous (eg, eVisits eConsults, and remote patient monitoring [RPM]) modalities (Supplemental Table 1) is a valuable tool to help reduce barriers in accessing needed and recommended healthcare.<sup>1</sup> Understanding the modality of virtual care being utilized by patients and providers and under what circumstances is important because not all patients and providers have equitable access to or knowledge of how to use virtual care modalities. This information can assess whether virtual care can supplement or replace in-person care.

Previous work emphasized the challenge of accurately determining virtual care modalities in healthcare datasets.<sup>2</sup> This difficulty could obscure who is using what modality for what specific services. Determining virtual care modality within EHRs is particularly challenging as no consensus exists around what information in the EHR to utilize.<sup>2-5</sup> EHR systems require information such as patient demographics, encounter type, diagnoses and procedures, and billing data.<sup>6</sup> These different sources of information may disagree with each other and untangling those discrepancies can be challenging. The study aims were to (a) develop a method to identify virtual care modalities and (b) determine the distribution of virtual care modalities using EHR data from a national network serving safety net clinics.

## 2 | METHODS

### 2.1 | Data source

EHR data from OCHIN, a healthcare innovation center providing a single instance of the Epic EHR to safety net clinics, were utilized. As of September 30, 2023, OCHIN was serving over 1400 safety net clinics within 190 health systems across 31 states. This study used primary care outpatient visits from April 1, 2020 through March 31, 2023.

### 2.2 | Study population

Primary care safety net clinics included were those that were “live” on OCHIN’s EHR at least 6-months prior to the start of the pandemic and throughout the study period. The study population included patients >18 years of age who had at least one in-person or virtual care visit in one of the 316 primary care clinics.

### 2.3 | Variable definition

To classify visit type (virtual or in-person) and visit modality (audio, video, eVisits, eConsults, and RPM), we used PubMed to identify

articles on virtual care modalities using EHR data since 2020.<sup>3-5</sup> These articles were reviewed to determine what fields within the EHR were utilized, and those sources checked within OCHIN’s Epic EHR system. We reviewed a list of encounter-type codes and billing codes and modifiers previously created by OCHIN data scientists to distinguish virtual care from in-person visits. All encounter-type codes were inspected to determine if any codes referencing telehealth had not been included in the previously created list. Common Procedural Terminology codes and billing modifiers for outpatient primary care virtual care services were compiled from sources to add to the existing list of billing codes and modifiers.<sup>7-10</sup>

Internal experts on clinical, scheduling, billing workflows, and those building out new functionalities within OCHIN’s EHR were consulted. These experts provided information on additional data to utilize and informed decisions on sources to prioritize when discrepancies in visit modality were found.

Data from four main fields—encounter-type codes, an EHR field that specifies the type of service provided during the visit and is entered after the visit has been completed; scheduled visit type, an EHR field completed when the appointment is made; billing codes and modifiers; and “telehealth mode”—were identified as the most useful sources to determine visit modality. Telehealth mode is a field created by OCHIN and added to the EHR in mid-March 2021. An appointment cannot be made without completing telehealth mode (in-person, video, or audio). The telehealth mode field is auto-populated for the clinician at the start of the encounter and modifiable if the visit modality changes. Telehealth mode can also identify eConsults,<sup>11</sup> RPM visits, and eVisits.<sup>12</sup> Other sources of information from Epic were explored but deemed not useful because of limited use by clinicians and/or schedulers.

Using the above sources of information, we first identified visit type and then assigned virtual care visits to one of the following modalities: video, audio-only, eVisit, eConsult, or RPM.

### 2.4 | Algorithm development

Data sources were compared to each other, and discrepancies were found. Although internal experts lacked consensus on what information to prioritize, telehealth mode and billing codes were the two sources cited as the source of “truth” by different experts. Two preliminary algorithms were created. We consulted with clinical informaticists on instances where discrepancies in virtual care mode were commonly seen to determine how to prioritize the information and make changes to the algorithms. Based on feedback, encounter-type codes were deprioritized because some clinics preferred to use this field to document the category of healthcare service provided (eg, obstetrics or annual exam) as opposed to the visit type. Scheduled visit type was also deprioritized because it usually did not state the virtual care modality.

We created two algorithms to determine modality: (a) an algorithm prioritizing the telehealth mode over billing codes and modifiers, and (b) an algorithm prioritizing billing codes and modifiers over telehealth mode. In some instances, we were unable to assign visit

modality. This inability primarily resulted in visits before telehealth mode was launched and billing data were not available on the modality provided. We refer to unassigned visit modality as “unknown virtual care” throughout the rest of the paper. The logic for identifying visit type and virtual care modality in each of the two algorithms is provided in Supplemental Table 2.

## 2.5 | Statistical analysis

Chi-square and *t*-tests were used to test for statistically significant differences between patient demographics of those with in-person vs a virtual care visit. Chi-square tests were also used to test statistical differences between visit modalities in the two algorithms. We also restricted visits to those where the visit modalities between the two algorithms agreed. We examined the frequency of visit modality including all visits and those restricted to virtual care during the study period and over time. We compared instances where the algorithm modalities disagreed and agreed with each other. This study was approved by the Advarra Institutional Review Board.

## 3 | RESULTS

Visits from patients who were uninsured, residing in small rural areas, Black, or lived in neighborhoods with less broadband access had a smaller percentage of virtual care visits than patients with insurance, living in urban areas, any other racial category, or living in neighborhood with greater broadband access, respectively (Table 1). The percentage of encounters conducted via visit type differed significantly for each of the visit demographics ( $P < .001$ ).

Virtual care visits accounted for 33.2% of visits, while the percentage of video visits ranged from 8.3% to 11.2%, and audio-only visits accounted for between 16.0% to 19.0% of visits (Table 2). The algorithms had an overall agreement rate of 96.5% for all visits and 89.3% for virtual care visits. However, we found significant differences in the percentage of visits conducted by each virtual care modality between the algorithms ( $P < .001$ ). For both algorithms, 5.6% of all visits were unknown virtual care visits. The algorithm prioritizing telehealth mode showed a larger difference between the percentage of visits conducted via video vs those conducted by audio-only compared to the algorithm prioritizing billing codes (10.74 vs 4.80 percentage point difference, respectively, among all visits). Using the telehealth mode algorithm, 2.3 times as many audio-only visits were conducted as video visits compared to the billing code algorithm which found that only 1.4 times as many audio-only visits compared to video visits. When restricted to visits where the algorithms agreed on the visit modality, we found almost 2-fold more audio-only than video visits. Using either algorithm, less than 1% of all visits and just over 1% of virtual care visits were conducted via eVisit, eConsult, or RPM.

Although the algorithms disagreed for 10.7% of virtual care visits, the majority of the disagreement between the two algorithms were encounters coded as audio-only on the telehealth mode but billed as a

video visit (Figure 1). Among visits where the modality disagreed, 92.6% were categorized as audio-only visits by the telehealth mode algorithm whereas only 6.6% were categorized as audio-only visits by the billing code algorithm (Supplemental Table 3). All visits identified as RPM visits via telehealth mode were also billed as RPM visits. Throughout the study period, regardless of which algorithm was utilized, audio visits accounted for a much larger percentage of virtual care visits than video visits (Figure 2).

## 4 | DISCUSSION

Findings indicated that the virtual care visit modality depends upon what information is prioritized in the measure. Although a few studies have examined the impact of virtual care modalities, not all studies using EHR data are explicit in the methodology used to identify virtual care modality. EHR data are imperfect but can still provide an important source of information about patient healthcare.

We found that, regardless of modality measurement method used, safety net clinic patients and their providers were more likely to utilize audio-only for a virtual care visit than video. This difference remained throughout the study period. Although this finding has been previously reported by other studies examining low-income patients,<sup>13,14</sup> our study expands upon these findings in a larger, national network.

These results have implications for measuring and optimizing the use of virtual care visits. Because failure to correctly capture billing information could result in lost revenue or fraud, the algorithm prioritizing billing code data may most accurately capture visit modality. However, billing codes alone may not be sufficient because not all virtual care billing codes require a modifier and not all differentiate the modality of the visit. Within this healthcare network, nearly one-fifth of telehealth visits had an unknown modality in the first year and these data should be used with caution.

Findings will be used by OCHIN to track visit type and visit modalities to inform clinics and providers about what patients are using these services. This information will be integrated into the OCHIN research data warehouse for use in research projects interested in understanding how virtual care modalities impact healthcare access and quality. Although telehealth mode was created to help bill correctly, discrepancies between the two algorithms demonstrate that telehealth mode may not be used in that manner.

Research on virtual care modality should explicitly state what information was utilized to identify the visit modality, especially when working with EHR data. However, more research is needed to better understand the impacts of virtual care on patients and providers and to understand the impact of different virtual care modalities on equitable access to care. The Centers for Medicare and Medicaid Services has ruled they will no longer reimburse for audio-only visits after the end of the extension (December 31, 2024) and some private insurers have stopped reimbursing for all audio-only visits.<sup>15,16</sup> The limited research on the effectiveness of audio-only visits may be responsible for these changes. These policy changes have the potential to further exacerbate disparities in access to and use of healthcare among patients who are already less likely to access needed and recommended care.

**TABLE 1** Encounter demographics by visit type (column percentages).

	In-person		Virtual care		P value
	n = 5 725 392	(66.8%)	n = 2 850 915	(33.2%)	
<b>Sex</b>					
Female	3 551 896	(62.0)	1 831 461	(64.2)	<.001
Male	2 173 496	(38.0)	1 019 454	(35.8)	
<b>Rurality</b>					
Urban	4 483 118	(78.3)	2 528 287	(88.7)	<.001
Large Rural	732 964	(12.8)	229 153	(8.0)	
Small/Isolated Rural	503 250	(8.8)	91 930	(3.2)	
Unknown	6060	(0.1)	1545	(0.1)	
<b>Race</b>					
Asian	306 350	(5.4)	268 528	(9.4)	<.001
Black	1 016 822	(17.8)	390 565	(13.7)	
White	3 684 233	(64.4)	1 796 040	(63.0)	
Other Race	136 048	(2.4)	78 309	(2.8)	
Unknown Race	581 939	(10.2)	317 473	(11.1)	
<b>Ethnicity</b>					
Hispanic	1 963 386	(34.3)	1 007 858	(35.4)	<.001
Non-Hispanic	3 408 209	(59.5)	1 653 494	(58.0)	
Unknown Ethnicity	353 797	(6.2)	189 563	(6.7)	
<b>Insurance</b>					
Medicaid	2 660 223	(46.5)	1 479 734	(51.9)	<.001
Medicare	1 104 279	(19.3)	500 958	(13.7)	
Private	961 508	(16.8)	417 120	(14.6)	
Uninsured	849 003	(14.8)	328 702	(11.5)	
Other Insurance	150 379	(2.6)	124 401	(4.4)	
<b>Percent Neighborhood Broadband Access</b>					
10th percentile (<72.8%)	647 003	(11.3)	175 716	(6.2)	<.001
25th percentile (72.8%–80.2%)	941 012	(16.4)	356 264	(12.5)	
50th percentile (80.3%–85.5%)	1 466 516	(25.6)	689 575	(24.2)	
75th percentile (85.6%–89.6%)	1 423 751	(24.9)	706 737	(24.8)	
90th percentile (>89.6%)	1 242 596	(21.7)	919 444	(32.3)	
Unknown	4514	(0.1)	3179	(0.1)	
<b>Age</b>					
Mean (SD)	48.4	(16.8)	47.8	(16.5)	<.001
<b>Charlson CI, Study Start</b>					
Mean (SD)	1.9	(2.5)	2.0	(2.5)	<.001
<b>Charlson CI, Study End</b>					
Mean (SD)	2.2	(2.6)	2.3	(2.6)	<.001

#### 4.1 | Strengths & limitations

The algorithms included data from multiple sources within the EHR and were informed by internal experts. This process may help reduce the error in identifying virtual care modality. Medical record notes may be a potential source of information to explore

for further refinement, but initial exploration of chart notes found the use of vague terms and no specific mention of the modality. We used data from a single EHR which may limit the generalizability of these findings. However, this data came from multiple health systems with unique care processes and workflows, many of the fields used are required elements of all EHR systems, and

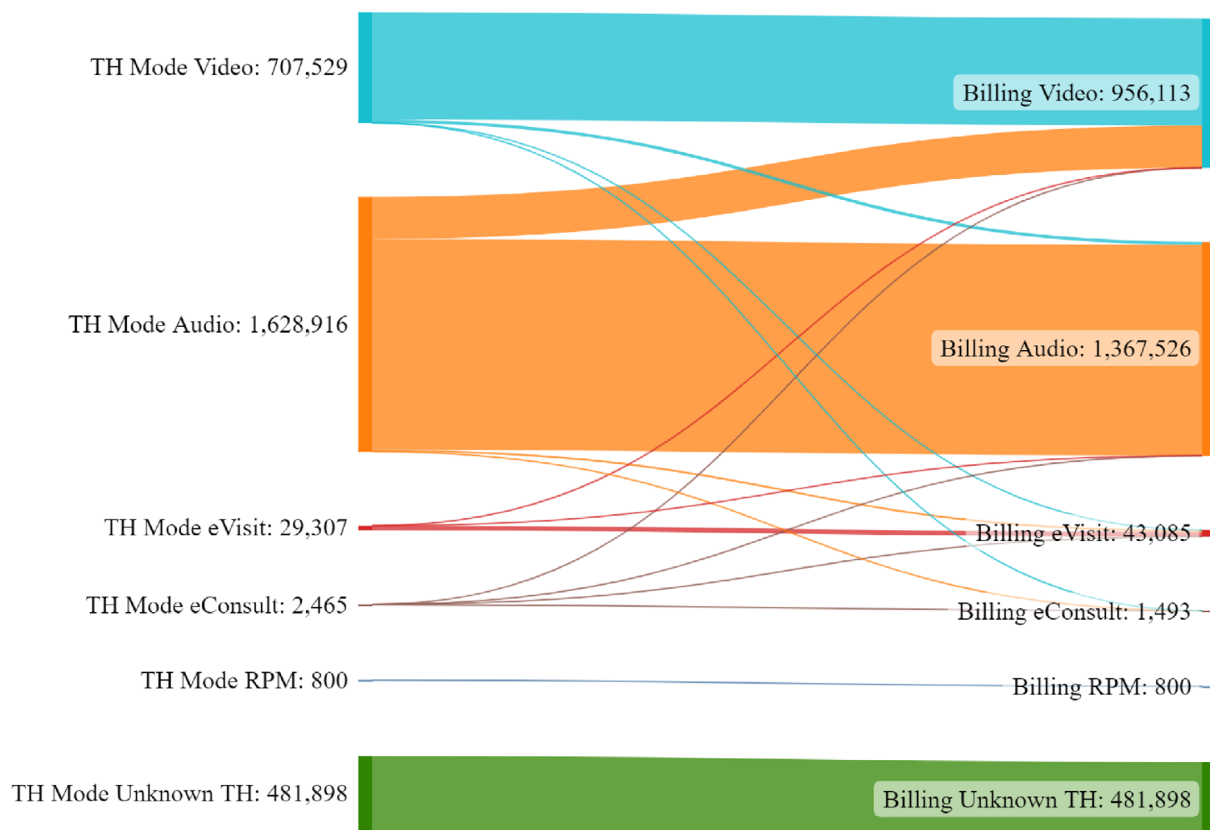
**TABLE 2** Visit modality by algorithm.

	TH mode priority	Billing code priority	P value	Algorithm agreement
Visit modality (all visits)	n = 8 576 307	n = 8 576 307		n = 8 272 250
In-person	5 725 396 (66.76)	5 725 396 (66.76)	-	5 725 392 (69.21)
Video	707 529 (8.25)	956 114 (11.15)	<.001	686 039 (8.29)
Audio	1 628 916 (18.99)	1 367 526 (15.95)	<.001	1 347 334 (16.29)
Other virtual care <sup>a</sup>	32 572 (0.38)	45 378 (0.53)	<.001	31 587 (0.38)
Unknown TH	481 898 (5.62)	481 898 (5.62)	-	481 470 (5.83)
Visit modality (VC visits)	n = 2 850 915	n = 2 850 915		n = 2 546 858
Video	707 529 (24.82)	956 113 (33.54)	<.001	686 039 (26.94)
Audio	1 628 916 (57.14)	1 367 526 (47.97)	<.001	1 347 334 (52.90)
Other virtual care <sup>a</sup>	32 572 (1.14)	45 378 (1.59)	<.001	31 587 (1.24)
Unknown TH	481 898 (17.10)	481 898 (17.18)	-	481 898 (19.16)

<sup>a</sup>Other Virtual Care includes eVisits, eConsults, and remote patient monitoring visits.

**Prioritize telehealth mode data**

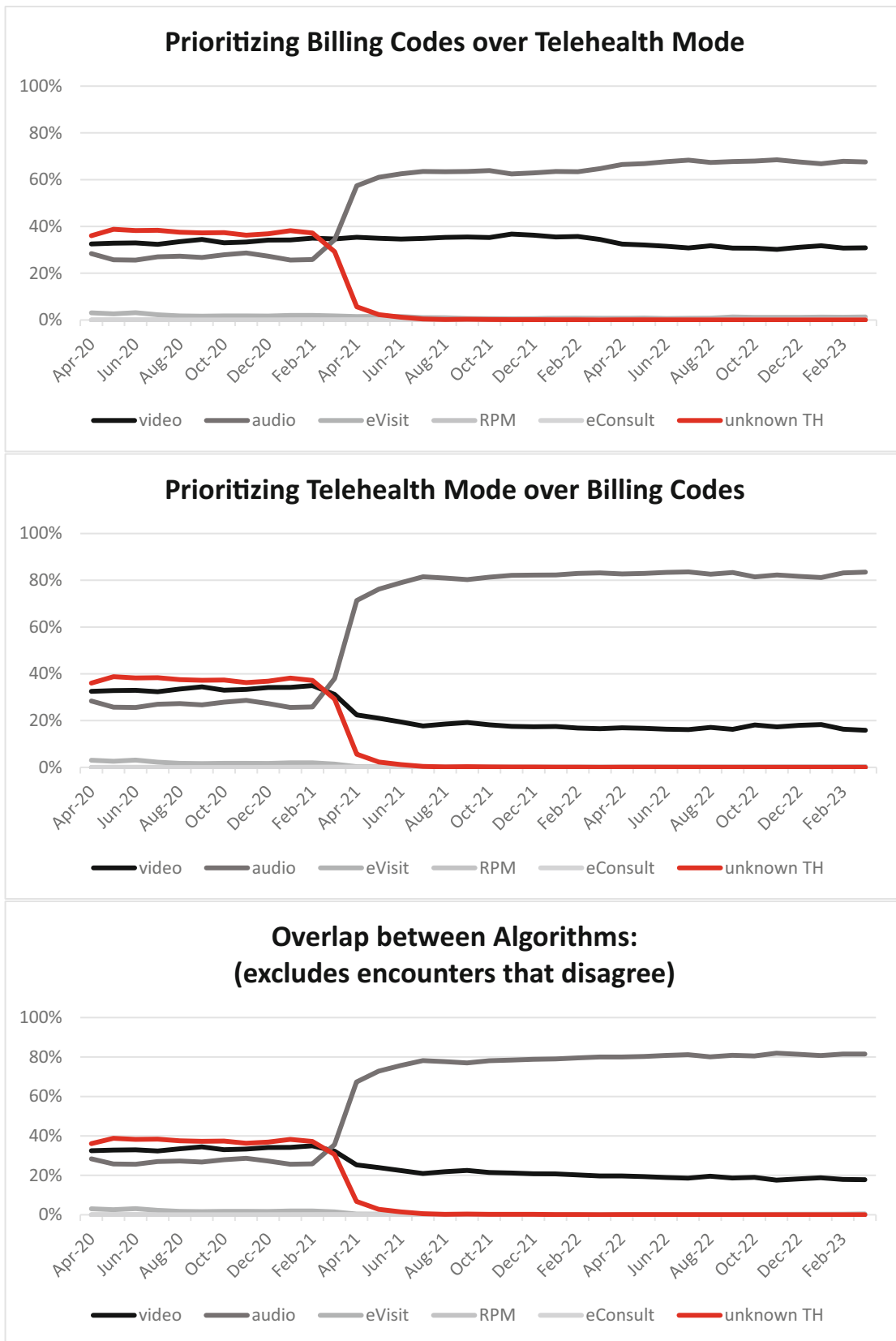
**Prioritize billing code data**



**FIGURE 1** Disagreement between virtual care modality algorithms; one prioritizing telehealth mode data and the other prioritizing billing code data. The majority of the disagreement between the algorithms came from visits with the telehealth mode recorded as audio-only but billed as a video visit.

the process of using internal experts to understand what data to use and prioritize can be replicated by others. Although telehealth mode, a key component of these algorithms, may be unique to this system, it comes from scheduling and encounter workflows

that are standard in all EHRs. Finally, a larger percentage of visits in the first year of the study were unable to be classified by telehealth modality making use of data from this time period challenging.



**FIGURE 2** Trends in virtual care modality by algorithm. After telehealth mode was introduced in March 2021, unknown telehealth visits declined. After that time, regardless of which algorithm was used, audio-only visits accounted for a higher rate of virtual care visits than video visits.

## 4.2 | Conclusions

Using EHR data, we developed two algorithms, one prioritizing billing codes and the other telehealth mode, to identify virtual care modalities. We found discrepancies in the algorithms between the percentage of visits classified as audio or video. Both algorithms suggested that audio visits are important for patients served by safety net clinics. Elimination of reimbursement for audio visits may exacerbate already existing inequities in care for low-income.

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### CONFLICT OF INTEREST STATEMENT

The authors declare no other conflicts of interest.

### ORCID

Annie E. Larson  <https://orcid.org/0000-0002-0080-3220>

Brenda M. McGrath  <https://orcid.org/0000-0003-4208-1059>

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### SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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