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A COVID-19 Primer: Analyzing Health Care Claims, Administrative Data, and Public Use Files

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Introduction

As COVID-19 disrupts people's lives and livelihoods and threatens institutions around the world, the need for fast, data-driven solutions to combat the crisis is growing. This primer is designed to help researchers, data scientists, and others who analyze health care claims or administrative data (herein referred to as "claims") quickly join the effort to better understand, track, and contain COVID-19. Readers can use this guidance to help them assess data on health care use and costs linked to COVID-19, create models for risk identification, and detect complications that may follow a COVID-19 diagnosis.

The primer is based on two assumptions:

1. *All readers have a working knowledge of health care claims or administrative data.* The primer does not cover topics such as the process for acquiring data, the claims life cycle, diagnoses or procedure-coding guidelines, taxonomies or value sets for non-COVID chronic conditions, or common data models.
2. *Claims are inherently lagged and poorly suited for real-time monitoring or analytics.* But over time, claims can shed light on the costs of care, the use of certain services, and the impact of complications from COVID-19. Claims-based analyses of the COVID-19 pandemic could also produce training data for machine-learning algorithms or predictive models, which could be useful for future pandemic responses.

This primer builds on the knowledge of more than 200 Mathematica staff who work with Medicare, Medicaid, and all-payer claims every day. It is a living document with new and updated content added periodically. The first section covers COVID-19 conditions and cohorts, and the second focuses on COVID-19 services and locations (Table 1). The third includes information on linking COVID-19 files to claims data using different cloud platforms. Over time, we plan to make development tools for claims analyses available on our GitHub.

We strive to support our readers. Please contact info@mathematica-mpr.com to suggest new topics for or revisions to this primer.

Table 1. Contents

Analyzing data on COVID-19 and related conditions

The first step in examining COVID-19 and related claims is to accurately identify claims through diagnosis codes, paying close attention to the evolving coding recommendations. Given that proper reimbursement for claims is driven by diagnosis coding, providers will have an incentive to stay current with coding recommendations, and the claims will reflect direction from federal, state, or private payers.

The Centers for Disease Control and Prevention (CDC) released only one ICD-10-CM diagnosis code (U071) for confirmed and presumptive cases of COVID-19, but there are many related conditions of analytic interest. The emergence of respiratory conditions such as pneumonia is a major clinical concern related to COVID-19, and users will want to identify people who develop such conditions, stratifying by specific populations (or cohorts) that are immunocompromised or have certain chronic conditions.

Please note the following caveats and reminders:

- Patients who have hospital stays or reside in a facility often produce at least two claims: institutional (UB-04) and professional (1500 form). Remember to count only one service event (defined by dates) per person when counting unique services for people with COVID-19.
- CDC published interim coding guidelines in mid-March, but its official COVID-19 diagnosis code only applies to services provided on or after April 1. Thus, everything before April 1 is likely to have variable coding, despite the interim guidance.

The remainder of this section provides specific guidance on using claims to identify people who have a COVID-19 diagnosis, respiratory conditions related to COVID-19, possible exposure to the virus, or health conditions that put them at special risk.

COVID-19 diagnoses

Users can examine diagnosis codes to find patients who have or previously had COVID-19 (Table 2). CDC created a diagnosis code for records of confirmed or presumptive cases dated on or after April 1, 2020. CDC also created a diagnosis code (effective January 1, 2021) for the identification of people who have had COVID-19.

Table 2. COVID-19 diagnoses

Topic	Values
Diagnosis codes	Search all primary and secondary diagnoses for the following codes: Before April 1, 2020: B9729 Effective April 1, 2020: U071 (disease diagnosis of COVID-19 confirmed by lab testing) Effective January 1, 2021: Z8616 (history of COVID-19)
Claims	Hospital inpatient and outpatient care, skilled nursing and long-term care, and professional services

Source: https://www.cdc.gov/nchs/icd/icd10cm.htm

Because of testing protocols, claims likely undercount the true number of COVID-19 cases (as do other data sources). But users can still identify many patients with COVID-19 by examining claims for hospital care, skilled nursing or long-term care, and professional services (such as lab visits).

Exposure to COVID-19

If a person has been exposed to someone with COVID-19 but has negative (or no) test results, use the coding guidance in Table 3. These may be individuals who are infected but never received a test because they used telehealth instead of visiting a clinic or hospital. Claims for these patients could be easy to miss because telehealth

appointments are found in professional (rather than institutional) claims, but counting them is important for the purposes of risk classification.

To understand the extent to which COVID-19 causes people to seek testing or medical care, consider querying claims with the diagnosis code for exposure to COVID-19 or the code for COVID-19 diagnosis. Given the widespread concerns about COVID-19, we recommend querying all claims for hospital inpatient and outpatient, skilled nursing and long-term care, and professional services. Users should query the exposure or diagnosis code along with the associated symptom diagnosis code—R05 (cough), R0602 (shortness of breath), or R509 (unspecified fever)—to find exposed people who have symptoms.

Table 3. COVID-19 exposure

Topic	Values
Diagnosis codes	Search all primary and secondary diagnoses for COVID-19 (B9729 and U071) or one of the following codes: • Suspected but ruled out exposure: Z03818 • Contact with and (suspected) exposure to other viral communicable diseases: Z20828 • Contact with and (suspected) exposure to COVID-19: Z20822 (effective January 1, 2021) • Encounter for screening for COVID-19: Z1152 (effective January 1, 2021)
Claims	Hospital inpatient and outpatient, skilled nursing and long-term care, and professional services

Source: https://www.cdc.gov/nchs/icd/icd10cm.htm

COVID-related conditions

To identify COVID-19 cases that led to respiratory, multisystem, and connective-tissue illness, follow the guidance in Table 4. When searching for claims, look for a COVID-19 diagnosis *and* for codes for these related conditions. Again, users should query primary and secondary diagnoses in claims for hospital inpatient and outpatient care, skilled nursing and long-term care, and professional services.

Observations from Mathematica's work: We conducted preliminary scans of claims containing a COVID-19 diagnosis on services provided after April 1, 2020. Our findings show that the rate of COVID-19 diagnoses codes listed as the primary diagnosis varies by claim type. Almost all professional claims list COVID-19 as the primary diagnosis, but inpatient claims more often include COVID-19 as a secondary diagnosis. For inpatient claims, more severe conditions (such as sepsis) will appear as the primary diagnosis, rather than COVID-19, because of payment policies. Viral pneumonia (J1289) is the most common secondary diagnosis listed on claims with COVID-19 as the primary diagnosis.

Table 4. Conditions related to COVID-19

Topic	Values
Diagnosis codes for respiratory conditions	Search all primary and secondary diagnoses for COVID-19 (B9729 and U071) and the following codes: • Viral pneumonia: J1289 • Bronchitis: J208 (acute) or J40 (unspecified) • Lower respiratory infection: J988 (specified) or J22 (unspecified) • Acute respiratory distress syndrome: J80 • Pneumonia due to coronavirus disease 2019: J1282 (effective January 1, 2021)
Diagnosis codes for other related conditions	Search all primary and secondary diagnoses for COVID-19 (U071) and the following codes: • Multisystem inflammatory syndrome (MIS): M3581 (effective January 1, 2021) • Other specified systemic involvement of connective tissue: M3589 (effective January 1, 2021)
Claims	Hospital inpatient and outpatient, skilled nursing and long-term care, and professional services

Source: https://www.cdc.gov/nchs/icd/icd10cm.htm

Classification of inpatient hospital discharges to compute payment

To calculate payment, Medicare assigns a Medicare Severity-Diagnosis Related Group (MS-DRG) code to each inpatient discharge. An MS-DRG specific to COVID-19 has not been created, but CMS enacted a policy to increase payments by 20 percent for inpatient discharges of people diagnosed with COVID-19. CMS released a FAQ listing the MS-DRG assignments for the diagnoses that qualify for this 20 percent increase (Table 5). COVID-19 diagnosis codes will appear as secondary on inpatient claims with MS-DRGs related to sepsis because the base payments for these MS-DRGs are higher than the rates for MS-DRGs with the additional 20 percent.

Table 5. MS-DRG assignment for inpatient discharges

Discharge dates	Diagnosis codes	MS-DRG assignment
On or after January 27, 2020, and on or before March 31, 2020	Principal J1289 (other viral pneumonia) Secondary B9729 (other coronavirus as the cause of disease classified elsewhere) J9601 (acute respiratory failure with hypoxia) (MCC)	MS-DRG 193 (simple pneumonia and pleurisy with MCC)
	Principal J208 (acute bronchitis due to other specified organisms) Secondary B9729 (other coronavirus as the cause of disease classified elsewhere)	MS-DRG 203 (bronchitis and asthma without CC/MCC)
	Principal J22 (unspecified acute lower-respiratory infection) Secondary B9729 (other coronavirus as the cause of disease classified elsewhere)	MS-DRG 206 (other respiratory system diagnoses without MCC)

Discharge dates	Diagnosis codes	MS-DRG assignment
	Principal J80 (acute respiratory distress syndrome) Secondary B9729 (other coronavirus as the cause of disease classified elsewhere) Procedure 5A1955Z (respiratory ventilation, greater than 96 consecutive hours)	MS-DRG 207 (respiratory system diagnosis with ventilator support > 96 hours)
	Principal 098513 (other viral diseases complicating pregnancy, third trimester) Secondary J208 (acute bronchitis due to other specified organisms) B9729 (other coronavirus as the cause of diseases classified elsewhere)	MS-DRG 833 (other antepartum diagnoses without operating room procedure, without CC/MCC)
	Principal A4189 (other specified sepsis) Secondary B20 (HIV disease CC) J1289 (other viral pneumonia MCC) B9720 (other coronavirus as the cause of diseases classified elsewhere) Procedure 5A1955Z (respiratory ventilation, greater than 96 consecutive hours)	MS-DRG 974 (HIV with major related condition, with MCC)
On or after April 1, 2020, through the end of the COVID-19 public health emergency period	Principal U071 (COVID-19) Secondary J1289 (other viral pneumonia MCC) J9601 (acute respiratory failure with hypoxia) (MCC)	MS-DRG 177 (respiratory infections and inflammations with MCC)
	Principal U071 (COVID-19) Secondary J22 (unspecified acute lower-respiratory infection) N179 (acute kidney failure, unspecified CC)	MS-DRG 178 (respiratory infections and inflammations with CC)
	Principal U071 (COVID-19) Secondary J208 (acute bronchitis due to other specified organisms)	MS-DRG 179 (respiratory infections and inflammations without CC/MCC)
	Principal U071 (COVID-19) Secondary J80 (acute respiratory distress syndrome) Procedure 5A1955Z (respiratory ventilation, greater than 96 consecutive hours)	MS-DRG 207 (respiratory system diagnosis with ventilator support > 96 hours)

Discharge dates	Diagnosis codes	MS-DRG assignment
	Principal 098513 (other viral diseases complicating pregnancy, third trimester) Secondary U071 (COVID-19) J208 (acute bronchitis due to other specified organisms)	MS-DRG 831 (other antepartum diagnoses without operating room procedure, with MCC)
	Principal A4189 (other specified sepsis) Secondary B20 (HIV disease CC) U071 (COVID-19) J1289 (other viral pneumonia MCC) Procedure 5A1955Z (respiratory ventilation, greater than 96 consecutive hours)	MS-DRG 974 (HIV with major related condition, with MCC)

CC = complication or comorbidity; MCC = major complication or comorbidity.

Conditions associated with greater risk of COVID-19

Researchers have found that chronic and immunocompromising conditions are linked to a higher risk of serious illness from COVID-19. There are many claims-based taxonomies to consider when identifying such conditions, but for simplicity, comprehensiveness, and access, we recommend using the Clinical Classifications Software Refined (CCSR), a publicly available taxonomy created and maintained by the Agency for Healthcare Research and Quality (AHRQ). One benefit of the CCSR is that it sorts all diagnosis codes by level of severity, allowing for greater user control. Other publicly-available options include the Chronic Conditions Warehouse (CCW) condition categories and the Hierarchical Condition Categories.

Although the list of high-risk groups will evolve as we learn more about COVID-19, we will start by focusing on groups that CDC deems high risk as of April 9, 2020. The primer will not cover elderly people or nursing home residents as these cases are more self-explanatory than others. To identify the codes in each category in Table 6, see the CCSR Reference Crosswalk.

We recommend querying as many claim types as possible, prioritizing hospital inpatient and outpatient, facility, and professional services claims. For users who have access to hospital data only, include diagnoses from the hospitalizations with (ideally) a one-year look-back period.

Table 6. High-risk chronic conditions for COVID-19

High-risk condition	CCSR category	Notes
Chronic kidney disease	GEN003	
Chronic lung disease	RSP008	
Diabetes	END002–END006	
HIV	INF006	
Immunocompromised state	INF006, NEO,[a] BLD[a]	A more nuanced approach to identifying this condition is to use the codes from IMMUNID and IMMUNIP from the Quality Indicator software. The downside is that this software is not easily machine readable.
Liver disease	DIG018, DIG019, DIG023	
Moderate/severe asthma	RSP009	

High-risk condition	CCSR category	Notes
Serious heart conditions	CIR001–CIR011	This is a broad list of CCSR conditions that includes everything from congestive heart failure to hypertension; users should narrow down the list as needed.
Severe obesity	END009	

[a] Please see all subcategories in this CCSR category.

Services relevant to COVID-19

COVID-19 has altered the services delivered to nearly all patients, changing the types of services covered and the level of reimbursement from public and private payers. The use of services such as intensive care and ventilation is now regularly tracked by local and state public health agencies to measure the impact of COVID-19 on hospital capacity across the nation. Policymakers are encouraging providers to delay elective procedures to conserve personal protective equipment, and payers have expanded access to telehealth and other remote services. Hospitals and health systems are also reconfiguring their facilities to increase the capacity of intensive care units (ICUs) and to convert surgical wings and centers to COVID-19 units. convert surgical wings and centers to COVID-19 units.

In response to all of these changes, we provide the following guidance on identifying affected services.

Telehealth, virtual check-ins, and e-visits

CMS highly encourages the use of telehealth services—including telemedicine (treatment of a medical condition using a virtual platform), virtual visits (brief videoconferences with a provider), or e-visits (virtual interactions via an online portal)—during the COVID-19 pandemic. These services allow providers to remotely communicate with patients, consult with other providers, and monitor patients.

Before the pandemic, CMS had authorized over 100 telehealth services for reimbursement. CMS has since authorized more than 130 additional services for telehealth,[1] removed restrictions on originating sites, and allowed for the use of different software platforms. On October 14, 2020, CMS added 11 more codes to the list of telehealth services, for a total of 144 telehealth services eligible for reimbursement. In addition, each state has different rules and regulations that affect billing for telehealth, and certain demonstration programs have their own Healthcare Common Procedure Coding System (HCPCS) codes and guidelines. Table 7 provides some general coding recommendations based on guidelines from a CMS press release on COVID-19, supplemented by various public resources.

Studying the impact of COVID-19 on telehealth is complicated by the regularly updated guidance on how to code procedures, modifiers, and places of service. Before COVID-19, providers billed approved telehealth codes, typically using "telehealth" as the place of service. But starting March 1, in the billing guidance for newly allowed telehealth, CMS instructs coders to (1) use the place of service where care would have occurred if not for the pandemic and (2) include a modifier code indicating "telehealth." Note that this guidance is a revision of guidance issued earlier in the pandemic, which may lead to billing inconsistencies in March and April 2020.

[1] CMS added 45 additional temporary codes on April 30, 2020.

Observations from Mathematica's work: A review of professional telehealth claims indicates a change in billing patterns beginning in March 2020. Before March, most telehealth claims had a place-of-service code of 02, but in March, the modifier code 95 began appearing on most of these claims. For hospital outpatient telehealth claims, the vast majority contained a GO modifier before March 2020, but this number dropped slightly as more providers began using the 95 modifier code.

Mathematica compiled and cataloged changes to Medicaid telehealth policies as a result of COVID-19. Our results provide details (such as on providers, services, modalities, and payments) related to expanded telehealth services by state.

Most telehealth services are billed through professional claims, but it is unclear whether COVID-19 will increase the use of telehealth services billed by hospital outpatient facilities. We recommend initially focusing on professional claims. Two exceptions are federally qualified health centers and rural health centers, which provide professional services that are billed as outpatient claims.

Table 7. Telehealth, virtual check-ins, and e-visits

Type of visit	HCPCS/ CPT codes	Place of service or modifier	Notes on other billing requirements
Telehealth	View CMS's list (updated December 12, 2020)	Before March 1, 2020: 02 (telehealth) After March 1, 2020: Any place of service (based on originating site) with modifier 95 (tele health) After March 1, 2020: modifier CS (cost sharing waived) can be reported for preventive services via rural health centers and federally qualified health centers	The following modifiers also apply to telehealth, regardless of timing: GO (specific to diagnosis of acute stroke), GQ (specific to Alaska and Hawaii), GT (on institutional claims billed under critical access hospital Method II), GY (other telehealth modifiers)
Virtual check-ins	G2010, G2012, 98966–98968	Any	
E-visits	99421–99423, G2061–G2063	Any	

Laboratory tests

Diagnostic testing for COVID-19 identifies people who are currently infected, whereas serological (or antibody) testing identifies people who were previously infected. The code set for COVID-19 lab testing has expanded in response to the development and approval of new tests. Table 8 shows the current HCPCS/Current Procedural Terminology (CPT) codes for diagnostic and serological COVID-19 testing. We included the codes for specimen collection because these codes are associated with people who are homebound, and inclusion of these populations will provide a more accurate count of people who were exposed to or suspected of having COVID-19 in a given area. We recommend the inclusion of modifier code CS (cost-sharing waived) for payment analyses related to COVID-19 testing since CMS made this modifier effective March 1, 2020.

Professional service and hospital outpatient claims should be analyzed to quantify the number of tests performed. Patients hospitalized and showing symptoms of COVID-19 may be tested, but because HCPCS codes are not typically included in institutional claims, we are monitoring the coding guidance on how to capture these tests when they are not billed as part of a professional claim.

Observations from Mathematica's work: A review of current claims data indicates that procedure codes for COVID-19 testing appear in hospital outpatient and professional service claims, and the most commonly reported testing codes are U0002 and 87636.

Table 8. Diagnostic and serology test codes

Test type	HCPCS/CPT values	Notes
DNA/RNA test	Pre-COVID-19 emergency: 87471	
	COVID-19 testing: 87635	Released March 13, 2020
	0202U (infectious disease, including COVID-19)	Effective May 20, 2020
	0223U (infectious disease, including COVID-19)	Effective June 25, 2020
CDC real-time test	U0001	
Non-CDC test	U0002	
Proprietary analyses to detect SARS-CoV-2	0225U or 0226U	Effective August 10, 2020
Specimen collection	G2023 or G2024	
High-production COVID tests	U0003 or U0004	Released April 14, 2020
Diagnostic antibody	0224U	Effective June 25, 2020
Antigen detection by immunoassay	87426	Effective June 25, 2020
Neutralizing antibody	86408 (screen) 86409 (titer)	Effective August 10, 2020
Serological testing—qualitative or semiquantitative	86328 or 86769	Released April 10, 2020
Serological testing—quantitative	86413	Effective September 8, 2020

Therapeutics

CMS has assigned 12 new ICD-10 procedure codes to capture therapeutics delivered in the inpatient setting to treat COVID-19. Because convalescent plasma, remdesivir, sarilumab, and tocilizumab can be administered via a central or peripheral vein, these therapeutics have two codes each. Other therapeutics that can be administered by infusion, injection, or oral medication have four codes each. The codes took effect August 1, 2020, and CMS has mapped them to the procedure codes previously used for these substances (Table 9). CMS implemented 21 additional codes (effective January 1, 2021) for treatments that include monoclonal antibodies and vaccines; these codes can be found in Table 9 as New Technology Group 6.

Given that these therapeutics can be administered to COVID and non-COVID patients, we recommend identifying COVID-specific therapeutics using the diagnosis codes for COVID (see the COVID-19 diagnoses section of this brief) as well as the procedure code on the claim for the service. These codes can be found on hospital inpatient claims.

Table 9. ICD-10 procedure codes for therapeutics

Treatment	ICD-10 procedure code	Description	Prior IDC-10 procedure code
Convalescent plasma	XW13325	Transfusion of convalescent plasma (nonautologous) into peripheral vein, percutaneous approach, New Technology Group 5	30233K1, 30233L1
	XW14325	Transfusion of convalescent plasma (nonautologous) into central vein, percutaneous approach, New Technology Group 5	30243K1, 30243L1
Remdesivir	XW033E5	Introduction of remdesivir anti-infective into peripheral vein, percutaneous approach, new technology group 5	3E03329
	XW043E5	Introduction of remdesivir anti-infective into central vein, percutaneous approach, New Technology Group 5	3E04329
Sarilumab	XW033G5	Introduction of sarilumab into peripheral vein, percutaneous approach, New Technology Group 5	3E033GC
	XW043G5	Introduction of sarilumab into central vein, percutaneous approach, New Technology Group 5	3E043GC
Tocilizumab	XW033H5	Introduction of tocilizumab into peripheral vein, percutaneous approach, New Technology Group 5	3E033GC
	XW043H5	Introduction of tocilizumab into central vein, percutaneous approach, New Technology Group 5	3E043GC
Other new technology therapeutic substance	XW013F5	Introduction of other new technology therapeutic substance into subcutaneous tissue, percutaneous approach, New Technology Group 5	3E013GC
	XW033F5	Introduction of other new technology therapeutic substance into peripheral vein, percutaneous approach, New Technology Group 5	3E033GC
	XW043F5	Introduction of other new technology therapeutic substance into central vein, percutaneous approach, New Technology Group 5	3E043GC
	XW0DXF5	Introduction of other new technology therapeutic substance into mouth and pharynx, external approach, New Technology Group 5	3E0DXGC
Monoclonal antibody—bamlanivimab	XW033F6	Introduction of bamlanivimab monoclonal antibody into peripheral vein, percutaneous approach, New Technology Group 6	
	XW043F6	Introduction of bamlanivimab monoclonal antibody into central vein, percutaneous approach, New Technology Group 6	
Monoclonal antibody—etesevimab	XW033E6	Introduction of etesevimab monoclonal antibody into peripheral vein, percutaneous approach, New Technology Group 6	
	XW043E6	Introduction of etesevimab monoclonal antibody into central vein, percutaneous approach, New Technology Group 6	

Treatment	ICD-10 procedure code	Description	Prior IDC-10 procedure code
Monoclonal antibody—leronlimab	XW013K6	Introduction of leronlimab monoclonal antibody into subcutaneous tissue, percutaneous approach, New Technology Group 6	
Monoclonal antibody—REGN-COV2	XW033G6	Introduction of REGN-COV2 monoclonal antibody into peripheral vein, percutaneous approach, New Technology Group 6	
	XW043G6	Introduction of REGN-COV2 monoclonal antibody into central vein, percutaneous approach, New Technology Group 6	
Monoclonal antibody—other new technology	XW013H6	Introduction of other new technology monoclonal antibody into subcutaneous tissue, percutaneous approach, New Technology Group 6	
	XW033H6	Introduction of other new technology monoclonal antibody into peripheral vein, percutaneous approach, New Technology Group 6	
	XW043H6	Introduction of new technology monoclonal antibody into central vein, percutaneous approach, New Technology Group 6	
CD24Fc immunomodulator	XW033L6	Introduction of CD24Fc immunomodulator into peripheral vein, percutaneous approach, New Technology Group 6	
	XW043L6	Introduction of CD24Fc immunomodulator into central vein, percutaneous approach, New Technology Group 6	
Baricitinib	XW0DXM6	Introduction of baricitinib into mouth and pharynx, external approach, New Technology Group 6	
	XW0G7M6	Introduction of baricitinib into upper gastrointestinal tract, via natural or artificial opening, New Technology Group 6	
	XW0H7M6	Introduction of baricitinib into lower gastrointestinal tract, via natural or artificial opening, New Technology Group 6	
Vaccine	XW013S6	Introduction of COVID-19 vaccine Dose 1 into subcutaneous tissue, percutaneous approach, New Technology Group 6	
	XW013T6	Introduction of COVID-19 vaccine Dose 2 into subcutaneous tissue, percutaneous approach, New Technology Group 6	
	XW013U6	Introduction of COVID-19 vaccine into subcutaneous tissue, percutaneous approach, New Technology Group 6	
	XW023S6	Introduction of COVID-19 vaccine Dose 1 into muscle, percutaneous approach, New Technology Group 6	
	XW023T6	Introduction of COVID-19 vaccine Dose 2 into muscle, percutaneous approach, New Technology Group 6	
	XW023U6	Introduction of COVID-19 vaccine into muscle, percutaneous approach, New Technology Group 6	

Vaccinations in outpatient settings

The American Medical Association released new CPT codes for the two coronavirus vaccines for nonhospitalized patients, along with related codes for the administration of these vaccines (Table 10). The Food and Drug Administration approved the Pfizer-BioNTech COVID-19 vaccine on December 11, and administration began December 14. The Moderna vaccine was approved on December 18, and administration began December 21.

Table 10. CPT codes for vaccines and vaccine administration

	CPT code	Description	Notes
Vaccine	91300	COVID-19 vaccine, mRNA-LNP, spike protein, preservative free, 30 mcg/0.3mL dosage, diluent reconstituted, for intramuscular use	Pfizer-BioNTech COVID-19 vaccine; should be administered twice, with 21 days between doses
	91301	COVID-19 vaccine, mRNA-LNP, spike protein, preservative free, 100 mcg/0.5mL dosage, diluent reconstituted, for intramuscular use	Moderna COVID-19 vaccine; should be administered twice, with 28 days between doses
Vaccine administration	0001A	Immunization by intramuscular injection of COVID-19 vaccine, mRNA-LNP, spike protein, preservative free, 30 mcg/0.3mL dosage, diluent reconstituted; first dose	First dose of Pfizer-BioNTech COVID-19 vaccine
	0002A	Immunization by intramuscular injection of COVID-19 vaccine, mRNA-LNP, spike protein, preservative free, 30 mcg/0.3mL dosage, diluent reconstituted; second dose	Second dose of Pfizer-BioNTech COVID-19 vaccine
	0011A	Immunization by intramuscular injection of COVID-19 vaccine, mRNA-LNP, spike protein, preservative free, 100 mcg/0.5mL dosage, diluent reconstituted; first dose	First dose of Moderna COVID-19 vaccine
	0012A	Immunization by intramuscular injection of COVID-19 vaccine, mRNA-LNP, spike protein, preservative free, 100 mcg/0.5mL dosage, diluent reconstituted; second dose	Second dose of Moderna COVID-19 vaccine

Practice expenses

Clinics are incurring extra expenses during the COVID-19 pandemic—a result of increased sanitation, use of personal protective equipment, and staff time required for symptom checks. To enable clinics to report these additional expenses, the American Medical Association established a new code, 99072, which took effect on September 8, 2020. The new code can be used only during a public health emergency, as defined by law; applies only to services provided in nonfacility settings; and can be reported only once per in-person visit. Professional service claims should be analyzed to assess the number of patient visits containing 99072.

ICU stays

ICU capacity is a major concern and has been regularly monitored by public health agencies during the pandemic. However, a number of units in a hospital could serve as ICUs. Table 11 provides revenue center codes based on the ICU definition set forth by AHRQ's Healthcare Cost and Utilization Project team.

We recommend querying hospital inpatient claims only. Due to prolonged hospital stays, COVID-19 patients may generate multiple inpatient claims that should be aggregated at the stay level, based on dates of service, before conducting analysis.

Table 11. Revenue center codes for ICU

Revenue center codes	Description
200	Intensive care—general classification
201	Intensive care—surgical
202	Intensive care—medical
203	Intensive care—pediatric
204	Intensive care—psychiatric
206	Intensive care—post-ICU; redefined as intermediate ICU (effective October 1996)
207	Intensive care—burn care
208	Intensive care—trauma
209	Intensive care—other intensive care
210	Coronary care—general classification
211	Coronary care—myocardial infarction
212	Coronary care—pulmonary care
213	Coronary care—heart transplant
214	Coronary care—post-coronary care unit (CCU); redefined as intermediate CCU (effective October 1996)
219	Coronary care—other coronary care
233	Incremental nursing charge rate—ICU (includes transitional care)
234	Incremental nursing charge rate—CCU (includes transitional care)

Use of ventilators

Besides ICU beds, respiratory ventilators are a crucial tool for treating COVID-19 patients in critical care. Table 12 lists the ICD-10-PCS value sets published as part of the AHRQ Quality Indicator software. Note that patients can sometimes be intubated but not placed on a traditional ventilator. To capture these instances, researchers may want to include the intubation codes (beginning with 0B) in Table 12 along with the ventilator codes (beginning with 5A).

We recommend querying hospital inpatient claims only, but we are monitoring the extent to which these services are found in other claim types.

Table 12. Procedure codes for ventilators and intubation

ICD-10-PCS code	Description
5A1935Z	Respiratory ventilation, less than 24 hours
5A1945Z	Respiratory ventilation, 24 to 96 hours
5A1955Z	Respiratory ventilation, more than 96 hours
0BH13EZ	Insertion of endotracheal airway into trachea, percutaneous approach
0BH17EZ	Insertion of endotracheal airway into trachea, via natural or artificial opening
0BH18EZ	Insertion of endotracheal airway into trachea, via natural or artificial opening, endoscopic

Linking claims to public use files

A large and growing number of data resources are publicly available for COVID-19 analysis. Many of these sources were available before COVID-19, and only a few are specific to COVID-19 prevalence, testing, mortality, or services.

Mathematica frequently updates a curated list of data, dashboards, and other resources to support COVID-19 analyses. For detailed information on the data sources described below (such as data coverage, frequency of updates, level of aggregation, availability of application programming interfaces (APIs), and the extent of overlap between sources), visit Mathematica's COVID Data and Resources GitHub page.

This section lists relevant public use files for COVID-19 analysis. A few notes about this information follow:

- We assumed that readers understand how to analyze geographic information—for example, by cross-walking zip codes, counties, or metropolitan statistical areas.
- To point users to clean, curated data, we listed aggregate sources instead of original sources whenever possible.
- Before creating a dashboard, please consider the large number already available through Tableau or other sources.

Curated or aggregated data sources

Instead of pulling from the original source, cloud service providers and federal agencies are aggregating data for analysis. Table 13 shows sources with multiple files relevant to COVID.

Table 13. Resources containing multiple COVID-relevant public use files

Vendor	Resource	Notes
Tableau	• COVID-19 data hub	Tableau offers a repository of dashboards and COVID-related data files.
Amazon Web Services (AWS)	• COVID-19 public data lake • Marketplace data for COVID-19 research	The AWS platform offers both public and special-use data sources related to COVID-19, health care supply, and social determinants of health.
Google Cloud Platform (GCP)	• Public data sets • COVID-19 public data sets	GCP BigQuery has a wide range of public data sources related to COVID-19, health care supply, and social determinants of health.

Best sources for common analyses

Table 14 shows the best sources of COVID-related data to link to claims.

Table 14. Recommended data sources for COVID-19 research

Type of data	Source	Smallest unit	Notes
Cases and deaths	Johns Hopkins University	County	Data are updated daily and are similar in content and granularity to the *New York Times* data.
Testing, ICU use, hospitalizations	The COVID Tracking Project	State	Data source and quality are reported.
Social determinants of health	Census data hub	Varies (county and sometimes zip code)	Hub provides a rich source of data for downloading or exploring via a dashboard.
Policy actions	Kaiser Family Foundation	State	

Acknowledgments and sources

The information in this brief was compiled by Mathematica staff, both those working specifically on COVID-19 projects and the broader team. These staff drew on a variety of sources, from billing guidelines to seminars and presentations. We extend special thanks to the following:

- Mathematica staff: Mike Sisti (for his review of the Value Set Authority Center), Laura Nolan (for information on the Medicaid perspective and lab services), Su Liu (for input on ventilator and intubation coding), John Schurrer (for reviewing the primer), Tom Bell (for information on telemedicine), Ethan Jacobs (for information on telehealth), and Constance Delannoy (for public data sources)
- University of California Davis staff: Patrick Romano and Oluseun Atolagbe for their input on ventilator and intubation coding
- The National Association of Health Data Organizations for arranging webinars and resources related to COVID-19
- AHRQ for the diagnosis and procedure-coding tools and value sets included in its publicly available Quality Indicators
- CMS and the American Medical Association for many COVID-19 resources on billing
- The Office of the National Coordinator for Health Information Technology for centralizing information on value sets

Log of changes

- April 16: initial release
- April 23: added COVID-related services (telehealth, virtual check-ins, e-visits, lab tests, ICU stays, and ventilator use); expanded the diagnoses in Table 2 beyond COVID-19 viral pneumonia and corrected the interim coding advice; added references to additional publicly available condition categories to define cohorts

- April 30: added section on linking claims to public data sources; added information on how diagnosis and procedure codes are being used in claims
- June 7: corrected a reference to coding guidance for people exposed to COVID-19 (changed from Table 3 to Table 5); added a section on MS-DRGs; added 45 new telehealth codes; removed home health as a claim for lab testing; added serological testing codes; added intubation to ventilation codes; fixed link to Kaiser Family Foundation site; moved section on COVID-19 exposure codes to come immediately after the section on COVID-19 diagnosis codes
- July 24: added new laboratory test procedure codes and modifier code guidance (source)
- August 12: added new therapeutics codes; fixed an incorrect reference to a table with ventilator coding
- September 18: added a new serological testing code and a section about coding for practice expenses
- October 15: added four new diagnostic and serology test codes to Table 8; added information about updated telehealth codes
- December 23: added codes for vaccines administered in the outpatient setting; added 21 procedure codes effective January 1, 2021; added diagnosis codes effective January 1, 2021; added information about updated telehealth codes

Acronyms

AHRQ	Agency for Healthcare Research and Quality
API	Application programming interface
ARDS	Acute respiratory distress syndrome
AWS	Amazon Web Services
CC	Complication or comorbidity
CCSR	Clinical Classification Software Refined
CCU	Coronary care unit
CDC	Centers for Disease Control and Prevention
CM	Clinical modification
COVID	Coronavirus disease
CPT	Current Procedural Terminology
GCP	Google Cloud Platform
HCPCS	Healthcare Common Procedure Coding System
ICD	International Classification of Diseases
ICU	Intensive care unit
MCC	Major complication or comorbidity
MS-DRG	Medicare Severity Diagnosis-Related Group
SARS	Severe acute respiratory syndrome