DaVINCI:
COVID-19 and COVID-19 Testing in DoD and VA Population

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COVID-19 Pandemic

- The COVID-19 pandemic has been sweeping around the globe for over a year and a half now

- COVID-19 has impacted every aspect of our lives, including healthcare utilization

- Vaccines became widely available this spring, which may be a light at the end of our long tunnel

- How can we use DaVINCI to analyze DOD and VA data related to COVID-19?

Outline

- Overview of DaVINCI and the DaVINCI cohort

- Summary and Limitations of COVID-19 data in DoD OMOP and DoD Source tables (with some comparisons to VA):

  - Identifying and analyzing COVID-19 lab testing in the DoD and VA Source Tables

  - COVID-19 diagnoses and tracking cases in DoD and VA OMOP

  - Identifying and analyzing COVID-19 vaccinations in DoD/VA OMOP and Source Tables

DaVINCI

What is DaVINCI?

- Currently, 2 separate DaVINCI databases exist: one lives in a DoD analytic environment (MIP – Redshift), and the other in the VA analytic environment (VINCI – SQL Server)

- The set of tables and fields are the same for the OMOP CDM data tables


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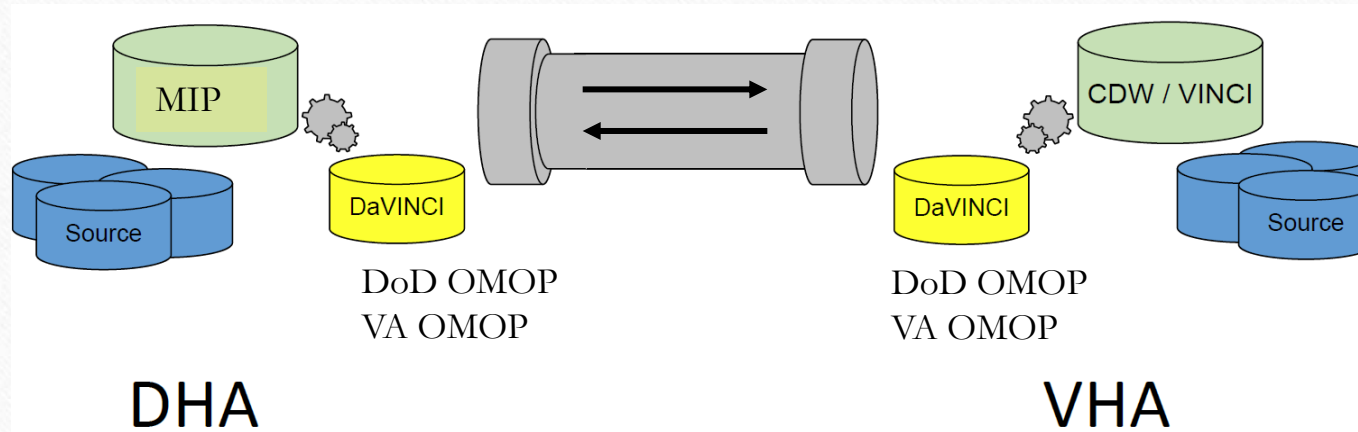
DaVINCI VA & DoD OMOP Tables

Category	OMOP Table Name	VA OMOP	DoD OMOP
Clinical	CONDITION_OCCURRENCE	2,273,566,044	1,869,624,856
Clinical	DEATH	8,005,742	1,188,184
Clinical	DEVICE_EXPOSURE	171,795,075	102,852,998
Clinical	DRUG_EXPOSURE	4,967,974,344	1,231,632,863
Clinical	FACT_RELATIONSHIP	9,272,022	1,831,727,646
Clinical	MEASUREMENT	15,033,573,540	1,993,313,977
Clinical	NOTE	0	43,856,260
Clinical	OBSERVATION	491,173,530	2,217,744,783
Clinical	OBSERVATION_PERIOD	15,209,496	9,307,536
Clinical	PERSON	23,753,749	9,860,907
Clinical	PROCEDURE_OCCURRENCE	2,256,294,443	1,818,098,199
Clinical	SPECIMEN	6,752,554,511	125,527,063
Clinical	VISIT_OCCURRENCE	2,926,319,211	940,892,776
Health System	CARE_SITE	1,221,209	1,422,724
Health System	LOCATION	44,449,311	197,992
Health System	PROVIDER	6,903,537	11,189,042
	Total	**34,982,065,764**	**12,208,437,806**

Highlighted OMOP tables were used to generate data on COVID-19 in this presentation along with Source Specific Tables (discussed later)

What is the OMOP Common Data Model (CDM)?
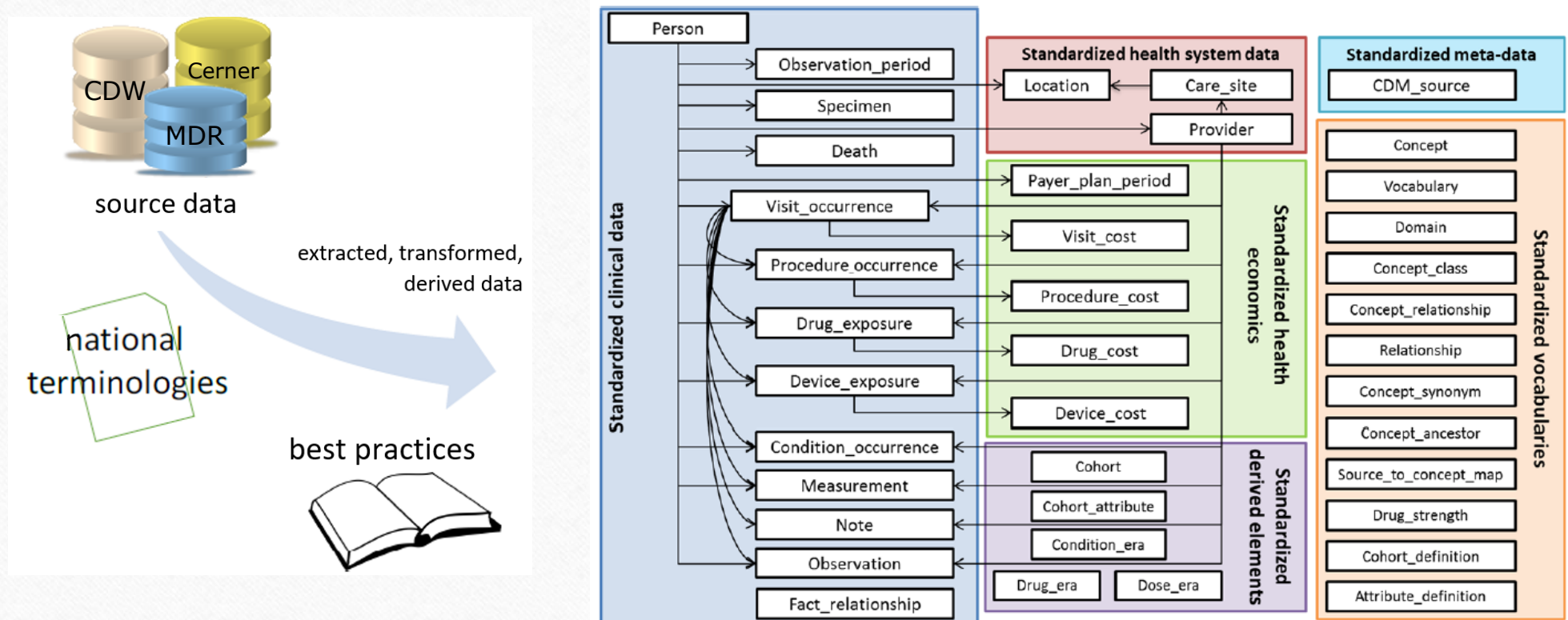
DaVINCI Cohort

DaVINCI Scope

- While the Military Health System (MHS) treats more unique patients on an annual basis, over half of those patients are "family members"

- The DaVINCI scope largely <u>excludes</u> DoD family members

9.4M Eligible Beneficiaries*

7.9M Unique patients treated in FY2017*

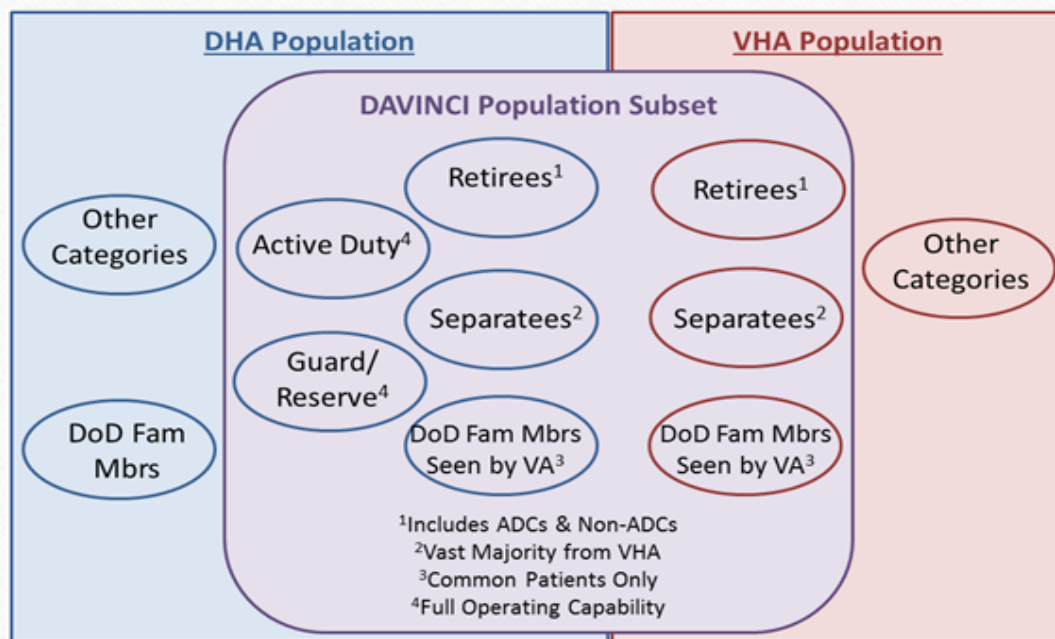*Source: 'Evaluation of the Tricare Program: Access, Cost, and Quality; Fiscal Year 2018 Report to Congress*

9.1M Veteran Enrollees*

6.4M Unique patients treated in FY2017*

**Source: VA Benefits & Health Care Utilization Pocket Card at http://www.va.gov/vetdata/docs/pocketcards/fy2018q4.pdf*

DaVINCI Cohort (~24 million)

Totals by "current" status:

- Active Duty: 1.4M

- Guard / Reserve: 380k

- Retirees: 2.2M

- DoD-only Separatees: 2M

- Veterans: 9.2M

- Deceased: 8.4M

DaVINCI creates a consolidated view of healthcare from accession to interment for Service women and men, Veterans, and other eligible patients receiving care from DoD or VA

DaVINCI Cohort Scenarios

EDIPI	CY	CM	MHS Eligible	Age	Beneficiary Category	Marital Status	Sponsor Service
1	2000	1	1	40	Active Duty	S	F
1	2020	2	1	40	Active Duty	S	F
1	2020	3	1	40	Active Duty	S	F
1	2020	4	1	40	Active Duty	S	F
1	2020	5	1	40	Active Duty	S	F
1	2020	6	1	40	Active Duty	S	F
1	2020	7	1	40	Active Duty	S	F
1	2020	8	1	40	Retiree	S	F
1	2020	9	1	40	Retiree	S	F
1	2020	10	1	40	Retiree	S	F

- Defense Enrollment and Eligibility Reporting System (DEERS) monthly snapshot records show changing beneficiary status
  - Once a person shows in DEERS as Active Duty, they become part of the DaVINCI Cohort
- All available health records, for all-time, are captured for DaVINCI cohort members
  - Not limited to their time on Active Duty
  - All Pre- and Post- Active Duty care is captured

Methodology for Identifying Cohorts in DaVINCI

To better examine the impact of COVID-19, individuals from the DoD and VA are uniquely assigned to a cohort following a hierarchy (for each calendar year):

1. **New Deceased**:
   - Deaths occurring in the current year (FY 2021)
2. **Active Duty/Guard Reserve ("Service Members"):**
   - Those in the Military Health System (MHS) who have a DEERS Beneficiary Category of Active Duty, Guard or Reserve
3. **Veteran VA User/Retiree:**
   - Those who have a DEERS Beneficiary Category of Retired
   - Those who are recognized in the VA system and are flagged as veteran, who also do not have future DEERS Beneficiary Category of Active Duty/Guard/Reserve ("Service Members")
4. **DoD Family Member:**
   - Those who have DEERS Beneficiary Category of a 'Dependent of a Service Member'
5. **Veteran VA User**: **Non-Veteran VA User:**
   - Those known to the VA system but are not flagged as Veteran users
6. **Separatee:**
   - Individuals who have past instances of Active Duty, Guard, Reserve, or Retired status but have not appeared in the VA data

COVID-19 Lab Testing

COVID-19 Lab Test Techniques

- Polymerase Chain Reaction (PCR): Tests for presence of SARS-CoV-2 RNA by amplifying the amount of virus present in the body. Indicates a current infection and is considered the gold standard.

- Antigen testing (aka Rapid Test): Tests for the presence of antigens in response to a SARS-CoV-2 infection. Indicates a current infection and gives quick results, but less accurate than PCR.

- Antibody testing: Tests for the presence of antibodies created to fight SARS-CoV-2. Indicates that the patient has been exposed to the virus at some point (not necessarily a current infection).

COVID-19 Lab CPT Codes in MTFs

CPT Code	CPT Description	Notes
87635	INFECTIOUS AGENT DETECTION BY NUCLEIC ACID (DNA OR RNA); SEVERE ACUTE RESPIRATORY SYNDROME CORONAVIRUS 2 (SARS-COV-2) (CORONAVIRUS DISEASE [COVID-19]), AMPLIFIED PROBE TECHNIQUE	PCR Testing. This is by far the most common code used in lab testing (~90% since May 2020). Appears to be used often (incorrectly) for antigen/rapid testing as well.
86328	IMMUNOASSAY FOR INFECT AGENT ANTIBODY(IES),QUALITATIVE/SEMIQUANTITATIVE,SINGLE STEP METHOD (EG,REAGENT STRIP);SEVERE AC RESPIRATORY SYNDROME CORONAVIRUS 2 (SARS-COV-2) (CORONAVIRUS DIS [COVID-19])	Antibody testing. Not used in direct care until October 2020.
86769	ANTIBODY; SEVERE ACUTE RESPIRATORY SYNDROME CORONAVIRUS 2 (SARS-COV-2) (CORONAVIRUS DISEASE [COVID-19])	Antibody testing. Not used in direct care until July 2020.
0202U	INFECT DIS (BACT/VIRAL RESPIR TRACT INFECT),PATHOGEN SPEC NUC ACID (DNA/RNA),22 TARGETS INCLD SEVERE AC RESP SYNDROME CORONAVIR 2 (SARS-COV-2),QUAL RT-PCR,NASOPHAR SWAB,EA PATHOGEN REP AS DET/NOT DET	Proprietary Laboratory Analysis (PLA) code for the Biofire RP2.1 test

Other COVID-19 Lab CPT Codes

CPT Code	CPT Description	Notes		CPT Code	CPT Description	Notes
87426	INF AGNT ANT,IMMUNO;SARS-COV-2	Antigen testing (used a lot in private sector)		86408	NEUTR ANTIBODY,SARS-COV-2;SCRN	Neutralizing antibody screen
87428	SARSCOV & INF VIR A&B AG IA	Antigen testing for SARS-CoV-2 and Influenza A/B		86409	NEUT ANTIBODY,SARS-COV-2;TITER	Neutralizing antibody titer
87636	INF AGN DET;SARS-COV-2&FLU A&B	PCR SARS-CoV-2 and Influenza A/B		0223U	INF,D/RNA,22 TAR,SARSCOV2,SWAB	PLA for QIAGEN PCR
87637	INF AGN;SARS-COV-2,FLU&RSV,AMP	PCR SARS-CoV-2, Influenza A/B, and RSV		0224U	ANTIBODY,SARS-COV-2,W/WO TITER	PLA for Mt. Sinai antibody
U0001	CDC 2019 NOV CORONAVR RT DX PN	CDC confirming test		0225U	INF,D&RNA,21 TAR,SARSCOV2,AMPL	PLA for GenMark PCR
U0002	2019-NCOV COR,SAR-COV-2,NO-CDC	Locally developed test (used a lot in private sector)		0226U	SVNT,SARS-COV-2,ELISA,PLAS,SER	PLA for Ethos Labs ELISA
U0003	SARS-COV-2,AMP PRB,HI THRUPUT	High throughput test (used a lot in private sector)		0240U	INF,RNA,3TAR,SARS-COV-2,UP RES	PLA for Cepheid COVID + Flu A/B
U0004	SARS-COV-2,ANY,NON-CDC,HI THRU	Non-CDC High throughput test (used a lot in private sector)		0241U	INF,RNA,4TAR,SARS-COV-2,UP RES	PLA for Cepheid COVID + Flu A/B + RSV
87811	SARS-COV-2 COVID19 W/OPTIC	Antigen test by direct visual observation		86413	SARS-COV-2 ANTB QUANTITATIVE	Quantitative antibody

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COVID-19 Logical Observation Identifiers Names and Codes (LOINCs)

- COVID-19 LOINCS:

LOINC	LOINC Name
94500-6	SARS-CoV-2 (COVID-19) RNA [Presence] in Respiratory specimen by NAA with probe detection
94558-4	SARS-CoV-2 (COVID-19) Ag [Presence] in Respiratory specimen by Rapid immunoassay
94565-9	SARS-CoV-2 (COVID-19) RNA [Presence] in Nasopharynx by NAA with non-probe detection

- DoD OMOP:
  - Direct Care: COVID-19 LOINCs are rarely used (<1%)
    - LOINCs have been mapped to DoD OMOP but CDR Chemistry data does not have COVID LOINCs as the reference table has not been updated
  - Purchased Care: No LOINCS
- VA OMOP: VA has mapped LOINCS to OMOP

COVID-19 Lab Test Names
in DOD Data

- Using CPT codes does not reliably identify all COVID-19 tests and particularly the kind of lab testing

- In the MHS, in direct care, lab test names tend to be more accurate, but can be more difficult to use since they can vary from CHCS host to CHCS host (and to MHS GENESIS)

  - Note: Names have become much more standardized since July/August 2020

Top Four Lab Test Names in DoD Data*

Month	#1 Test Name (and share)	#2 Test Name (and share)	#3 Test Name (and share)	#4 Test Name (and share)
March 2020	CORONAVIRUS PCR (61%)	COVID-19 (20%)	COVID-19 PNL (LC) (5%)	2019-nCoV (4%)
April 2020	CORONAVIRUS PCR (47%)	COVID-19 (24%)	Coronavirus PCR EPI 14827 (6%)	SARS-COV-2 RAPID (5%)
May 2020	CORONAVIRUS PCR (34%)	COVID-19 (27%)	SARS-COV-2 RAPID (9%)	SARS-CoV-2 PCR NASAL (7%)
June 2020	SARS-CoV-2 PCR (58%)	SARS-CoV-2 RAPID (15%)	CORONAVIRUS PCR (9%)	SARS-CoV-2 TOTAL ANTIBODIES (3%)
July 2020	SARS-CoV-2 PCR (66%)	SARS-CoV-2 RAPID (17%)	SARS-COV-2, NAA (4%)	SARS-CoV-2 QUALITATIVE IGG (2%)
August 2020	SARS-CoV-2 PCR (51%)	SARS-CoV-2 RAPID (17%)	SARS-COV-2 PCR (17%)	SARS-CoV-2 PCR (REF) (3%)
September 2020	SARS-COV-2 PCR (58%)	SARS-CoV-2 RAPID (15%)	SARS-CoV-2 PCR (8%)	SARS-COV-2, NAA (LABCORP) (4%)
October 2020	SARS-COV-2 PCR (61%)	SARS-CoV-2 RAPID (14%)	SARS-CoV-2 PCR (7%)	SARS-COV-2, NAA (2%)
November 2020	SARS-COV-2 PCR (57%)	SARS-CoV-2 RAPID (12%)	SARS-CoV-2 PCR (11%)	SARS-COV-2 RAPID (4%)
December 2020	SARS-COV-2 PCR (56%)	SARS-COV-2 RAPID (11%)	SARS-CoV-2 PCR (10%)	SARS-COV-2, NAA (3%)
January 2021	SARS-COV-2 PCR (41%)	SARS-CoV-2 PCR (15%)	SARS-COV-2 RAPID (13%)	SARS-CoV-2 ANTIGEN (5%)

*Direct Care Only

Standardized COVID-19 Lab Test Names in DoD Data (CHCS vs MHS GENESIS)*

CHCS	MHSG
SARS-CoV-2 PCR	SARS-CoV-2 PCR
SARS-CoV-2 RAPID	SARS-CoV-2 PCR EPI 17211
SARS-CoV-2 NAA	SARS-CoV-2 PCR KS 17211
SARS-CoV-2 RNA (Quest)	SARS-CoV-2 NAA LC139900
SARS-CoV-2 QUALITATIVE IGG	SARS-CoV-2 TOTAL ANTIBODIES
COVID ABS IGG/IGA	SARS-CoV-2 QUALITATIVE IGG LC164055
SARS-CoV-2 TOTAL ANTIBODIES	SARS-CoV-2 QUALITATIVE IGG EPI 17205
SARS-CoV-2 ANTIGEN (coming soon)	SARS-CoV-2 ANTIGEN

*Direct Care Only

All COVID-19 Lab Test Names in DoD Data*

2019 NOVEL CORONAVIRUS	COVID-19 CDC PCR	NOVEL CORONAVIRUS 2019 RT PCR	SARS-COV-2 ANTIBODY, IGA	SARS-CoV-2 PCR, NAA	SARS-COV-2,NAA (COVID-19)-LC	xSARS-COV-2 RAPID
2019 NOVEL CORONAVIRUS, NAA	COVID-19 DHEC USE ONLY	pmm.COVID-19 PANEL	SARS-CoV-2 Antibody, IgG	SARS-CoV-2 PNL	SARS-COV-2,NAA (COVID-19)-LCA	xx.COVID ABS IGG/IGA(BIOSCIEN)
2019 NOVEL CORONAVIRUS,NAA LC	Covid-19 Diag Panel(AT)	pmm.SARS-COV-2 (REF)	SARS-CoV-2 ANTIBODY, IGG	SARS-CoV-2 POCT	SARS-COV-2,NAA (LABCORP)	xx.COVID REFLEX ONLY TO LRMC
2019-nCoV	COVID-19 DIAG PANEL(BIOFIRE)	POC SAR-COV-2 ANTIGEN	SARS-CoV-2 ANTIBODY, IGM	SARS-CoV-2 QUAL AB PROFILE	SARS-COV2,NAA LC	xx.LC_DiaSorin SARS CoV-2 IgG
ALASKA VIROLOGY LAB COVID PCR	Covid-19 DIAG(QST)	POC SARS CoV 2 ANTIGEN	SARS-COV2 ANTIGEN	SARS-CoV-2 QUAL IGG IGM PANEL	SARS-COV-2,NAA LC	xx.LC_EuroImmun CoV-2 IgG Ab S
ANTI-SARS-CoV-2	COVID-19 DIATHERIX	POC SARS-COV-2 ANTIGEN	SARS-CoV-2 ANTIGEN	SARS-CoV-2 QUALITATIVE IGA	SARS-COV-2/FLU A&B	xx.LC_GSD SARS CoV-2 IgG Ab
ANTI-SARS-COV-2, IGG	COVID-19 FBCH INPT/STAFF ONLY	RAPID COVID19	SARS-COV-2 ANTIGEN	SARS-CoV-2 QUALITATIVE IGA	SARS-COV-2/FLU A/FLU B/RSV	xx.LC_IDK SARS CoV-2 IgG Ab
BI0FIRE C0VID-19	COVID-19 KCDC PCR	RAPID COVID-19	SARS-COV-2 ANTIGEN (ARMY)	SARS-CoV-2 QUALITATIVE IGG	SARS-COV-2/RESPIRATORY PANEL	xxCORONAVIRUS(BMEDDAC ONLY)
BIOFIRE COVID-19 PANEL	COVID-19 KDHE	RAPID FLU/SARS-COV-2 PANEL	SARS-COV-2 ANTIGEN (INHOUSE)	SARS-CoV-2 QUALITATIVE IGG	SARS-COV-2/RESPIRATORY PANEL	xxPRE-OP COVID-19
BIOFIRE VID-19	Covid-19 MONITOR PNL(AT)	RAPID SARS/FLU COMBO	SARS-COV-2 ANTIGEN PANEL	SARS-CoV-2 QUALITATIVE IGG LC164055	WAIVED COVID-19 AG	xxSARS COV2 RAPI(LAB USE ONLY)
BIOFIREVID-19	Covid-19 MONITOR(QST)	RAPID SARS-CoV-1/2	SARS-COV-2 ASYMPTOMATIC	SARS-CoV-2 QUALITATIVE IGM	WAIVED SARS-CoV-2 AG	xxSARS-COV-2 ANTIBODY, IGG
CORONAVIRUS nCoV	COVID-19 PANEL (BD MAX MILW)	RESPIRATORY PANEL 2.1(LOCAL)	SARS-COV-2 BIOFIRE	SARS-CoV-2 QUALITATIVE IGM	x.CORONAVIRUS PCR PNL	xxSARS-COV-2, NAA (LC)
CORONAVIRUS PCR	COVID-19 PANEL (IDPH)	ROBINS COVID-19 PCR	SARS-CoV-2 IGA AB QL	SARS-CoV-2 RAPID	x.CORONAVIRUS PCR PNL (EPI)	ZCOVID-19 IACH
CORONAVIRUS PCR (URGENT)	COVID-19 PANEL (QUEST)	SAFB COVID-19	SARS-CoV-2 IGG	SARS-CoV-2 RAPID	x.COVID-19 (773rd)	ZSARS-COV-2 IGA AB QL
Coronavirus PCR EPI 14827	COVID-19 PANEL (WDL)	SAFB SARS-CoV-2 PCR	SARS-CoV-2 IGG	SARS-CoV-2 RAPID PANEL	x.COVID-19 DIATHERIX	ZSARS-COV-2 IGG AB QL
CORONAVIRUS(BMEDDAC ONLY)	COVID-19 PANEL(SAN DIEGO)	SARS CORONAVIRUS 2,IGG AB	SARS-CoV-2 IgG (QUEST)	SARS-CoV-2 RAPID W/CYCLE TIME	x.LC 164056 EURO SARS IGG	ZSARS-COV-2 IGM AB QL
COV-2 IGG AB SARS	COVID-19 PNL (LC)	SARS COV	SARS-CoV-2 IgG Ab	SARS-CoV-2 RNA Detect CG830792	x.LC 164056 EUROIMMUN REFLEX	zSARS-COV-2 RAPID
COV-2 IGM AB SARS	COVID-19 PNL (NIDDL)	SARS CoV-2 ANTIGEN	SARS-COV-2 IGG AB QL	SARS-COV-2 SYMPTOMATIC	x.LC 164058 GSD IgG REFLEX	zz.COVID-19 ADDENBROOKES
COV2/Flu/RSV	COVID-19 PREOP	SARS COV-2 IGA AB	SARS-COV-2 IGG-IGM ABS	SARS-CoV-2 TOTAL ANTIBODIES	x.LC 164058 GSD SARS IGG RFLX	zz2019 NOVEL CORONAVIRUS, NAA
COVID 19	COVID-19 RAPID	SARS COV-2 IGG AB	SARS-COV-2 IGG-IGM ABS	SARS-COV-2 TOTAL ANTIBODIES	x.LC 164059 IDK SARS IGG RFLX	ZZCOVID-19 KDHE
COVID 19 IN-HOUSE NAA	COVID-19 RAPID (AV)	SARS CoV-2 IgG Ab (LABCORP)	SARS-COV-2 IGM AB QL	SARS-COV-2 TOTAL IGG	x.LC 164059 IDK SARS REFLEX	zzpmm.COVID-19 PANEL
COVID ABS IGG/IGA(BIOSCIENTIA)	COVID-19 RT-PCR (WRAIR)	SARS COV-2 IGM AB	SARS-CoV-2 NAA	SARS-COV-2 TOTAL IGG PANEL	x.LC 164060 DIASORIN SARS IGG	ZZSARS CoV-2 IgG Ab (LABCORP)
Covid_19DIAG PNL(AT-VERITOR)	COVID-19 SCL PCR	SARS COV-2, NAA LC	SARS-CoV-2 NAA (LC)	SARS-CoV2, NAA	x.LC 164060 DIASORIN SARS RFLX	ZZSARS-COV-2, NAA
COVID-19	Covid-19 SCR PNL(AT)	SARS CoV-2, NAA LC139900	SARS-CoV-2 NAA LC139900	SARS-COV-2, NAA	x.SARS-COV-2 PCR (MIL REF)	zzSARS-COV-2, NAA (LC)
COVID-19 (ACTIVE DUTY 1 OF 2)	Covid-19 SCR PNL(AT-VERITOR)	SARS-2-COV RAPID	SARS-CoV-2 PCR	SARS-COV-2, NAA	x.SARS-CoV-2 PCR (REF)	ZZZ SARS-COV-2 ANTIGEN
COVID-19 (BIOFIRE)	Covid-19 SCR(QST)	SARS-COV ANTIGEN	SARS-COV-2 PCR	SARS-COV-2, NAA (LABCORP)	x_2019 n-CoV PCR	ZZZCORONAVIRUS PCR (URGENT)
COVID-19 (CEPHEID)	COVID-19(BMEDDAC ONLY)	SARS-CoV-2	SARS-COV-2 PCR (MIL REF)	SARS-COV-2, NAA (LABCORP)	x_COVID-19	
COVID-19 (CIVILIAN)	COVID-19(DDEAMC)	SARS-COV-2	SARS-COV-2 PCR (MIL REF)	SARS-COV-2, NAA (LC)	x_COVID-19 PCR (BIOFIRE)	
COVID-19 (IDPH)	DCLS/CDC NOVEL CORONAVIRUS	SARS-COV-2 (COVID-19), NAA	SARS-CoV-2 PCR (REF)	SARS-COV-2, NAA LABCORP	x_COVID-19 PNL (LC)	
COVID-19 (INFINITY)	DIASORIN COV-2 IGG AB SARS	SARS-COV-2 (MIL REF)	SARS-CoV-2 PCR (REF)	SARS-CoV-2, NAA LC	x_COVID-19 RT-PCR (WRAIR)	
COVID-19 (VAFB)	EUROIMMUN COV-2 IGG AB SARS	SARS-CoV-2 (QL) ANTIBODIES	SARS-CoV-2 PCR EPI 14827	SARS-CoV-2, NAA LC	X_INACTIVE_COVID-19 PNL (LC)	
COVID-19 ADDENBROOKES	GSD COV-2 IGG AB SARS	SARS-CoV-2 (QL) ANTIBODIES	SARS-CoV-2 PCR EPI 17211	SARS-COV-2, NAA LC139900	x_SARS-CoV-2 PCR PNL (EPI)	
COVID-19 Ag	IDK COV-2 IGG SARS	SARS-COV-2 AB IGG	SARS-CoV-2 PCR KS 17211	SARS-COV-2, NAA(LC)	x_SARS-CoV-2 PCR PNL (LAB CORP	
COVID-19 AIR	LABCORP 2019 NOVEL CORONAVIRUS	SARS-COV-2 AB IGM	SARS-COV-2 PCR NASAL	SARS-CoV-2,NAA	x_SARS-CoV-2 PCR PNL (WRAIR)	
COVID-19 BIOFIRE	LOCAL COVID-19	SARS-COV-2 AB PNL QL(CENTAUR)	SARS-COV-2 PCR W/CYCLE TIME	SARS-COV-2,NAA	x_SARS-COV-2 XPRESS	

*Direct Care Only

COVID-19 Lab Results in DoD Data

- This has been filtered to Lab Test "SARS-CoV-2 PCR"

- Positive results can be identified with any of the following: P, D, DETECTED, DET, POS, Detected, POSITIVE, Positive, PNCV19, POSITIVE 2019-NCOV, R, PP, PRESUMPTIVE POSITIVE, PPNCV19, POSITIV, REACTIVE, Pos, POSITIVE FOR COVID-1, Reactive, …

Direct Care Only

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Common CADRE Lab Result Values

Obs        LABTEST            LABVALUE                count

 1    SARS-CoV-2 PCR      N                         214210
 2    SARS-CoV-2 PCR      NOT DETECTED               86814
 3    SARS-CoV-2 PCR      ND9                        74135
 4    SARS-CoV-2 PCR      ND                         49564
 5    SARS-CoV-2 PCR      NEG                        32748
 6    SARS-CoV-2 PCR      NEGATIVE                   29829
 7    SARS-CoV-2 PCR      P                           9010
 8    SARS-CoV-2 PCR      Not Detected                8241
 9    SARS-CoV-2 PCR      DET                         4794
10    SARS-CoV-2 PCR      DETECTED                    4618
11    SARS-CoV-2 PCR      D                           3990
12    SARS-CoV-2 PCR      POS                         3001
13    SARS-CoV-2 PCR      TNP                         2561
14    SARS-CoV-2 PCR      Negative                    1813
15    SARS-CoV-2 PCR      TEST NOT PERFORMED          1218
16    SARS-CoV-2 PCR      POSITIVE                    1194
17    SARS-CoV-2 PCR      Detected                     672
18    SARS-CoV-2 PCR      INV                          345
19    SARS-CoV-2 PCR      Neg                          317
20    SARS-CoV-2 PCR      REJ                          259
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Common GENESIS Lab Result Values

Obs    ORDERABLE_DISP      RESULT_VALUE           count

 1    SARS-CoV-2 PCR      Screening              72207
 2    SARS-CoV-2 PCR      Negative               67909
 3    SARS-CoV-2 PCR      Not Detected           21593
 4    SARS-CoV-2 PCR      Diagnosis              17072
 5    SARS-CoV-2 PCR      Positive                6598
 6    SARS-CoV-2 PCR      Detected                1466
 7    SARS-CoV-2 PCR      Diagnostic              1071
 8    SARS-CoV-2 PCR      Surveillance             838
 9    SARS-CoV-2 PCR      TNP                      835
10    SARS-CoV-2 PCR      NEGATIVE                  71
```

DOD Data:
COVID-19 in a Panel

- Most COVID-19 tests to-date are single result tests, but panels are becoming more common
- COVID-19 is most often paired with the flu and Respiratory Syncytial Virus (RSV)
- Be careful to grab the correct result from the list of panel results in Source tables or DoD OMOP
  - DOD OMOP: Use the Fact Relationship table to link the Measurement (Lab CPT) and Note (Panel Result) tables

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CADRE Lab Results

Obs              LABTEST                    LABTESTR          LABVALUE

1      SARS-COV-2/FLU A/FLU B/RSV      INFLUENZA A PCR          P
2      SARS-COV-2/FLU A/FLU B/RSV      SARS-COV-2 PCR           N
```

```
GENESIS Lab Results

                                                          RESULT_
Obs        ORDERABLE_DISP          EVENT_CODE              VALUE

1       SC2/FLU A/FLU B/PCR      Influenza A PCR          Negative
2       SC2/FLU A/FLU B/PCR      Influenza B PCR          Negative
3       SC2/FLU A/FLU B/PCR      2019-nCoV                Negative
```

DOD Data:
Top Five MTFs Performing COVID Labs
(Mar 2020 to Jan 2021)

Month	#1 MTF	#2 MTF	#3 MTF	#4 MTF	#5 MTF
March 2020	Wright-Patt EpiLab	Landstuhl	BAMC	Walter Reed	San Diego
April 2020	Wright-Patt EpiLab	NH Guam	Walter Reed	San Diego	Bremerton
May 2020	Wright-Patt EpiLab	Walter Reed	NH Guam	Portsmouth	Ft. Bliss
June 2020	Wright-Patt EpiLab	BAMC	Ft. Jackson	Walter Reed	Langley AFB
July 2020	Wright-Patt EpiLab	Walter Reed	Ft. Benning	Seoul	Ft. Jackson
August 2020	Seoul	Wright-Patt EpiLab	Madigan	Ft. Jackson	Ft. Benning
September 2020	Wright-Patt EpiLab	Seoul	Walter Reed	Ft. Jackson	Landstuhl
October 2020	Wright-Patt EpiLab	Seoul	Walter Reed	Landstuhl	Madigan
November 2020	Wright-Patt EpiLab	Madigan	San Diego	Landstuhl	Seoul
December 2020	Wright-Patt EpiLab	Portsmouth	Landstuhl	San Diego	BAMC
January 2021	Madigan	Portsmouth	Ft. Sill	Landstuhl	Wright-Patt EpiLab

COVID-19 Lab Data

- COVID-19 Lab volume was captured using DaVINCI Source data
  - DoD:
    - Labs were pulled using the non-standardized text names in the CADRE/MHS GENESIS Lab Source table as these are more accurate than new CPT codes (which OMOP relies on to match to standardized concepts)
  - VA:
    - Labs were pulled using the volume of cases pre-filtered by the COVID-19 Lab Case and Chemistry (SORDCovid.CaseLabChem) Source table

Lab Volume in DoD and VA Source Tables
(Daily Lab volume with 7 day moving average)

Lab Volume (DaVINCI DoD Cohort – CADRE/MHSGEN Lab Source Table, Mar2020-May2021)
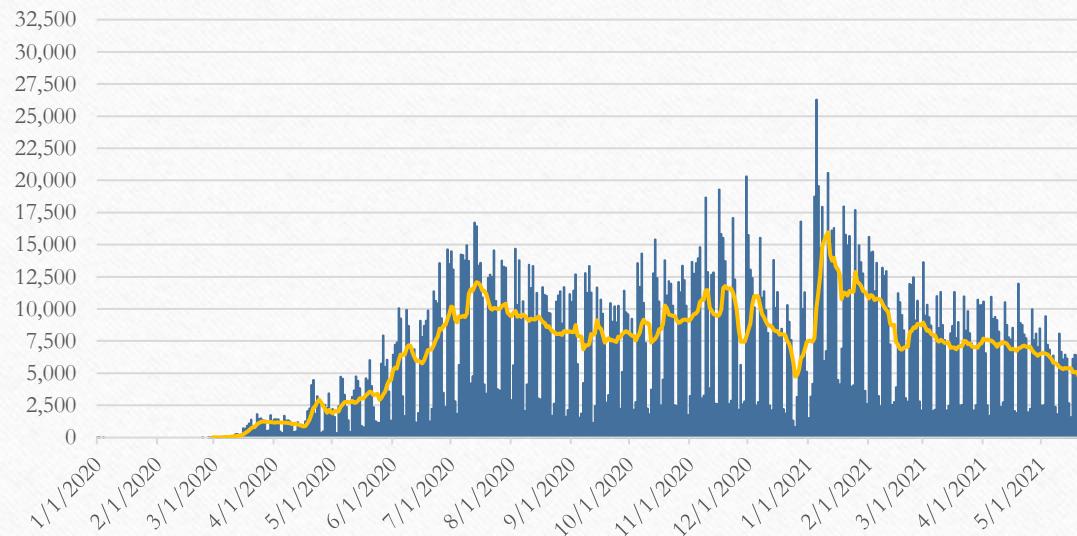
Lab Volume (DaVINCI VA Cohort - SORDCovid.CaseLabChem Source Table, Mar2020-Sep2021)

*DoD Data lag (~May 2021)
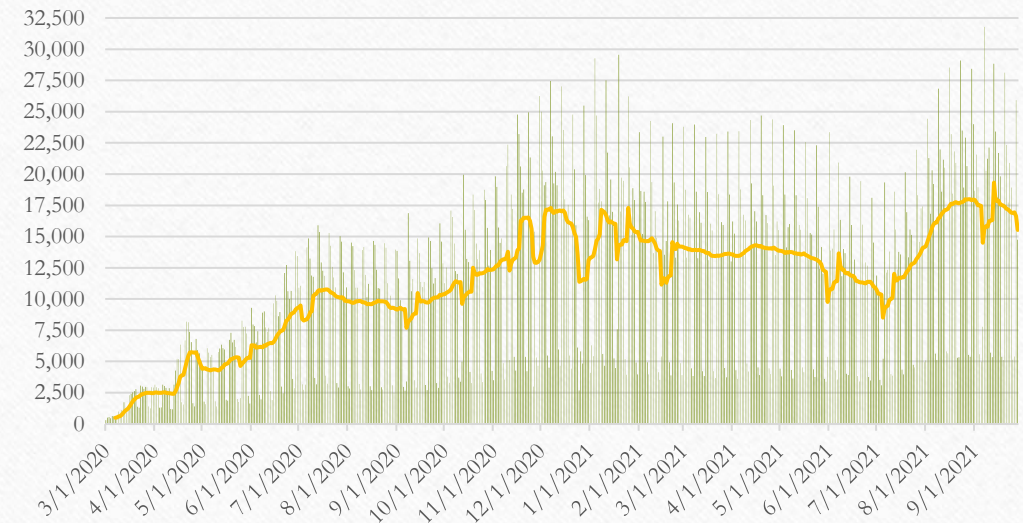
COVID-19 Infection Rate

- Two options for measuring the true infection rate:
  - Test everybody all the time (not feasible)
  - Test a random sample consistently (challenging to build a non-biased sample)
- Instead, we are relying on two secondary metrics:
  - Case rate (number of positive tests per population): Understates the true rate because some sick people (and especially asymptomatic people) don't get tested
  - Positivity rate (number of positive tests per total tests): Overstates the true rate because sick people are more likely to get tested
  - The relationship between these two rates is highly dependent on the number of tests being performed

DoD COVID-19 Positivity Rate
(Daily positive lab rate with 7 day moving average)

Positivity Rate (DaVINCI DoD Cohort – CADRE/MHSGEN Lab Source Data, Mar2020-May2021)
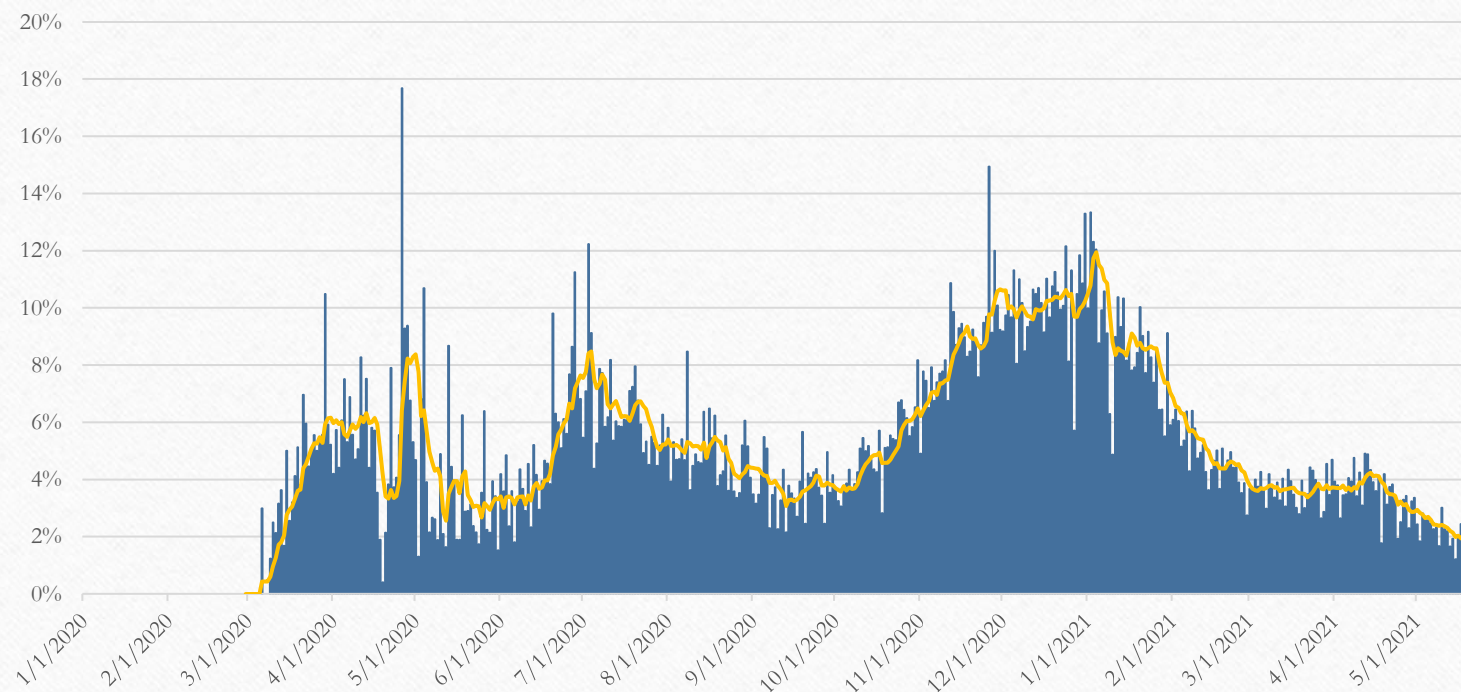
*DoD Data lag (~May 2021)

COVID-19 Diagnoses

COVID-19 Diagnosis Codes

ICD-10 Dx	Description	Notes
U07.1	COVID-19, virus identified	This is the main code to look for to identify patients diagnosed with COVID-19
J12.82	Pneumonia due to coronavirus disease 2019	
M35.81	Multisystem inflammatory syndrome	
Z11.52	Encounter for screening for COVID-19	
Z20.822	Contact with and (suspected) exposure to COVID-19	
Z86.16	Personal history of COVID-19	
U09.9	Post COVID-19 condition, unspecified	

- Note that diagnosis codes are the only way to identify patients with COVID-19 in private sector data (no lab results available)

COVID-19 Related Diagnosis Codes

ICD-10 Dx	Description	Notes
B97.29	Other coronavirus as the cause of diseases classified elsewhere	These codes are not necessarily specific to COVID-19 or SARS-CoV-2
J12.89	Other viral pneumonia	
Z03.818	Encounter for observation for suspected exposure to other biological agents ruled out	
Z20.828	Contact with and (suspected) exposure to other viral communicable diseases	
Z86.19	Personal history of other infectious and parasitic diseases	
R05	Cough	
R06.02	Shortness of breath	
R50.9	Fever, unspecified	
R43.8	Other disturbances of smell and taste	
B94.8	Sequelae of other specified infectious and parasitic diseases	
U07.2	COVID-19 virus not identified	This code was added to ICD-10, but not ICD-10-CM, so it is not used in the US

These codes were mainly used before the COVID-19 diagnosis codes were released, but they can also show up along with a COVID-19 diagnosis.

COVID-19 Case Data in OMOP

- COVID-19 diagnosis codes were mapped to a Standardized Concept in OMOP by OHDSI and applied to DoD and VA OMOP.

- COVID-19 case data can be captured from the DaVINCI Condition Occurrence OMOP table using ICD-10-CM codes

  - Note: For data in this presentation, we used the 7 major COVID-19 diagnosis codes mentioned previously (e.g., U07.1)

COVID-19 Diagnoses
(Daily diagnosis volume with 7 day moving average)

DaVINCI Cohort in DoD and VA OMOP
Source: Condition Occurrence Table
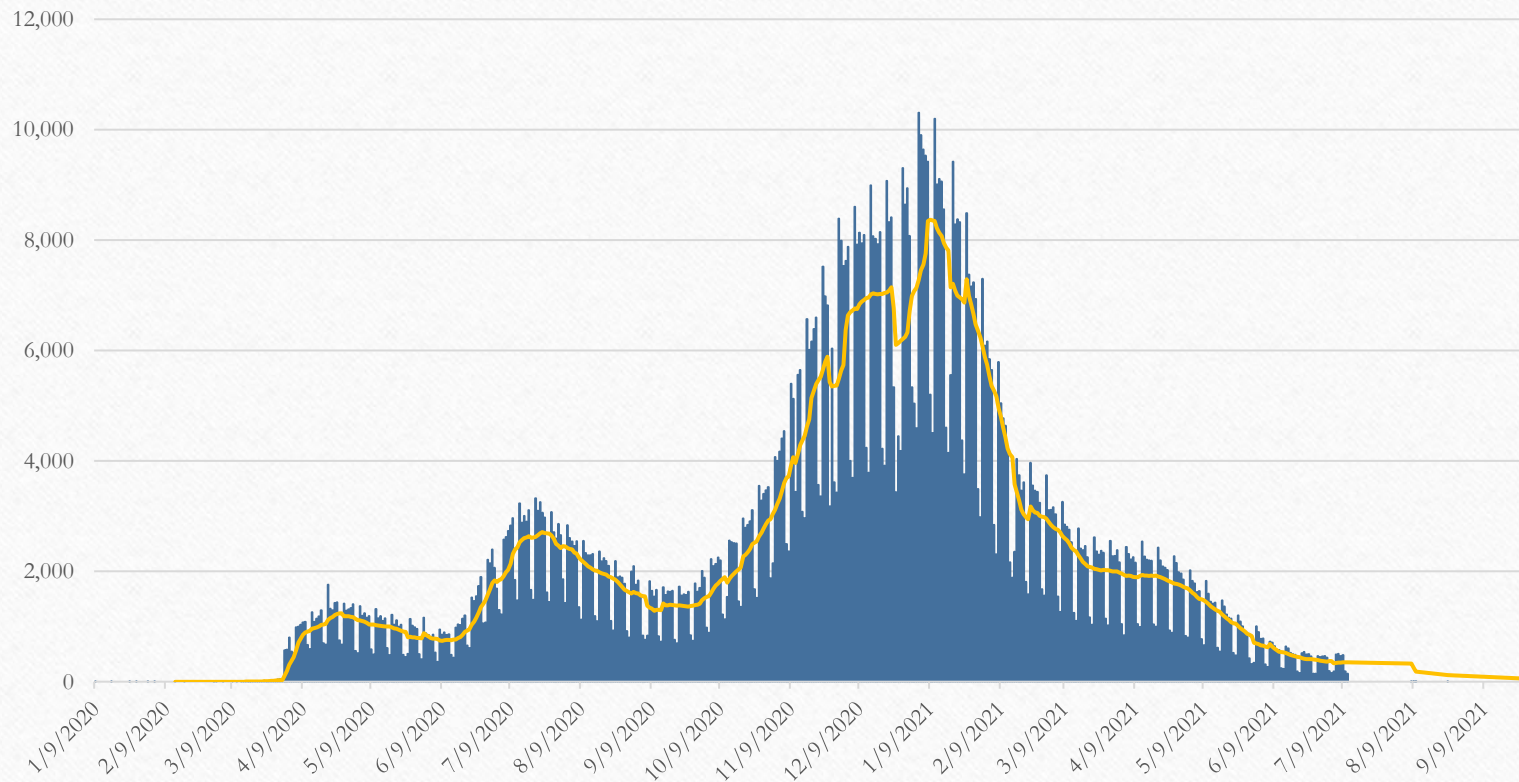
*DoD Data lag (~May 2021) & VA Data lag (~Jul 2021)

COVID-19 Diagnoses by Cohort

Population with Known Diagnosis (DaVINCI Cohort - DoD OMOP)
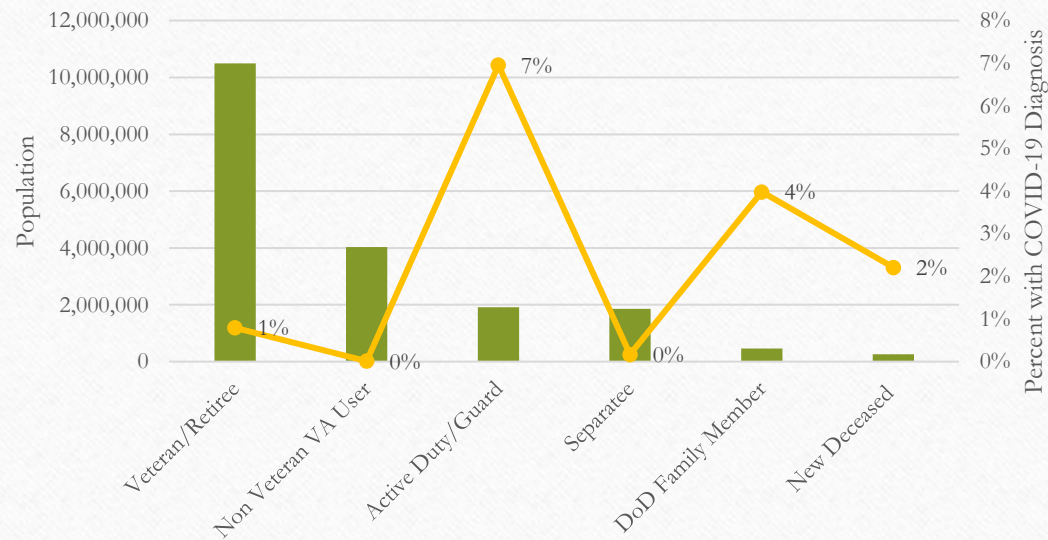
Population with Known Diagnosis (DaVINCI Cohort – VA OMOP)
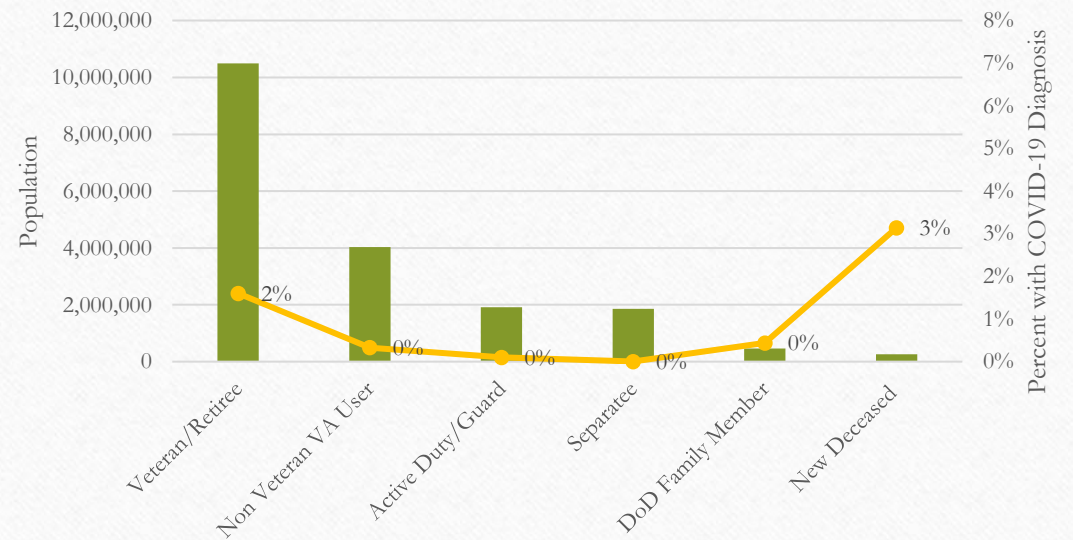
COVID-19 Diagnoses by Cohort

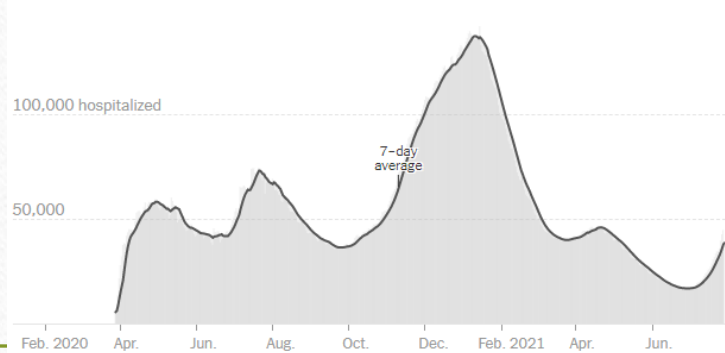Population with Known Diagnosis
(DaVINCI Cohort - DoD and VA OMOP Combined)
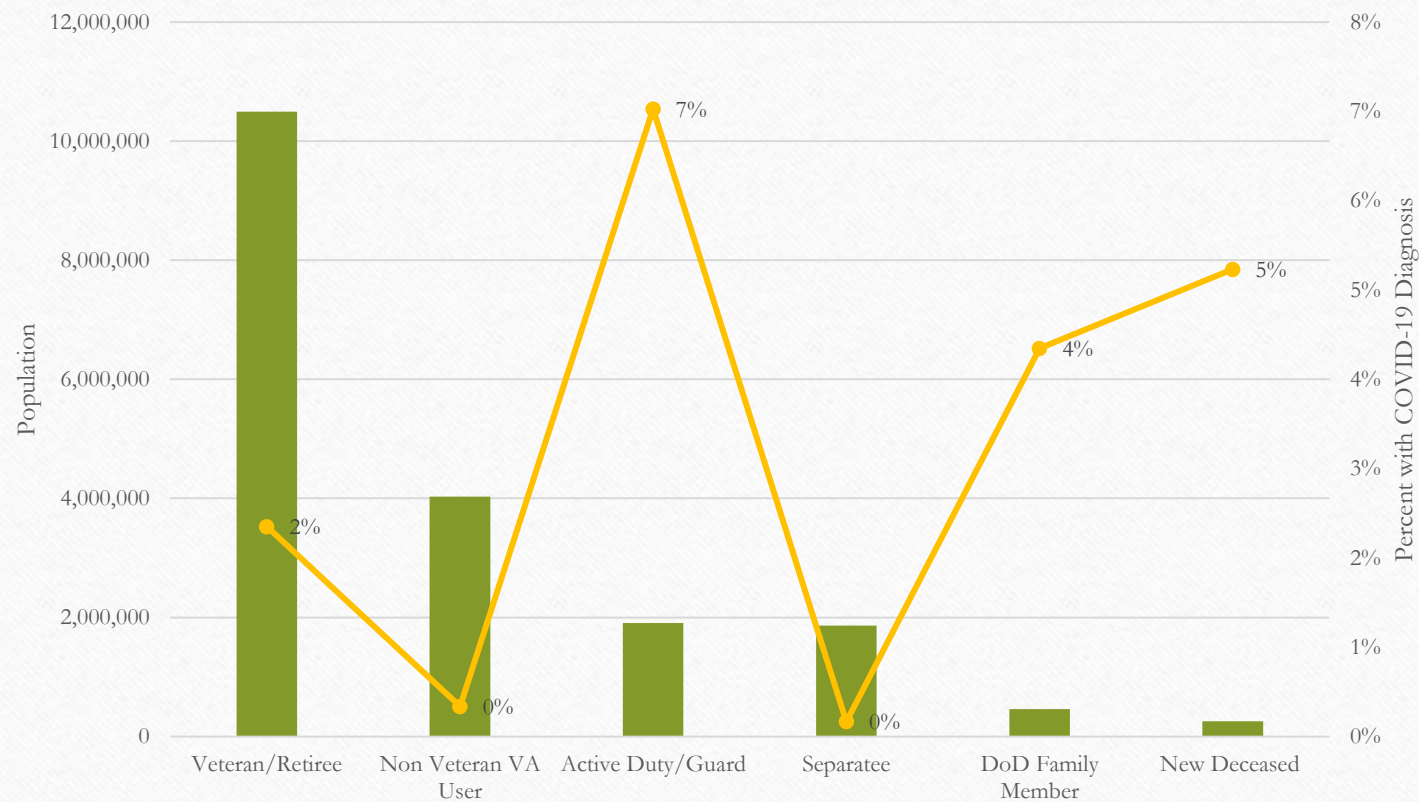
*New deceased cohort saw a gain through combination of DoD and VA OMOP

Tracking COVID-19

New reported cases by day (case rate)
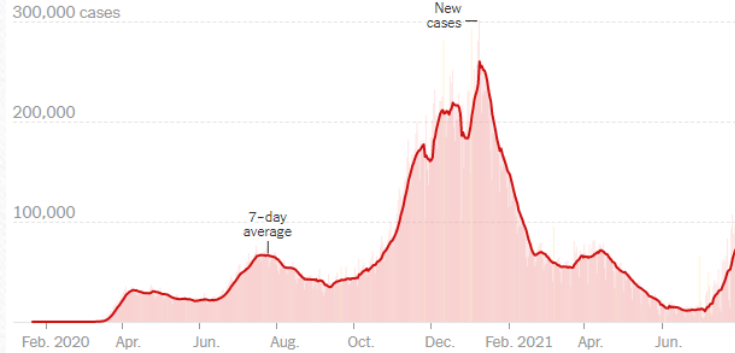
Hospitalizations

Positivity Rate
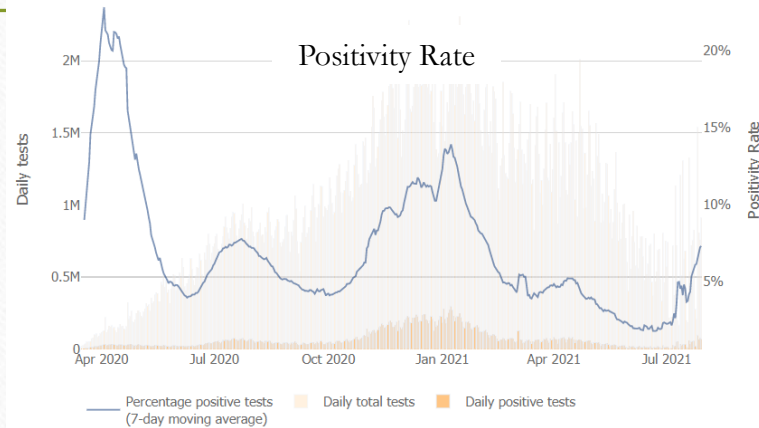
New reported deaths by day

- Which rate is the best predictor of the pandemic?

- Which rates are not shown?

  - Lab testing rate, hospitalizations per case, deaths per hospitalization, etc.

Positivity Rate from Johns Hopkins, others from New York Times

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COVID-19 Vaccines

COVID-19 Vaccine Codes

Manufacturer	CVX Code	Description	Vaccine CPT Code	Description	Administration CPT Code, 1st Dose	Description	Administration CPT Code, 2nd Dose	Description	NDC
Pfizer and BioNTech	208	COVID-19, mRNA, LNP-S, PF, 30 mcg/0.3 mL dose	91300	SARSCOV2 VAC 30MCG/0.3ML IM	0001A	ADM SARSCOV2 30MCG/0.3ML 1ST	0002A	ADM SARSCOV2 30MCG/0.3ML 2ND	59267100001
Moderna	207	COVID-19, mRNA, LNP-S, PF, 100 mcg/ 0.5 mL dose	91301	SARSCOV2 VAC 100MCG/0.5ML IM	0011A	ADM SARSCOV2 100MCG/0.5ML1ST	0012A	ADM SARSCOV2 100MCG/0.5ML.2ND	80777027310
AstraZeneca and Oxford	210	COVID-19 vaccine, vector-nr, rS-ChAdOx1, PF, 0.5 mL	91302	SARSCOV2 VAC 5X10^10VP/.5MLIM	0021A	ADM SARSCOV2 5X10^10VP/.5ML 1	0022A	ADM SARSCOV2 5X10^10VP/.5ML 2	00310122210
Janssen (Johnson & Johnson)	212	COVID-19 vaccine, vector-nr, rS-Ad26, PF, 0.5 mL	91303	SARSCOV2 VAC AD26 .5ML IM	0031A	ADM SARSCOV2 VAC AD26 .5ML	(single dose vaccine)		59676058005
Novavax	211	COVID-19 vaccine, Subunit, rS-nanoparticle+Matrix-M1 Adjuvant, PF, 0.5 mL	91304	SARSCOV2 VAC 5MCG/0.5ML IM	0041A	ADM SARSCOV2 5MCG/0.5ML 1ST	0042A	ADM SARSCOV2 5MCG/0.5ML 2ND	80631100001

https://www.cms.gov/medicare/medicare-part-b-drug-average-sales-price/covid-19-vaccines-and-monoclonal-antibodies
https://www.cdc.gov/vaccines/programs/iis/COVID-19-related-codes.html
https://www.ama-assn.org/system/files/2021-01/covid-19-immunizations-appendix-q-table.pdf

COVID-19 Vaccine Data

- In DoD and VA OMOP, Vaccines given should be captured by National Drug Codes (NDC), Vaccine Codes (CVX), or Procedure Codes (CPT) in the Drug Exposure table.

  - VA OMOP data is supplemented by the SORDCOVID.VACCINE (VA Source table) because not all vaccinations have been mapped to Standardized Concepts in VA OMOP

DoD Example: COVID-19 Vaccine CPTs

```
COVID-19 Vaccines in CAPER

Obs      DMISID      EDIPN      ENCDATE      CPT_4      CPT_5      CPT_6

 1        0061         A        20210106     0011A      91301
 2        0061         B        20210106     91301      0011A
 3        0061         B        20210106     91301      0011A
 4        0067         C        20210104     91300      0001A
 5        0067         D        20210111     91300      0002A
 6        0617         E        20210111     0011A      91301
 7        0617         E        20210112     0011A      91301
 8        0624         F        20210109     91301      90471      0011A
 9        0122         G        20210303     91301      0011A
10        0122         G        20210331     91301      0011A
11        0617         H        20210127     0011A      91301
12        0617         H        20210224     91301      0012A
13        0058         H        20210419     0012A      91301
```

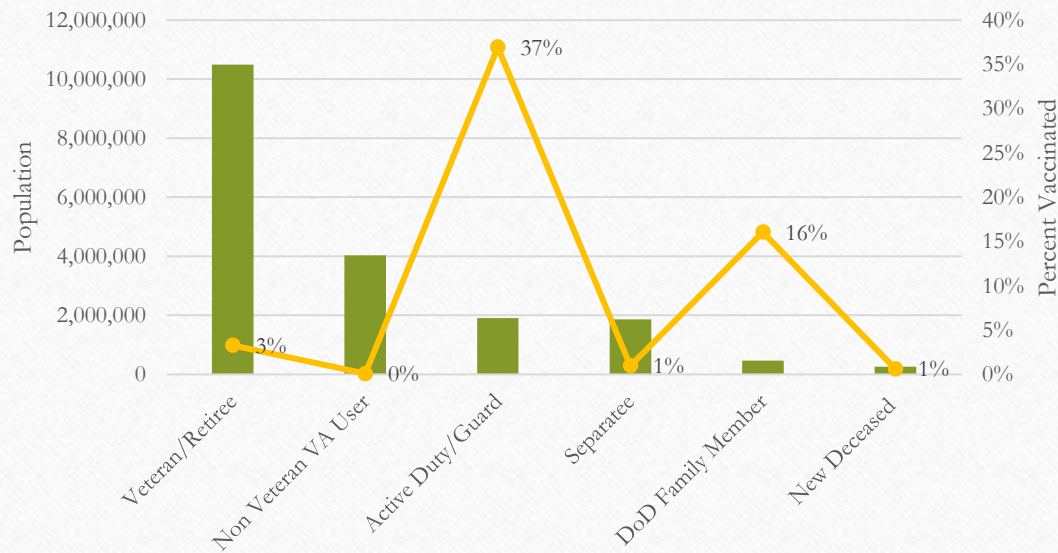| Notes |
| --- |
| Ft. Knox using Moderna |
| WR using Pfizer |
| No record for first dose for this person |
| Seems to be duplicate data, not two separate doses |
| 90471 is a generic immunization code |
| Person with two doses of Moderna, 28 days apart |
| Person with apparently three doses of the vaccine… |

Vaccine Exposure by Cohort

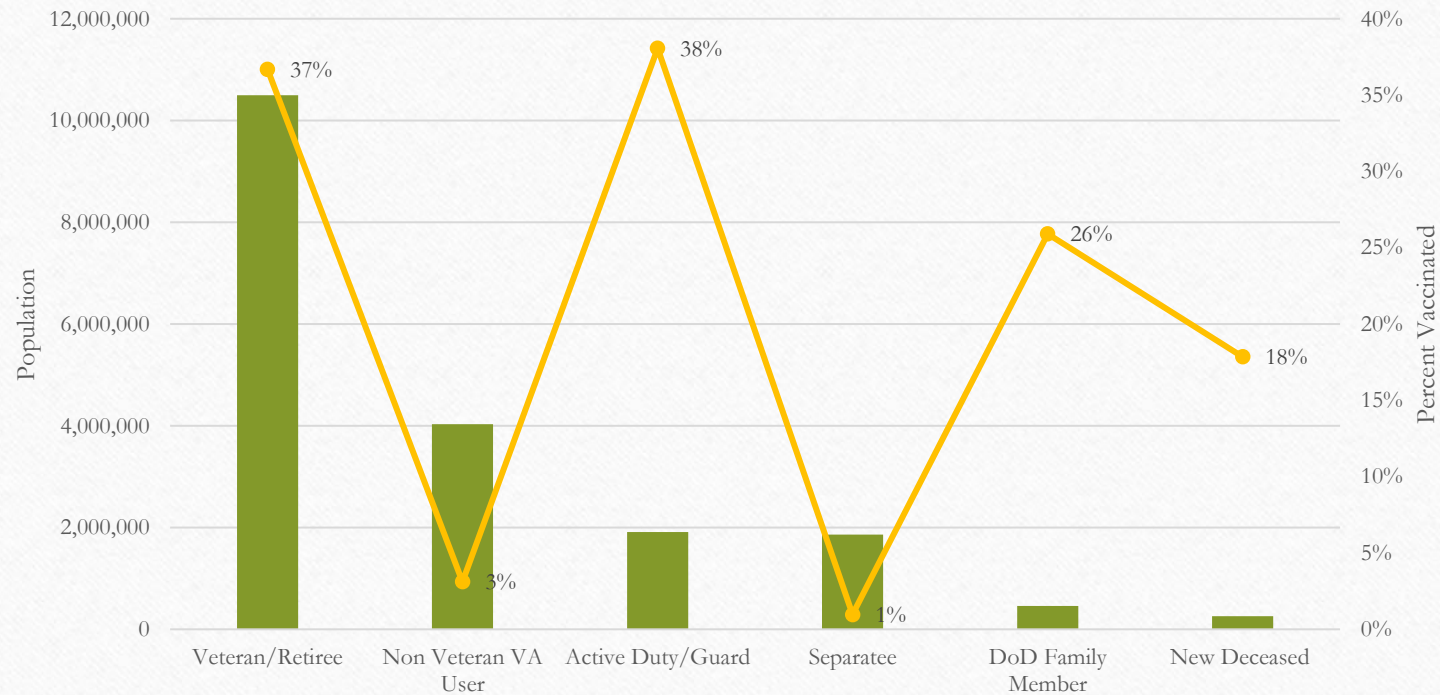Population with Known Vaccine Exposure (DaVINCI Cohort - DoD OMOP)

Population with Known Vaccine Exposure (DaVINCI Cohort - VA OMOP)
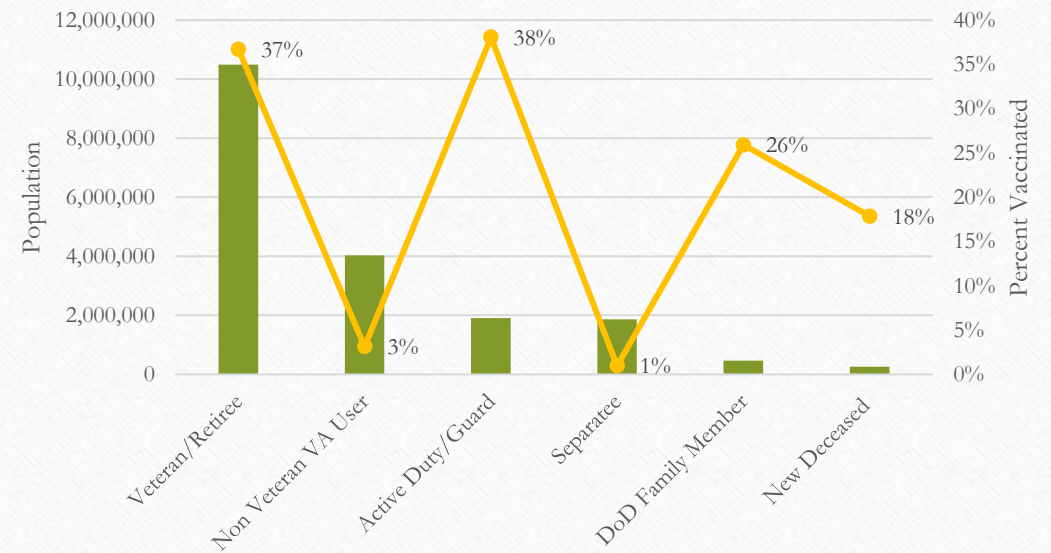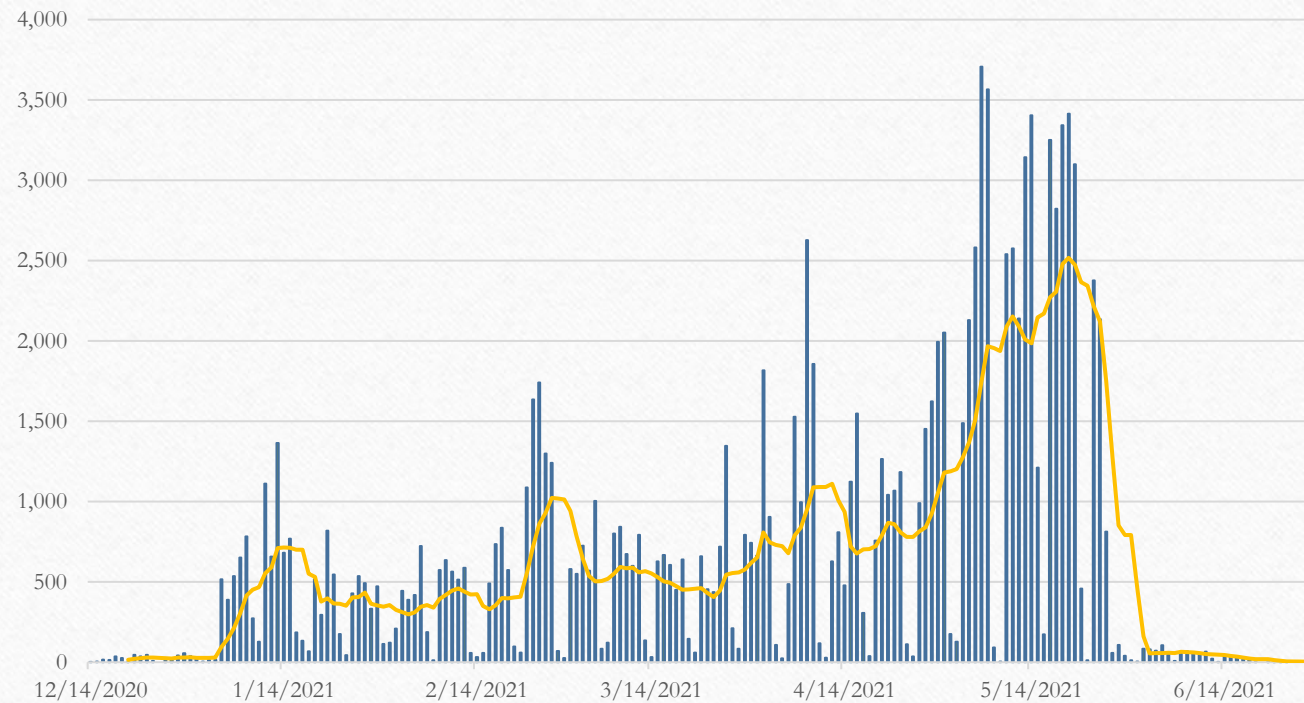
Vaccine Exposure by Cohort

Population with Known Vaccine Exposure (DaVINCI Cohort – DOD and VA OMOP Combined)

Two Shot Vaccine Non Follow-up
By Initial Dose Date
(Daily vaccine volume with 7 day moving average)

DaVINCI Cohort in DoD and VA OMOP

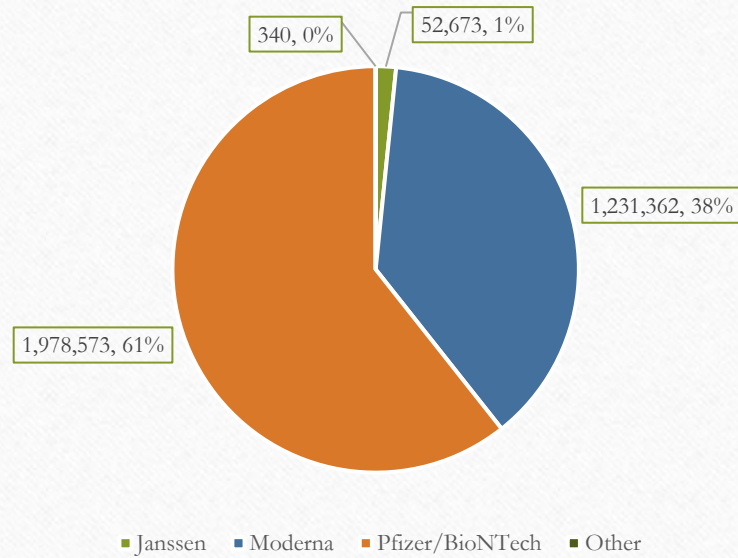
*DoD Data lag (~May 2021) & VA Data lag (~Jul 2021)

COVID-19 Vaccine Schedule

- Most COVID vaccines require two doses

- Perhaps require vaccines to be at least two weeks apart to avoid double counting due to data quality issues

- As of May, of those that had Pfizer or Moderna for their first dose and had two doses, 99.7% had the same brand for the second dose
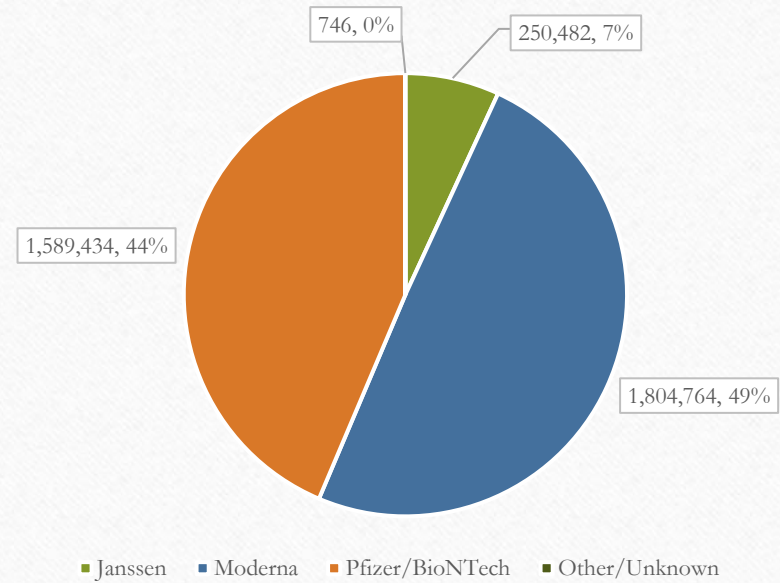
Manufacturer	Days Between Doses
Pfizer	21 days
Moderna	28 days
AstraZeneca	28 days
Janssen	single dose
Novavax	21 days

COVID-19 Vaccines by Manufacturer

Vaccines by Manufacturer (DaVINCI Cohort - DoD OMOP)

340, 0%
52,673, 1%
1,231,362, 38%
1,978,573, 61%

Janssen Moderna Pfizer/BioNTech Other

Vaccines by Manufacturer (DaVINCI Cohort - VA OMOP)

746, 0%
250,482, 7%
1,589,434, 44%
1,804,764, 49%

Janssen Moderna Pfizer/BioNTech Other/Unknown

Days from First Dose to Second Dose (DaVINCI Cohort in DoD and VA OMOP)

Pfizer/BioNTech — Mean = 22.4

Moderna — Mean = 29.1
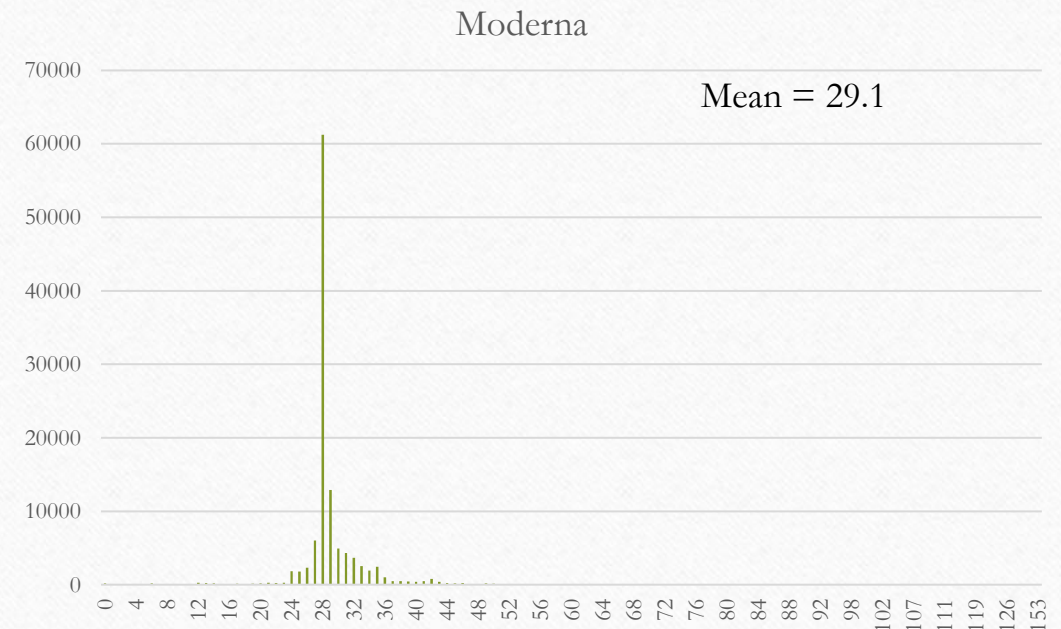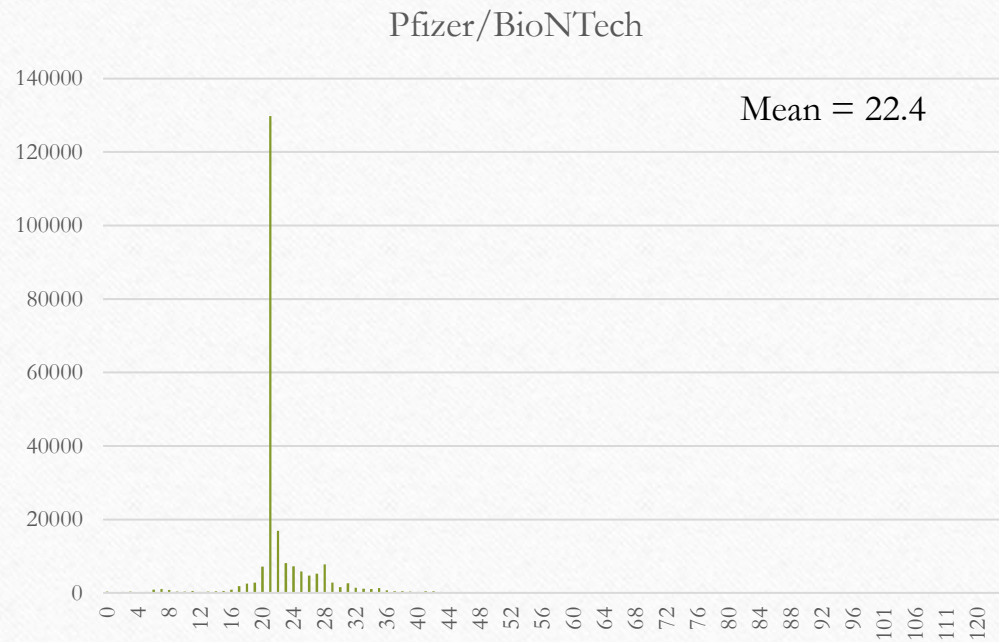
Miscellaneous COVID-19 Codes

Monoclonal Antibodies in DoD

- Monoclonal antibodies are a treatment that could prevent more severe cases of COVID-19 if given early in an infection

- The antibodies are made in the lab and injected into the patient and do the same work that natural antibodies would do, fighting off the virus

- These are expensive, so they are usually reserved for patients who are at risk for a severe case

- In the DoD, this treatment was provided less than 2,100 times between November 2020 and May 2021

HCPCS Code	HCPCS Description
M0239	BAMLANIVIMAB-XXXX INFUSION
Q0239	INJECTION,BAMLANIVIMAB,700 MG
M0243	IV infusion, casirivimab and imdevimab inc infusion and post administration monitoring
Q0243	Injection, casirivimab and imdevimab, 2400 mg

COVID-19 ICD-10-PCS Codes

Code	Description	Code	Description
XW013F5	Introduction of Other New Technology Therapeutic Substance into Subcutaneous Tissue, Percutaneous Approach, New Technology Group 5	XW013S6	Introduction of Covid-19 vaccine dose 1 into subcutaneous tissue, percutaneous approach, new technology group 6
XW033E5	Introduction of Remdesivir Anti-infective into Peripheral Vein, Percutaneous Approach, New Technology Group 5	XW013T6	Introduction of Covid-19 vaccine dose 2 into subcutaneous tissue, percutaneous approach, new technology group 6
XW033F5	Introduction of Other New Technology Therapeutic Substance into Peripheral Vein, Percutaneous Approach, New Technology Group 5	XW013U6	Introduction of Covid-19 vaccine into subcutaneous tissue, percutaneous approach, new technology group 6
XW033G5	Introduction of Sarilumab into Peripheral Vein, Percutaneous Approach, New Technology Group 5	XW023S6	Introduction of Covid-19 vaccine dose 1 into muscle, percutaneous approach, new technology group 6
XW033H5	Introduction of Tocilizumab into Peripheral Vein, Percutaneous Approach, New Technology Group 5	XW023T6	Introduction of Covid-19 vaccine dose 2 into muscle, percutaneous approach, new technology group 6
XW043E5	Introduction of Remdesivir Anti-infective into Central Vein, Percutaneous Approach, New Technology Group 5	XW023U6	Introduction of Covid-19 vaccine into muscle, percutaneous approach, new technology group 6
XW043F5	Introduction of Other New Technology Therapeutic Substance into Central Vein, Percutaneous Approach, New Technology Group 5	XW013H6	Introduction of other new technology monoclonal antibody into subcutaneous tissue, percutaneous approach, new technology group 6
XW043G5	Introduction of Sarilumab into Central Vein, Percutaneous Approach, New Technology Group 5	XW013K6	Introduction of Leronlimab monoclonal antibody into subcutaneous tissue, percutaneous approach, new technology group 6
XW043H5	Introduction of Tocilizumab into Central Vein, Percutaneous Approach, New Technology Group 5	XW033E6	Introduction of Etesevimab monoclonal antibody into peripheral vein, percutaneous approach, new technology group 6
XW0DXF5	Introduction of Other New Technology Therapeutic Substance into Mouth and Pharynx, External Approach, New Technology Group 5	XW033F6	Introduction of Bamlanivimab monoclonal antibody into peripheral vein, percutaneous approach, new technology group 6
XW13325	Transfusion of Convalescent Plasma (Nonautologous) into Peripheral Vein, Percutaneous Approach, New Technology Group 5	XW033G6	Introduction of Regn-Cov2 monoclonal antibody into peripheral vein, percutaneous approach, new technology group 6
XW13325	Transfusion of Convalescent Plasma (Nonautologous) into Peripheral Vein, Percutaneous Approach, New Technology Group 5	XW033H6	Introduction of other new technology monoclonal antibody into peripheral vein, percutaneous approach, new technology group 6
XW14325	Transfusion of Convalescent Plasma (Nonautologous) into Central Vein, Percutaneous Approach, New Technology Group 5	XW033L6	Introduction of CD24FC immunomodulator into peripheral vein, percutaneous approach, new technology group 6
XW0DXM6	Introduction of Baricitinib into mouth and pharynx, external approach, new technology group 6	XW043E6	Introduction of Etesevimab monoclonal antibody into central vein, percutaneous approach, new technology group 6
XW0G7M6	Introduction of Baricitinib into upper GI, via natural or artificial opening, new technology group 6	XW043F6	Introduction of Bamlanivimab monoclonal antibody into central vein, percutaneous approach, new technology group 6
XW0H7M6	Introduction of Baricitinib into lower GI, via natural or artificial opening, new technology group 6	XW043G6	Introduction of Regn-Cov2 monoclonal antibody into central vein, percutaneous approach, new technology group 6
XW043L6	Introduction of CD24FC immunomodulator into central vein, percutaneous approach, new technology group 6	XW043H6	Introduction of other new technology monoclonal antibody into central vein, percutaneous approach, new technology group 6

Questions?