IQVIA INSTITUTE FOR HUMAN DATA SCIENCE

Shifts in Healthcare Demand, Delivery and Care During the COVID-19 Era

TRACKING THE IMPACT IN THE UNITED STATES

APRIL
2020

Introduction

The COVID-19 pandemic is having deep and lasting impact on the U.S. healthcare system, causing shifts in the demand for drugs in hospitals and the community, in the delivery of care beyond COVID-19, in medical and drug coverage, and in the acceleration of efforts to develop new therapies and vaccines.

The IQVIA Institute for Human Data Science is publishing the first of what is expected to be a series of reports to highlight key shifts in the changing healthcare landscape in the COVID-19 era with emphasis on the immediate impact as well as the longer-term transformation of the healthcare eco-system that is being fueled by the global pandemic.

In this report we include some of the data science we are applying to simulate the evolution of active cases across the nation and individual states. We also frame the impact that changes in human behavior — based on movement restrictions and social distancing mandates — are having on decisions to make in-person medical interactions, and the downstream consequences on diagnostic testing, and therapy initiation. In particular, we note the reductions in cancer screenings and potential impact on patient care. Finally, the best human scientific knowledge across the globe is being applied to the discovery and development of new therapeutics and vaccines — as well as testing existing therapies for efficacy against COVID-19.

Collectively, this intersection of human data, data science and human science, will enable this pandemic to be understood, managed and eventually defeated. Moreover, it will help us gain a deeper understanding of fundamental factors and challenges relating to future strategies for pandemic preparedness, healthcare demand, care delivery and drug coverage and access.

The study was produced independently by the IQVIA Institute for Human Data Science as a public service, without industry or government funding. The contributions to this report of the IQVIA Data Science and Advanced Analytics team, led by Yilian Yuan; the U.S. Thought Leadership team led by Jay Margolis; the European Thought Leadership team led by Sarah Rickwood; and Adam Sohn, Jessica Meservey, Alana Simorellis, Allen Campbell and Paul Cariola are gratefully acknowledged.

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Executive Director
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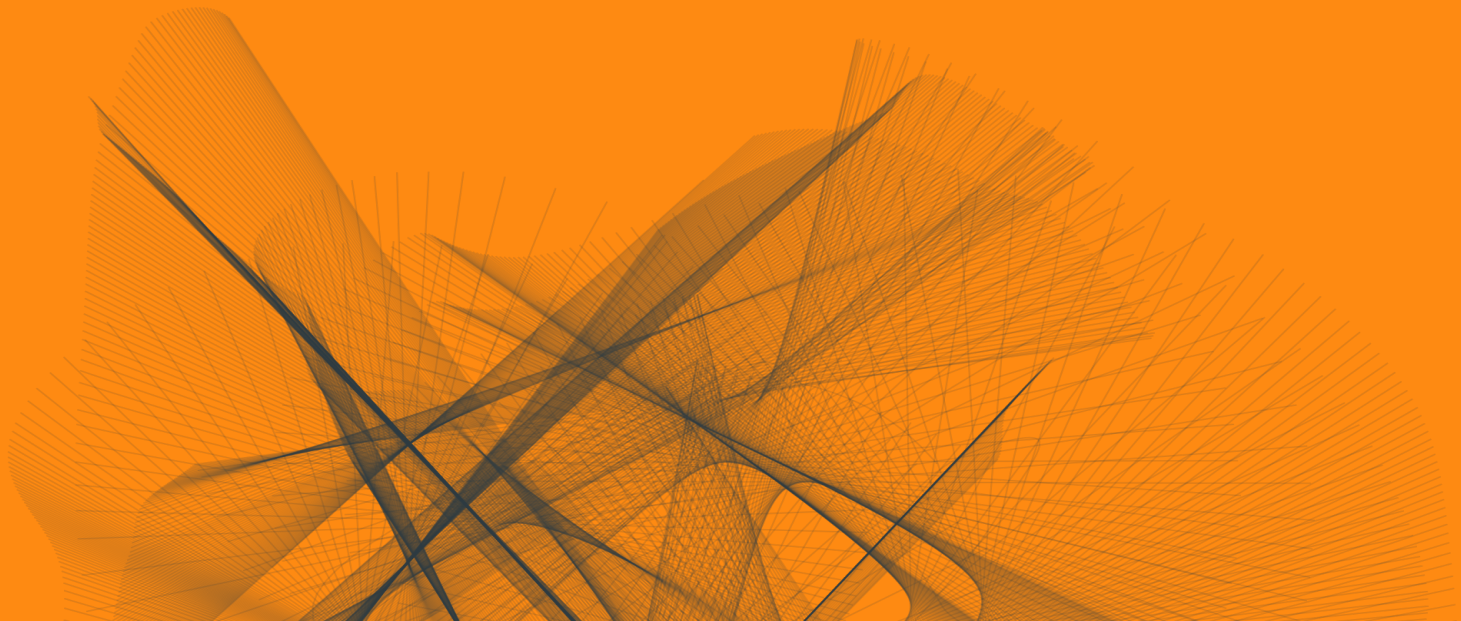
Table of contents



Overview

The entire U.S. healthcare system is being buffeted directly and indirectly by the COVID-19 pandemic. All stakeholders are experiencing the effects, from patients to clinicians delivering care, from healthcare providers to scientists pursuing therapeutics and vaccines. The magnitude of this impact is shifting weekly and even daily, across multiple dimensions, as summarized in this collection of charts and analyses.

Tracking the COVID-19 pandemic

+ While the U.S. is moving toward a modeled peak number of active cases in early May, state-level profiles differ widely in the number, timing and rate of active cases, including peak levels in New York exceeding 1,200 active cases per 100,000 population while California and Florida are modeled to peak at less than 10% of that level.

+ State testing levels vary widely in terms of the number of tests relative to population and the number of positive tests relative to total testing conducted. Despite high rates of increase across the country, as of April 28, only one states has tested more than 5% of its population. Additionally, the positive test ratios average 12.7%, with many states still above the benchmark of 10% used by public health officials to denote adequate breadth of testing.

+ Patients with certain comorbidities — hypertension, heart disease, lung disease, diabetes, compromised immune function and renal insufficiency — are at higher COVID-19 mortality risk. While no causality of comorbidities to COVID-19 mortality has been established, use of the medicine classes associated with treatment of those conditions can be a proxy for higher risk from COVID-19. States including California, Pennsylvania, Illinois, Florida and twelve others have populations with higher utilization of medicines associated with these comorbidities — suggesting more of their population suffer from these conditions — may be at risk of higher mortality rates in coming weeks as the virus spreads.

+ As states begin to assess their readiness to apply the Federal government's Guidelines for Opening Up America Again, no state has achieved the threshold of 14 consecutive days for any of the criteria areas, as testing levels remain below guidelines for most states. The level of day to day progress suggests these levels will be achieved in many states within 2 to 5 weeks.

Patient use of health services

+ The adoption of restricted movement orders across most states and changes by physician practices has resulted in a 70–80% reduction in the number of patient visits to doctor offices, including a 76% decline in patients presenting with asymptomatic conditions.

+ Telemedicine consultations have partially offset the decline in in-person visits, and now account for about 25% of patient consultations — as captured by insurance claims — with the highest shares in the specialties of psychiatry and allergy/immunology.

+ The overall reduction of about 70% in healthcare professional interactions is triggering a fall in the volume of lab tests, which are important indicators of disease diagnosis and initiation of treatment for patients with confirmed disorders based on test results. Lab tests initiated by Emergency Room Visits and in Inpatient settings have declined more than 90% from the beginning of February to the end of March, and tests initiated by Office Visits and Urgent Care centers have declined by 75–80% during the same period.

Overview

Impact on medicine use

+ The COVID-19 impact on medicine use differs by medicine type, with the most significant change seen in those drugs used directly to manage the symptoms of COVID-19 hospitalized patients and the therapeutics being used — prior to confirmatory trials — to treat the underlying condition.

+ Use of drugs currently being investigated in trials but not yet fully approved by FDA or so-called investigational treatments — including hydroxychloroquine, lopinavir+ritonavir (Kaletra), tocilizumab (Actemra) and sarilumab (Kevzara) — have seen an 2-fold increase in use over the past month, with 8 times higher use in hospitals.

+ Medicines used in hospitals for the treatment of the estimated 100,000+ patients being treated for COVID-19 — including respiratory treatments, sedatives and pain treatments — have increased between 100% and 700% since the beginning of January.

+ Most medicines used in the U.S. are for chronic conditions and the number of prescriptions dispensed increased during early March in anticipation of access and movement restrictions, followed by a sharp fall in the past two weeks. In total, about 38 million more refills than expected were processed so far this year for chronic conditions. However, there has been a reduction in new prescriptions since February 28 suggesting that over the past 6 weeks some 5 million fewer patients have engaged with a prescriber — either in person or via telehealth services — and as a result initiated treatment with a new drug.

+ Prescription opioids are notably tightly controlled and while chronic pain sufferers may have attempted to refill like other chronic users, they were largely prevented from doing so and in the past 3 weeks to April 10, filled 1 million fewer prescriptions than expected.

Care for cancer patients

+ Oncologists are adapting their level of patient interactions based on guidelines provided by professional societies and prioritizing their reduced capacity to see and treat patients depending on the tumor type and progression of the cancer.

+ Changes in the number of patient interactions with oncologists since February — based on medical and pharmacy claims processed through April 3 — have declined on average by 20%, but vary based across tumor types. Patients with tumors that are typically very aggressive, such as head and neck cancer, or diagnosed at advanced stages, such as pancreatic and ovarian cancer, are continuing to see oncologists in March at similar rates as in February, suggesting little or no disruption to their urgently needed care.

+ Cancer screenings — a critical part of cancer control — appear to have fallen sharply since movement restrictions and social distancing measures were implemented. The number of mammograms and colonoscopies and pap smears have declined by 87%, 90% and 83% respectively since February, while PSA testing for prostate cancer is down 60% and CT scans for lung cancer were 39% lower.

+ Reductions in screenings, if continued at these lower levels through early June, could translate to over 80,000 fewer diagnoses of cancer for patients. If not offset by incremental screenings, this would have a significant impact on the timely initiation of treatment for treatable cancers.

Overview

Patient insurance coverage and out-of-pocket costs

+ The onset of the COVID-19 pandemic in the U.S. has resulted in a sharp decline in consumer sentiment and economic conditions, reflected in a 20% fall in employment levels and 50% drop in car sales volume. The reduction in prescription medicines volume, by contrast, has fallen more modestly, by just over 10% in April over March, reflecting the resilience of demand for medicines seen in prior economic downturns and pandemics.

+ Some change in payer type and insurance coverage is becoming evident in prescription drug volumes and may be early indicators of changing employment levels. Since mid-March, the volume of cash-pay drugs — about 7% of total prescription volume in January — has fallen by 20%, and unlike insurance-covered prescriptions was not preceded by an increase, suggesting less ability among cash-pay patients to advance refills prior to movement restrictions.

+ Patient sensitivity to high out-of-pocket costs for prescription medicines — as measured by retail pharmacy abandonment rates — is largely unchanged though has declined for prescriptions carrying an out-of-pocket cost between $91–$150, perhaps reflecting less price sensitivity by those refilling prescriptions in anticipation of social distancing measures.

Research activity for therapeutics and vaccines

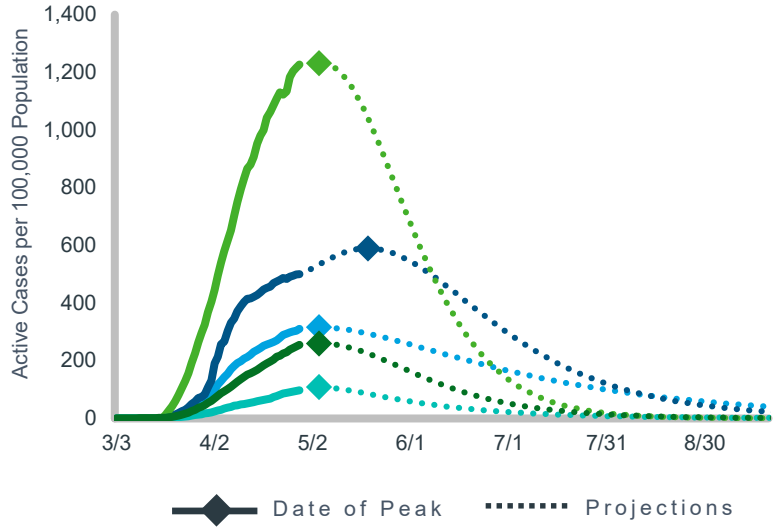
+ A surge of activity is underway in an effort to discover and develop effective therapeutics and vaccines for COVID-19. At least 182 drugs or regimens are in planned or active trials as therapeutics for patients diagnosed with COVID-19 or as vaccines, covering a diverse range of mechanisms largely focused on viral inhibition and immune modulation. An additional 50 vaccines are in discovery or preclinical stages and an additional 97 therapeutic drugs are in early discovery and preclinical testing, but not yet planned or active.

+ Over 900 trials are planned or underway for COVID-19-related medicines, under a federated model of development, with sites across the globe and sponsored by a large number of academic, governmental and private sector entities. Of these, over 400 trials are underway, with most being registered within the past 6 weeks, and the remainder anticipated to start in the next few weeks — an unprecedented level of activity focused on a single virus. About one-third of the trials planned or underway are based in China, which preceded the rest of the world in research by several weeks.

+ Clinical research underway includes a wide variety of trial designs, endpoints and timing, which in many cases will result in findings that will be challenging to reconcile or compare in order to determine optimal therapeutics and vaccines for global use. Notably, about 40% of trials planned or underway are not randomized and therefore will be difficult to interpret when results are announced. Only about 15% of the trials are conventional randomized, double-blinded, multi-arm studies with an active or placebo comparator, reflecting the pragmatic approach taken by many investigators who have emphasized the need for data to be developed even in the absence of typical trial design parameters.

While the United States is moving toward a modeled peak number of active cases in early May, state-level profiles differ widely

Exhibit 1: Projected Active Cases in the United States and Selected States



Total confirmed cases per 100k: 596 (525–748)
Peak May 4 (Apr 29–May 15)
Total cases: 2.0Mn (1.7–2.5Mn) **National**

Total confirmed cases/100k: 3,808 (3,088–4,093)
Peak: May 4 (Apr 29–May 13)
Total cases: 740k (600–796k) **NY**

Total confirmed cases/100k: 1,584 (1,452–1,716)
Peak: May 19 (May 9–May 28)
Total cases 71k (65–77k) **LA**

Total confirmed cases/100k: 551 (504–706)
Peak: May 4 (Apr 29–May 19)
Total cases: 55k (51–71k) **MI**

Total confirmed cases/100k: 180 (178–202)
Peak: May 4 (May 1–May 8)
Total cases: 72k (71–81k) **CA**

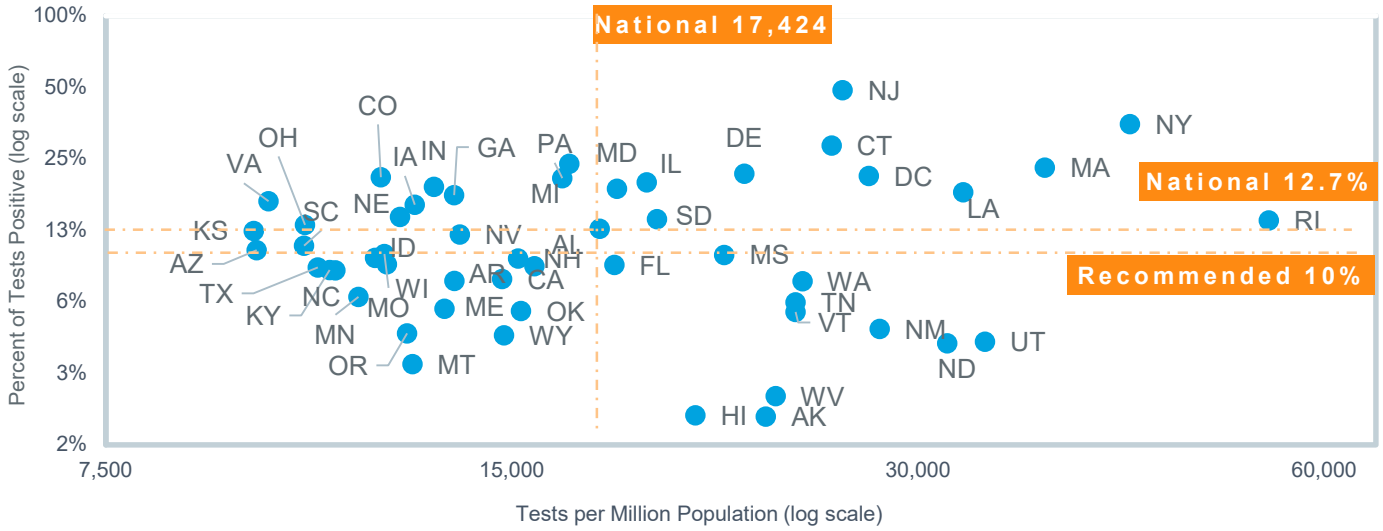
Source: IQVIA COVID-19 Active Cases Curve Simulator, Updated Apr 29, 2020

- IQVIA SEIR modeling, based on best available publicly available input data and assuming current mitigation practices are maintained, estimates the peak number of cases will be reached nationally on May 4 (Apr 29–May 15), and that total confirmed cases will reach 2.0 million (1.7–2.5 million).
- State level profiles of active cases vary widely, with peak levels modeled to exceed 1,200 per 100,000 population in New York, followed by 1,000 in New Jersey, 700 in Massachusetts and 590 in Louisiana; California and Florida, by contrast, are modeled to peak at 110 and 125 per 100,000 population respectively, less than 10% the level of New York state.
- The timing and level of peaks in active cases in each state is based on patterns of infection, time to inactivity through recovery or death, and the expected continuation of social distancing.
- Reduction in active cases is based on both a reduction in new cases through social distancing, and through higher testing rates.
- States which have been slower to adopt movement restrictions have also been slower to increase rates of testing, both of which leave them exposed to potential increases in cases later in the summer.

Exhibit notes: Modeling based on public data using IQVIA SEIR model. See Notes on Sources for more details.

Only one state has tested more than 5% of its population, and many states still have positive testing ratios above the 10% threshold

Exhibit 2: Tests per Million Population and Percentage of Tests Positive as of April 28, 2020

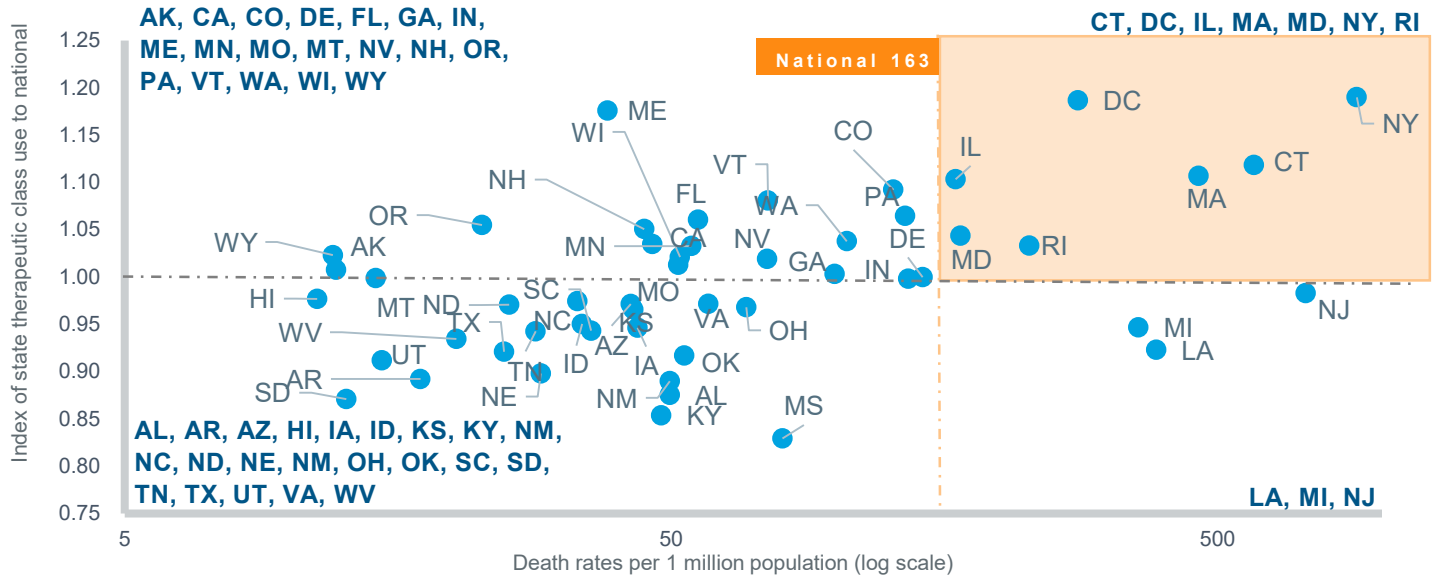


Source: COVID Tracking project accessed as of Apr 28, 2020

- The states with the highest per capita testing rates all have significantly worse (higher) positive test ratios than the 10% cited by the COVID-19 taskforce, suggesting the testing level is still not sufficient to accurately gauge infections.
- Twenty-eight states have ratios of positive tests to total tests below the 10% threshold with another 7 states within 5% of that level.
- Three states, New York, New Jersey, and Connecticut, have positive ratios above 25%, with New York doing the most tests, driven by New York City.
- Some states with lower testing rates are demonstrating the more desired low positive to total test ratio, which suggests that their outbreaks may be more contained to date.
- States with higher positive to total test rates have significant uncertainty about their overall case load and bring into doubt trends on cases.

State level medicine use suggests underlying comorbidities that may place patients at greater risk of poorer outcomes or death

Exhibit 3: States' Utilization of Therapeutic Classes Associated with COVID-related Comorbidities by Death Rates



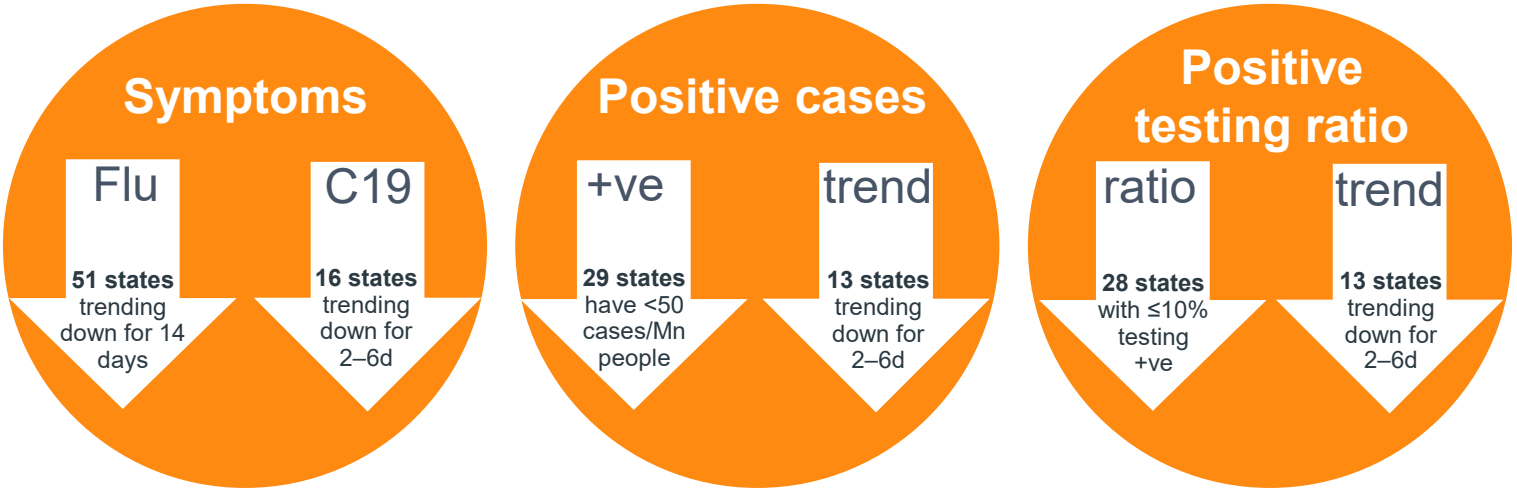
Source: IQVIA NPA, Dec 2019; Death rates accessed Apr 29, 2020 available from https://www.worldometers.info/coronavirus/country/us/

- It has been widely reported that patients with certain comorbidities, including hypertension, heart disease, lung disease, diabetes, compromised immune function, and renal insufficiency, are at higher risk for mortality from COVID-19.
- To understand if therapeutic utilization could help in the general identification of mortality risk, we indexed use of select therapeutics by state.
- While numerous factors drive infections, severity, and ultimately mortality rates, states with the highest mortality rate to date also tend to have higher utilization patterns of therapeutic classes associated with the noted comorbidities.
- States with greater use of these therapeutic classes, but which are demonstrating lower mortality rates, are also notably those which have achieved greater control of the pandemic to date, but could be at risk for higher mortality rates if cases are not as controlled in the future.
- Greater study of the medical histories and outcomes of COVID-19 patients will be urgent and necessary to provide insights to better manage patients in the event of a recurrence of infections later.

Exhibit notes: * Guan W-jie, Liang W-hua, Zhao Y, et al. Comorbidity and its impact on 1590 patients with Covid-19 in China: A Nationwide Analysis. Eur Respir J 2020; in press (https://doi.org/10.1183/13993003.00547-2020). States in each quadrant have been listed alphabetically in each corner of the chart.

No state has demonstrated two weeks of continuous decline for any of the metrics which would indicate the pandemic is contained

Exhibit 4: Summary of State Testing Metrics



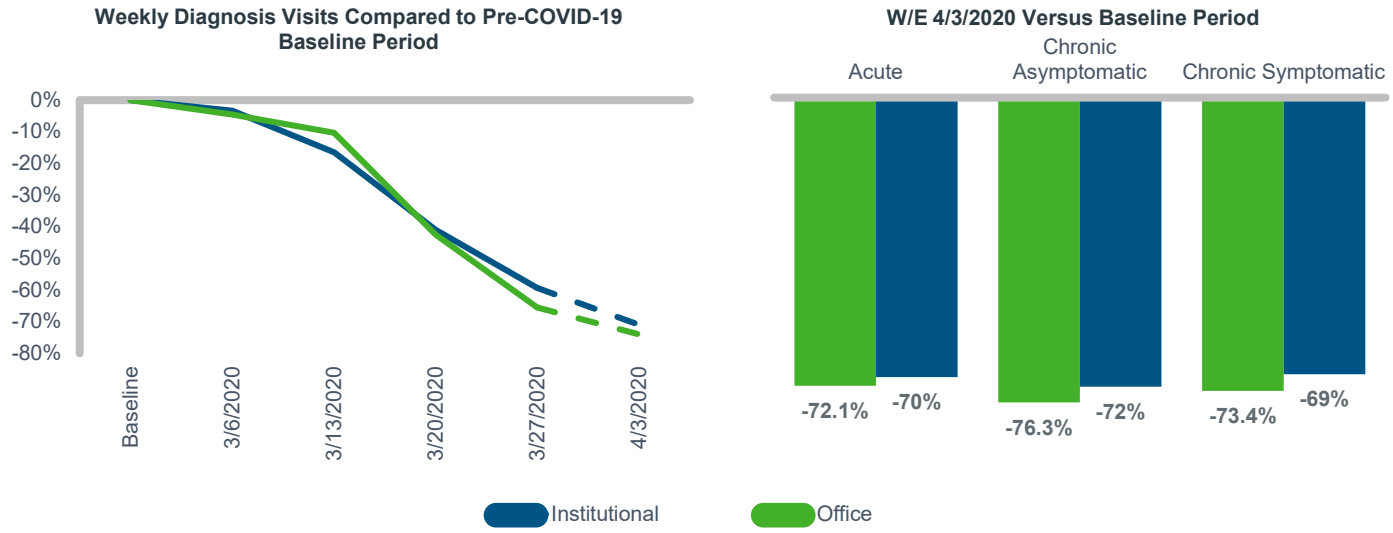
Source: COVID Tracking Project covidtracking.com accessed Apr 29, 2020; IQVIA FAN flu tracking Apr 10, 2020

- The COVID-19 task force has identified several criteria as 'gates' that need to be met prior to a phased reopening of the country.
- The gates relate to symptoms, testing, and hospitals, and this analysis assesses the first two criteria from public data or IQVIA datasets.
- The first gate, which is achieving a declining trajectory on both flu and COVID-like symptoms, reflects a level of uncertainty in testing and reporting of COVID-19 cases. All states have declining trends for flu symptoms and 16 have downward trends on overall COVID-19 reported symptoms.
- The measure of appropriate testing has been suggested as both a declining trajectory on overall positive COVID-19 tests and a declining ratio of positive to total tests.
- While no states have reported more than 14 days of declining new positive cases, 13 states have from 2 to 6 days of decline as of April 28.
- A ratio of positive tests to total tests of less than 10% has been by the COVID-19 taskforce and 28 states have levels below this threshold.
- Of states with positive testing ratios above 10%, New York has 6 consecutive days of decline and has reduced its ratio to 40%, while Indiana's 18% ratio has been declining for 3 straight days; 21 other states have unchanged or worsening ratios.
- No state has yet achieved 14 consecutive days of downward trajectory on any of the criteria, though day-to-day progress suggests these levels may be achieved in some states within 2–5 weeks.

Exhibit notes: C19 = COVID-19. +ve = positive COVID-19 cases. 2–6d = 2 to 6 consecutive days. Trending down is based on consecutive days of decline.

Patients have visited physician offices or clinics 70–80% less than pre-COVID-19 periods, with declines similar across disease types

Exhibit 5: Diagnosis Visits Change From 8 Week Pre-COVID Period By Place of Service



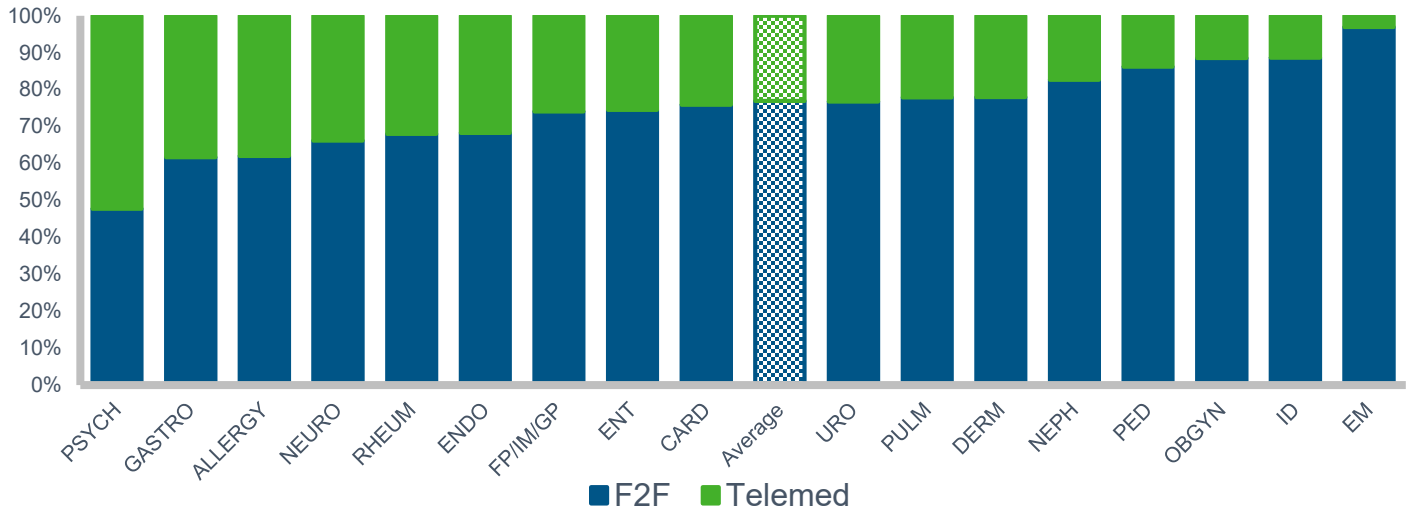
Source: IQVIA: Real World Data, Medical Claims, Apr 3 2020

- The adoption of restricted movement orders across most states and changes by physician practices has resulted in a steep reduction in patient visits to doctor offices, which are partially offset by increased used of telemedicine for patient consultations.
- In-person doctor visits by patients have declined by about 70–80% from their baseline level of about 100 million visits per month nationally.
- The level of decline is highest for patients with asymptomatic conditions, at a 76% reduction, and lowest for patients with acute or chronic symptomatic conditions, at a 72% and 73% reduction from baseline/prior year, respectively.

Exhibit notes: Data for latest week date controlled against prior periods; chart may not be reflective of all data expected to be received for current period. Market Type definitions based on IQVIA proprietary clinical definitions. Baseline period is eight weeks ending Feb 28, 2020

Telemedicine growth is strong and accounts for 23% of interactions that are still taking place during social distancing

Exhibit 6: Physician Interactions in Week Ending Apr 3, 2020



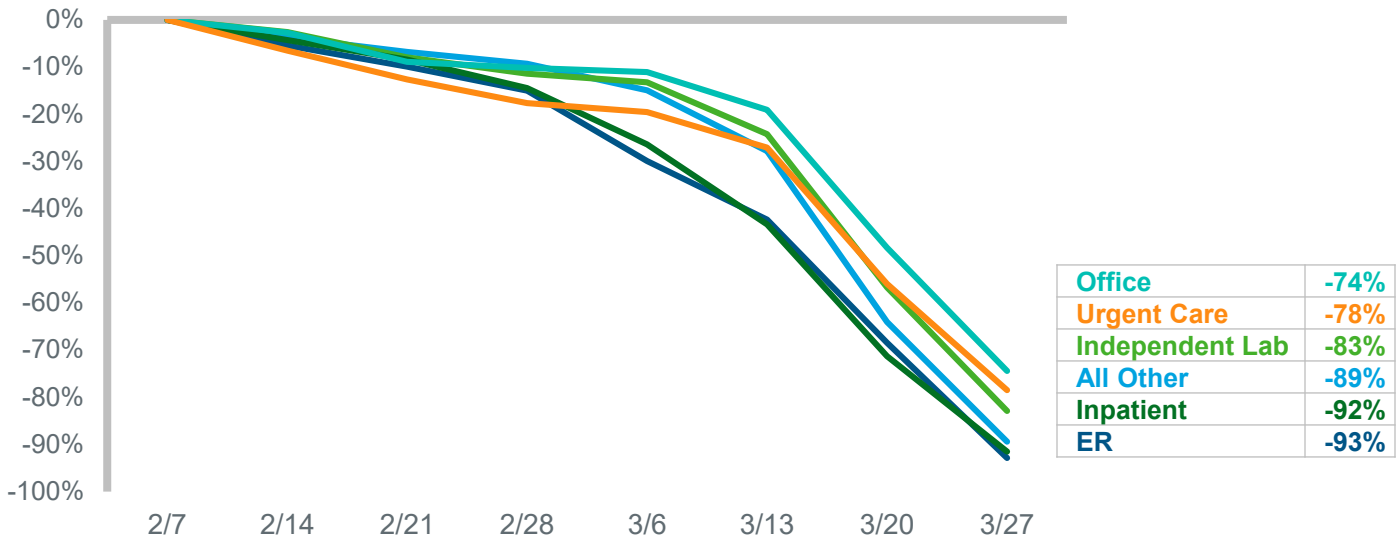
Source: IQVIA: Real World Data, Medical Claims, April 17, 2020, reporting week ending April 3, 2020.

- Physician interactions have declined from 60% to 70% as a result of social distancing policies, and the adoption of telemedicine has offset otherwise greater declines.
- Many providers have made concerted efforts to engage patients via remote means with so-called 'telemedicine' and while this has grown dramatically, it has not offset the majority of declines in face-to-face patient-doctor interactions.
- There has been regulatory easing in Medicare, with CMS loosening telemedicine reimbursement requirements, a move being followed by commercial insurers.
- Existing private telehealth providers have noted very large increases in their call volumes.
- Some specialties are much more likely to use telemedicine, including psychiatry, which had a higher degree of telehealth prior to COVID-19.
- In the baseline period, claims for telemedicine were less than 1% of claims, and while usage has climbed dramatically, use of virtual patient engagement has not offset the declines in office visits.

Exhibit notes: F2F = face to face visits; Telemed = telemedicine; Psych = psychiatry; Gastro = gastroenterology; Neuro = neurology; Rheum = rheumatology; FP/IM/GP = family practitioner/internal medicine/general practitioner; Ent = ear/nose/throat; Card = cardiology; Uro = urology; Pulm = pulmonology; Derm = dermatology; NEPH = nephrology; Ped = pediatrics; Ob/Gyn = obstetrics/gynecology; ID = infectious disease; EM = emergency medicine

Across all sites of care, lab tests have declined sharply regardless of disease state or site of care

Exhibit 7: Change in Labs Performed Versus Baseline Over Time



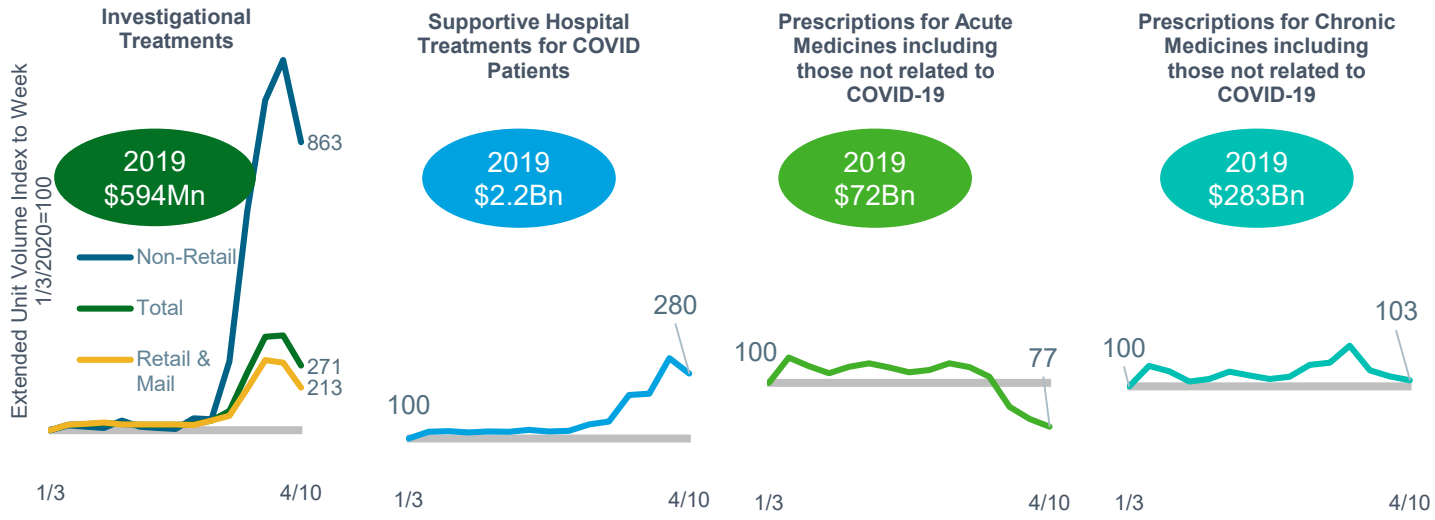
Source: IQVIA: Real World Data, Medical Claims, April 17, 2020, reporting week ending April 3, 2020.

- Across all sites of care, the number of lab tests has declined sharply since the beginning of March, reflecting fewer patient office visits and fewer diagnoses being made.
- Lab test volumes are important indicators of disease diagnosis, and initiation of treatment for patients with confirmed disorders based on test results.
- Lab tests initiated by Emergency Room (ER) visits and in inpatient settings have declined more than 90% from the beginning of February to the end of March.
- Lab tests initiated by office visits and urgent care centers have declined by 75–80% during the same period.
- Lack of diagnostic testing will likely lead to delayed treatments and potentially increased costs in the future.
- Early signs are that telehealth is generating very few lab orders, and a return to more traditional medical practice will require wider health system reopening.

Exhibit notes: Baseline period 4 weeks ending Jan 31, 2020

Use of COVID-19 related treatments has increased, while acute treatments have declined, and chronic therapies have been stockpiled

Exhibit 8: Volume for Selected Therapy Segments, Indexed to Week Ending Jan 3, 2020



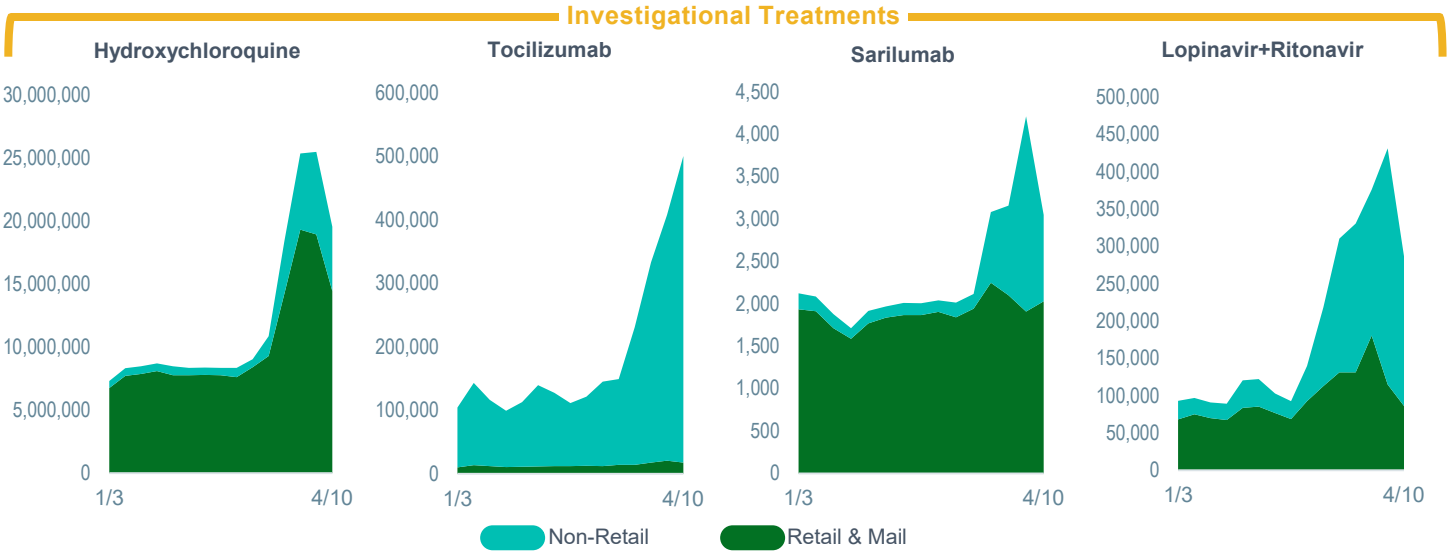
Source: IQVIA National Sales Weekly Apr 10, 2020; IQVIA National Sales Perspectives, Dec 2019

- For patients in hospital, with no proven treatments to address their conditions, a range of medicines approved for other uses have been used experimentally, while clinical trials for COVID-19 continue. These include trials testing tocilizumab, sarilumab, and lopinavir+ritonavir, as well as hydroxycholoroquine.
- For hospitalized patients, a wide range of additional treatments have seen increased use including analgesic, anesthesia, anti-pyretics.
- Rescue inhalers, notably albuterol, have been increasingly used for COVID-19 patients as their lung function worsens. Treatments such as nebulizers are undesirable in the hospital setting due to potential aerosolization of viral particles.
- Patients also receive antivirals as well as antibiotics to avoid complications from other infections.
- A selected group of the most common anesthesia and supportive medicines, noted as facing supply shortages by the American Society of Health System Pharmacists (ASHP), have seen a nearly three fold increase in their use despite the cessation of nearly all elective surgeries since mid March across the country.
- Acute therapies have seen a 23% drop-off from the level at the beginning of 2020 mostly in the weeks since social distancing came into force and likely related to fewer physician visits and ER visits.
- Chronic therapies, including both new and continuing prescriptions, saw above-normal volume in March, as some patients stocked up on refills of existing prescriptions.

Exhibit notes: Sales in 2019 are invoice-level from IQVIA National Sales perspectives and do not reflect off-invoice discounts or rebates. Volumes reflect extended unit volume sales to purchasers which could include stocking effects

Approved medicines are being used as investigational treatments for their mechanisms of action to address COVID-19 symptoms

Exhibit 9: Approved Medicines Repurposed for COVID-19, Extended Unit Volume



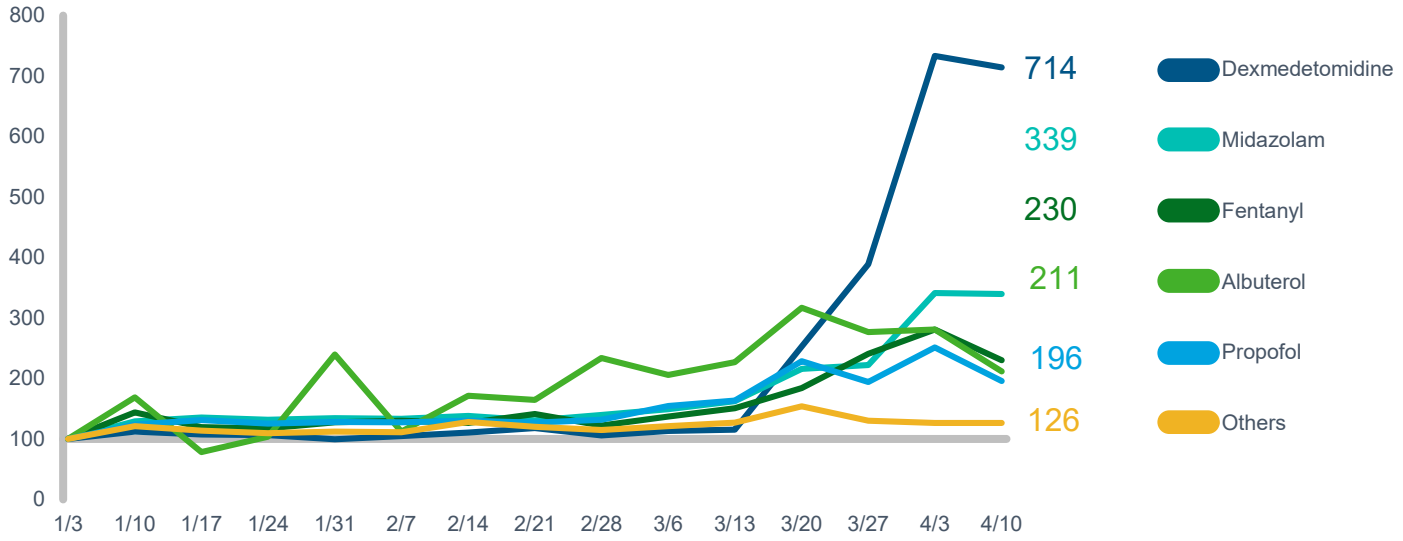
Source: IQVIA: Weekly Sales Perspective (WSP) Apr 10, 2020

- The increasing use of these repurposed medicines without full FDA approval reflects the severity of patients' prognosis.
- Hydroxychloroquine received an FDA emergency use authorization (EUA) but has yet to see confirmed clinical trial results, and has seen use in both retail and non-retail settings.
- Tocilizumab and sarilumab are being employed for their immunological properties relating to the resulting cytokine storm that drives organ failure and mortality in COVID-19 infections, and most of their incremental use is in hospital settings.
- The fixed-dose combination antiviral HIV drug lopinavir+ritonavir is being used based on early in vitro evidence that suggests antiviral activity against SARS-CoV-2, the virus that causes COVID-19. However, these viral protease inhibitors may not inhibit the main protease for SARS-CoV-2, leading some to question the mechanism of action.
- The data shown here represent hospital purchases, and week to week volatility can reflect a number of factors, including supply chain disruptions, that could in turn be caused by stockpiling by hospitals.
- The volumes shown for each product reflect widely differing dosages for each patient.

Exhibit notes: Medicines shown are not an exhaustive demonstration of experimental use of medicines. Volumes are not adjusted or estimated at a patient level.

Medicines typically used in ICUs or for sedation are being widely used for COVID-19 patients who require ventilators

Exhibit 10: Hospital Supportive Treatments Extended Unit Volume Indexed to Week Ending Jan 3 2020 = 100



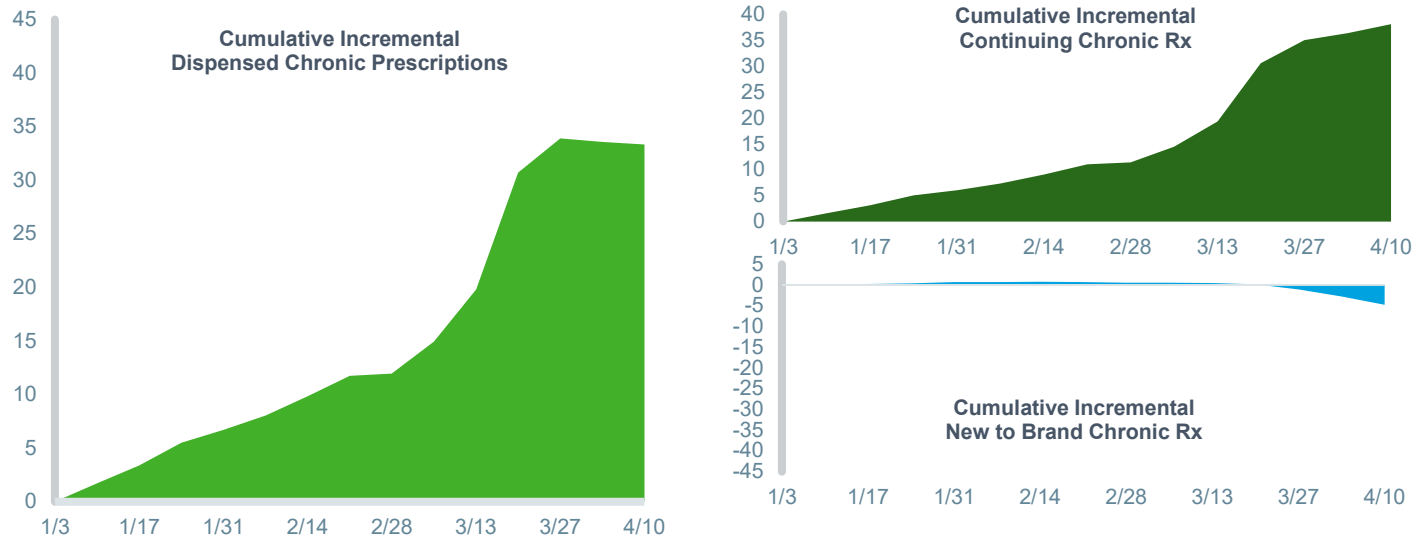
Source: IQVIA: Weekly Sales Perspective (WSP) Apr 10, 2020

- There has been a significant increase in the use of some medicines in hospitals strongly associated with managing patients in ICU as with COVID-19.
- Sedatives and anesthesia medicines have seen a significant uptick in usage even as many elective procedures have been largely stopped across the country.
- As some medicines were in short supply, hospitals sought out alternatives, with propofol up 96%, injectable fentanyl in hospitals up 130%, and dexmedetomidine (a sedative) up 614% from the baseline week January 3rd 2020.
- Albuterol rescue inhalers are seen as a more appropriate option for more mild patients needing nebulizers.
- Many of the medicines commonly needed for COVID-19 respiratory illness patients are lower volume generic medicines, and supplies in the supply chain were stretched particularly in mid to late March.
- Most of these medicines are now more robustly available with wholesalers prioritizing filling orders based on medical need.

Exhibit notes: Selected medicines based on Association of Health System Pharmacists (ASHP) note of medicines in high demand for ICU and COVID patient management accessed Apr 23, 2020 https://www.ashp.org/COVID-19/Bi-weekly-PPE-Survey-Results-Covid-19

Patients began to stockpile refill prescriptions as social distancing came into effect, while new brand prescriptions declined

Exhibit 11: Cumulative Expected Versus Actual New, Continuing and Total Chronic Prescriptions by Week, Millions



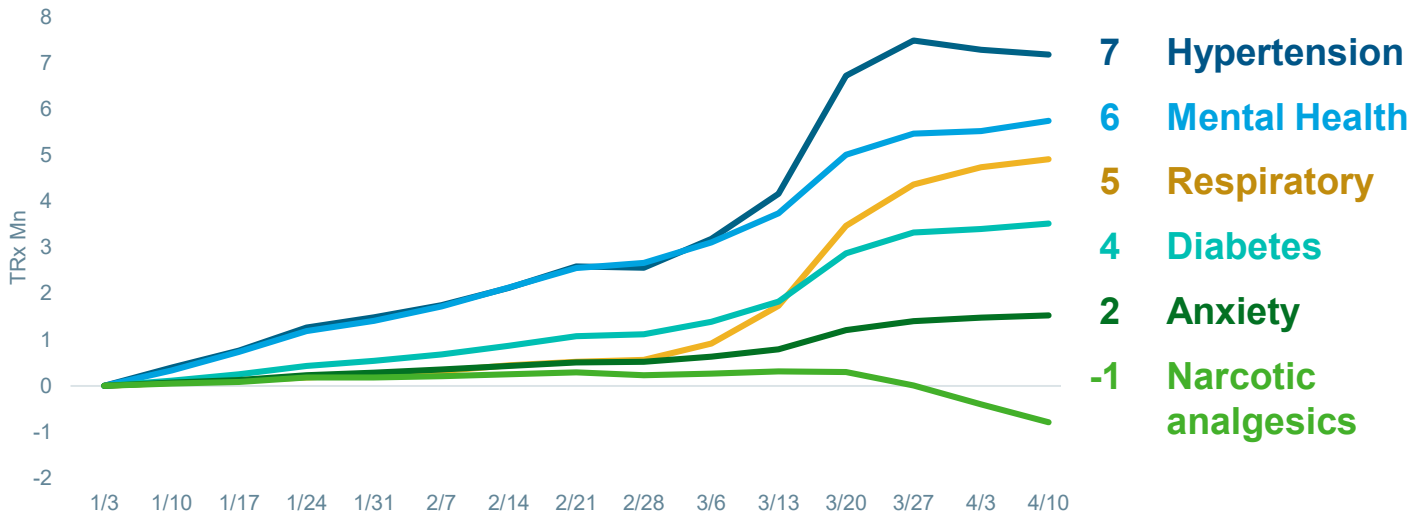
Source: IQVIA NPA New to Brand Weekly April 10, 2020

- Modeling expected new, refill, and total prescriptions per week using prior year week-to-week volume patterns shows a significant divergence during March 2020.
- The emerging awareness of COVID-19 drove some patients to refill their prescriptions sooner than they otherwise would have, and this dynamic continued for four weeks.
- Continuing prescriptions or refills increased dramatically in the weeks leading into national social distancing coming into effect and then have returned to levels in line with the prior year.
- Significant social isolation, movement restrictions, and shelter in place policies begin to be implemented in the week ending March 20th, with more being added in the weeks that followed.
- The way in which new and refill prescriptions have continued into the following weeks with movement restrictions is helpful in understanding that volume has not been completely interrupted, while some has shifted in time.
- New to brand prescriptions have declined dramatically and continue down, as many physician practices are closed or offering limited services.
- As of April 10, 33 million more chronic prescriptions have been dispensed than ‘normal’.
- Retail stores have increased the rate for their dispensing of 90 day RX during the crisis which will flatten prescription volumes.
- Share of retail pharmacy e-prescribing continues to increase even as weekly prescriptions decline.

Exhibit notes: Expected values based on First week of January 2020 applying week to week growth in 2019 from starting week (1st week of January). Difference between expected and actual values per week are plotted. Prescriptions are not adjusted for prescription length.

Some widely used medicine classes show significant pre-isolation stockpiling, but opioids volume has declined

Exhibit 12: Cumulative Expected Versus Actual Total Prescriptions, Millions



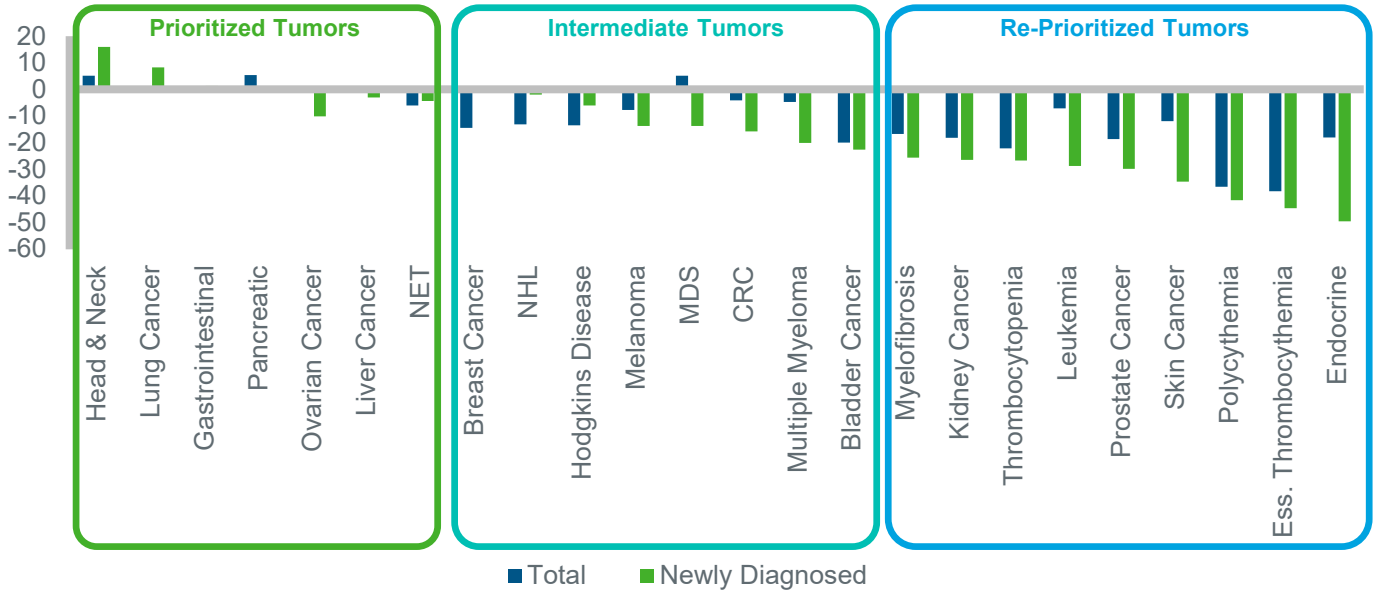
Source: IQVIA NPA Rapid, Apr 10, 2020

- As of April 10th, more prescriptions have been dispensed than 'normal', with common chronic medicines driving much of that extra volume.
- Hypertension, one of the diseases noted as having greater comorbidity with COVID-19, has seen a 0.6% excess volume over the weeks to date in 2020, most of that occurring in the weeks from March 6th to March 27th, as patients stockpiled before going into isolation.
- Diabetes, respiratory, and mental health each increased by over four million prescriptions and by 0.3%, 0.4% and 0.4%, respectively, over the expected amount for this year to date.
- Anxiety prescriptions have increased by two million but only 0.1% over expected.
- Narcotic analgesics have declined by one million prescriptions from the expected trend. These prescriptions were already declining in relation to the opioid epidemic, with restrictions on prescriptions preventing the stockpiling behavior seen in other classes, as well as reflecting the disruptions from social isolation in the last few weeks.

Exhibit notes: Expected values based on First week of January 2020 applying week to week growth in 2019 from starting week (1st week of January). Difference between expected and actual values per week are plotted.

Oncologists have adapted quickly and are prioritizing high-risk patients and tumors while reducing visits for lower-risk patients

Exhibit 13: Oncology Diagnosed Patient Interactions as a Percentage of Baseline Date (4 Weeks Ending Feb 28)



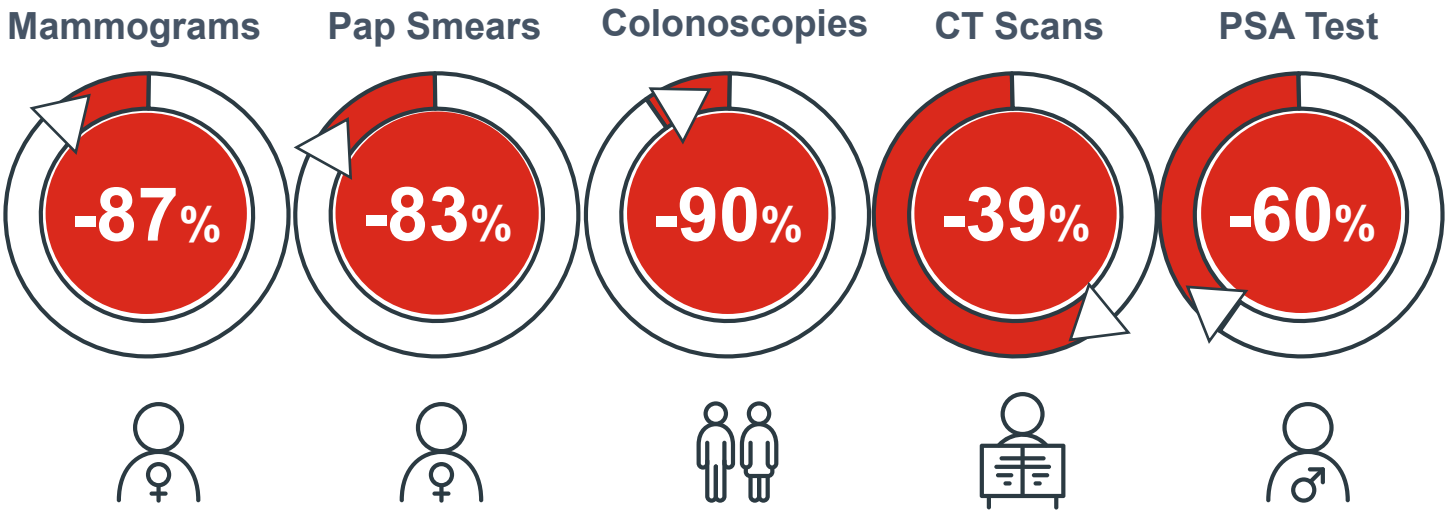
Source: IQVIA Oncology Medical and Pharmacy Claims week ending April 03, 2020

- Oncologists are adapting their level of patient interactions based on guidelines provided by professional societies that vary widely depending on the tumor type and progression of the cancer.
- Changes in the number of patient interactions with oncologists since February 2020 — based on medical and pharmacy claims processed through April 3 — have declined on average by 20%, but vary based across tumor types.
- Patients with tumors that are typically very aggressive, such as head and neck cancer, or diagnosed at advanced stages, such as pancreatic and ovarian cancer, were continuing to see oncologists in March at similar rates as in February, suggesting little or no disruption to their urgently needed care.
- Patients with tumors that are typically less aggressive and may be diagnosed early, including skin cancer and prostate cancer, have seen declines of 20–50% in oncologist visits during March. This may reflect that oncologists who are providing care across multiple tumor types are prioritizing their time and efforts to those patients with more advanced or aggressive tumors.

Exhibit notes: Limited to oncology market. 4-week average weekly volume; index period: 4-week ending with 2/28/20. NET = neuroendocrine tumor; NHL = non-Hodgkin lymphoma; MDS = myelodysplastic Syndrome; CRC = colorectal cancer

Diagnostics used to screen and monitor cancer have dropped dramatically due to postponement of non-essential visits

Exhibit 14: Reduction in Diagnostic Testing Procedures, Week Ending April 10 Compared to February 2020



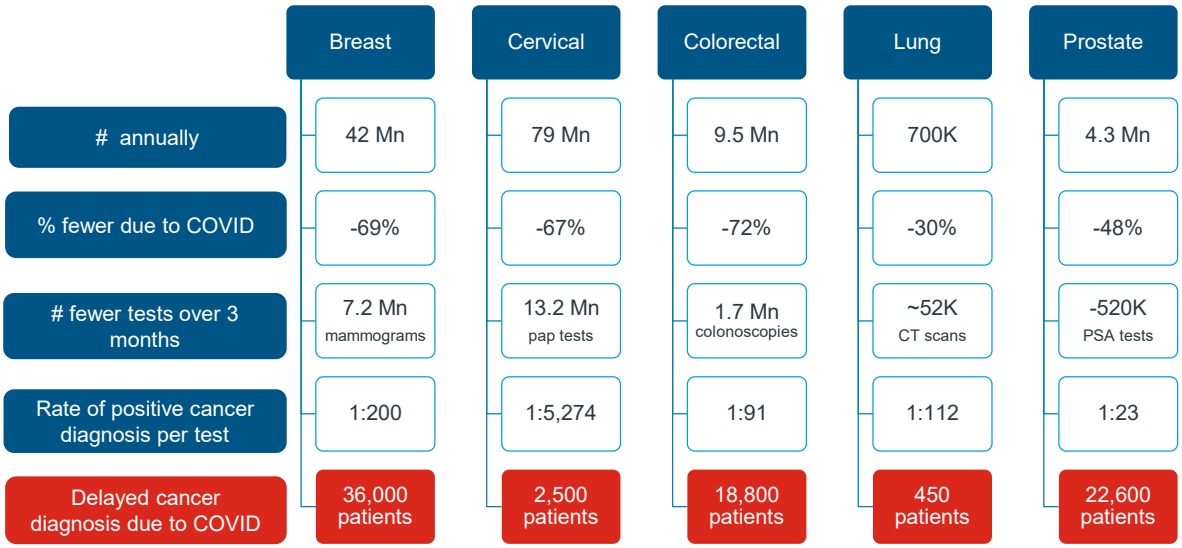
Source: IQVIA Real World Claims, April 17, 2020

- Claim codes for diagnostics commonly used to screen and monitor for cancer were generally stable from March 2019 through February 2020.
- However, as the country prepared for COVID by cancelling/postponing non-essential visits, procedure codes throughout March declined dramatically, coming to a near stand-still for some tests by the first week in April.
- Notably, CT scans for lung cancer and PSA tests for prostate cancer were less impacted than the others in this timeframe.
- It is anticipated that existing cancer patients, particularly those with late stage tumors, will continue to receive procedures as required, even as some may have been rescheduled during the first weeks of dramatic office closures in late March into early April.
- For claims in the week ending April 10th, there was an 87% reduction in mammograms, an 83% reduction in the number of pap smears, and a 90% reduction in the number of colonoscopies.
- Lower rates of disruption for CT scans may reflect the generally more serious nature of those tumors or be due to concerns about ruling out COVID-related issues in some patients.
- The 60% reduction for PSA tests may be related to patients with metastatic disease, or those in the process of assessing severity of their disease. This is often measured by the time it takes the PSA level to double, giving impetus to adhering to scheduled testing regimes for those patients.
- With these reductions in diagnostic testing, for often asymptomatic patients, the risk of failing to detect a tumor early will rise dramatically.

Exhibit notes: Claims in the week ending April 10, 2020 compared to the average of weeks in the baseline period Feb 1, 2020 to Feb 28, 2020. Claims in most recent weeks may be understated due to provider delays in filing claims. Period from week ending Feb 28 to April 10 have been adjusted based on historic modeling of delayed filing of claims, with progressively more complete data available up to eight weeks after the latest reporting week. The week ending April 17th has been excluded due to the degree of incomplete data. The true extent of the decline in claims could deviate from historic filing delays due to changes in administrative staffing in hospital and practices during COVID-19.

Over 22 million screening tests for five common tumors may be disrupted, risking delayed or missed diagnoses for 80,000 patients

Exhibit 15: Modeled Impact of Reduced Screening Tests Three Months Ending June 5, 2020



Over 22 million screening tests and over 80,000 positive cancer diagnosis potentially delayed

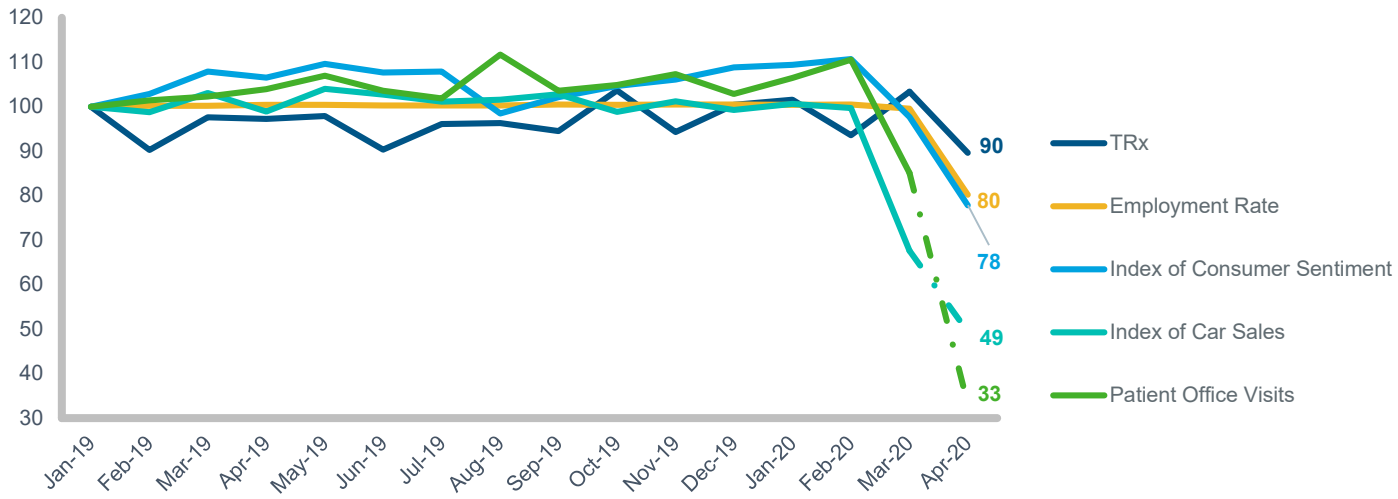
Source: IQVIA Institute, Apr 2020

- With non-essential appointments and screenings cancelled or postponed, five diagnostic tests/procedures for common cancers could be disrupted for 22 million patients.
- Delayed cancer diagnosis can lead to more advanced cancer upon diagnosis. However, not all abnormal tests lead directly to a cancer diagnosis, as many find pre-cancerous lesions and other abnormalities that, when diagnosis delayed, can create more advanced health problems.
- Claims for screenings for five of the most common cancers have declined dramatically from early March through April 10th. If this low level of testing were to continue through early June, tests would be down an estimated 30 to 72% in that three month period.
- Over 80,000 positive cancer diagnoses could be missed or delayed as a result of the level of disruption to healthcare associated with COVID-19.
- Current excess healthcare capacity to catch-up on missed tests and associated cancer treatments would require providers to shift priorities to make time and space in schedules and facilities as well as the cooperation of patients to return to healthcare providers. Both of these could be further disrupted by economic factors or reintroduction of social distancing in a reemergence of the outbreak.
- An immediate return to previous volumes of testing and care will require substantial reallocation of resources and likely last months after social distancing rules are relaxed.

Exhibit notes: Estimates of diagnostics were modeled from relevant tumor epidemiology sources. Positive diagnosis rates are from the American Cancer Society. Reduced numbers of claims are from IQVIA Real World Claims data, based on National claims data up to April 10th 2020. Periods until June 5th assumed to remain as low as the latest week resulting in a three month reduction compared to the baseline month of February 2020.

Social distancing has resulted in shifts in consumer sentiment and behavior coinciding with new unemployment claims

Exhibit 16: Monthly Values Indexed to January 2019 = 100



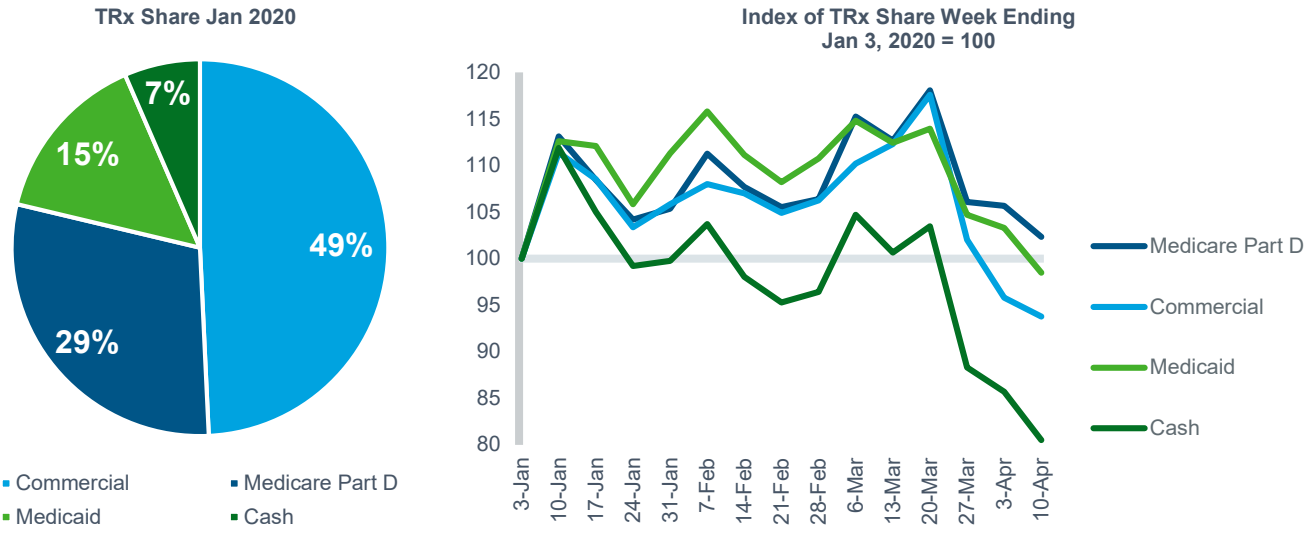
Source: University of Michigan Consumer Sentiment Survey; Federal Reserve Car Sales; Department of Labor and Bureau of Labor Statistics; IQVIA National Prescription Audit through April 17 2020; IQVIA National Disease and Therapeutic Index (NDTI) for office visits Mar 2020 and estimate of April based on IQVIA office-based medical claims April 17, 2020

- The onset of the COVID-19 pandemic in the U.S. has resulted in a sharp decline in consumer sentiment and economic conditions.
- Unemployment now estimated at 23% by end of April based on weekly new claims released on April 23rd, indexed to 80 compared to January 2019.
- Consumer sentiment has dipped from 98 in March to 78 in April, a rate of decline faster than in in the 2008–09 economic crisis.
- Car sales are estimated to be down 50% from April 2019, based on preliminary data reported April 22 by J D Power, and declined sooner than other confidence metrics.
- Medicines use has been more insulated than other sectors both due to patients filling prescriptions early and most patients have not lost their insurance at the same time they have lost their job.
- Since the week ending 3/27 there have been 26 million new unemployment claims in the US, however many states are reporting challenges in managing the volume of claims and Federal Reserve officials project unemployment to peak in May at 30% or approximately 44 million.
- The compression of new claims, with some retaining insurance coverage for some period of time, and the effects on consumers from receiving stimulus payments, along with the duration of social distancing shutdowns are large unknowns for both the economy and individual patient decisions.

Exhibit notes: Consumer sentiment from 100 to 89 Feb to Mar; Car sales drop 5.5 million in a month; Employment rate drops from 96.5% to 87% in three weeks and projected to drop to 70% by May' April TRx is based on 3 weeks to 4/17

Changes in insurance coverage and the behavior of patients during the COVID-19 pandemic have only recently begun to have an effect

Exhibit 17: Share of Prescriptions by Method of Payment

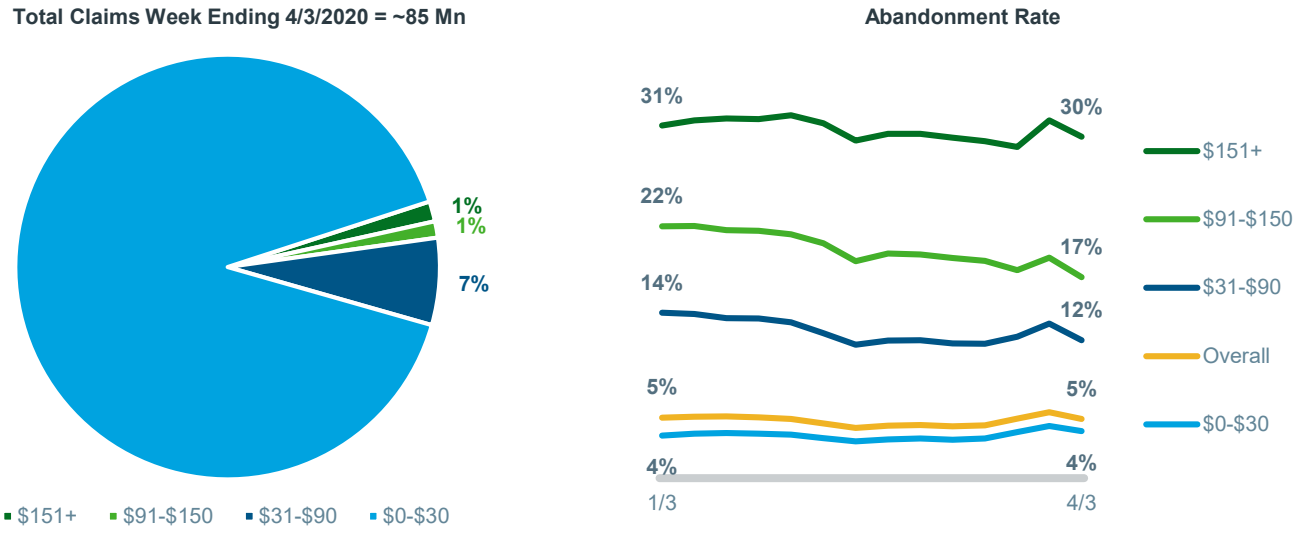


Source: IQVIA National Prescription Audit Extended Insights Weekly, April 10, 2020

- Changes in payer type and insurance coverage driven by the sudden increase of unemployment due to coronavirus have only recently begun to impact prescription volumes.
- Cash prescriptions have declined by 20% since the 20th of March but represent only 7% of prescriptions overall.
- Reports that those patients with hourly work most affected by rising unemployment claims were previously uninsured may correlate with the declining cash prescriptions.
- Medicaid and Medicare prescriptions have had only limited or no reduction to date, and these trends more likely reflect patients' choice to refill prescriptions early in March.
- Commercially insured patients have filled 4% and 6% fewer prescriptions in the last two weeks, respectively, compared to the first week of the year. However, this reflects a period of higher rates of prescriptions during March that are understood to reflect 'stockpiling.'
- As of April, the expected shift of patients from commercial to Medicaid or uninsured following the dramatic rise in unemployment claims has not yet occurred.

Patient sensitivity to cost has been largely unchanged by the COVID-19 pandemic to date

Exhibit 18: Patient Out-of-Pocket Costs and Abandonment



Source: IQVIA Formulary Impact Analyzer (FIA), Longitudinal Access & Adjudication Data (LAAD) Apr 17, 2020

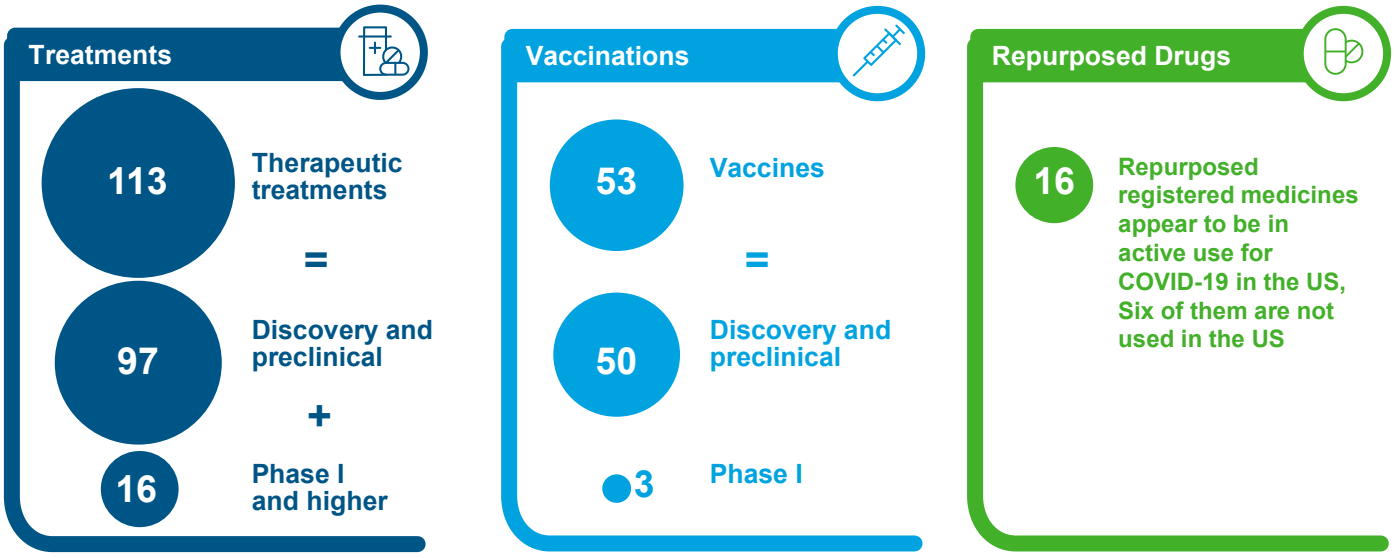
- The vast majority of prescriptions are low-cost, accounting for less than $30 patient out-of-pocket cost, and only 4% of patients abandon those prescriptions at the pharmacy.
- Abandonment is a term reflecting the preparation of a prescription for an individual patient which is ultimately not taken home, often due to cost.
- There are much higher levels of abandonment as patient cost responsibility rises, with seven times more abandonment at costs over $150 than under $30.
- At intermediate copays, there have been a decrease in patient abandonment rates, as patients show increased willingness to obtain a 'mid-priced' medication.
- Price sensitivity is potentially a leading indicator for abandonment, but as many patients have yet to lose insurance coverage, the effects may still be hidden, and further study will be required.

Exhibit notes: Data updated through April 17th has been analyzed but abandonment has been assessed only through April 3rd to allow for abandoned prescription coding to be reflected. Total LAAD claims represent a subset of total prescriptions. Total claims estimated based on 5% abandonment overall and total prescriptions in week ending April 3rd (81.1 million).

RESEARCH ACTIVITY FOR THERAPEUTICS AND VACCINES

At least 113 drugs or regimens and 53 vaccines are in planned or active trials as therapeutics for patients diagnosed with COVID-19

Exhibit 19: Landscape analysis of therapeutics and vaccine candidates, April 8 2020



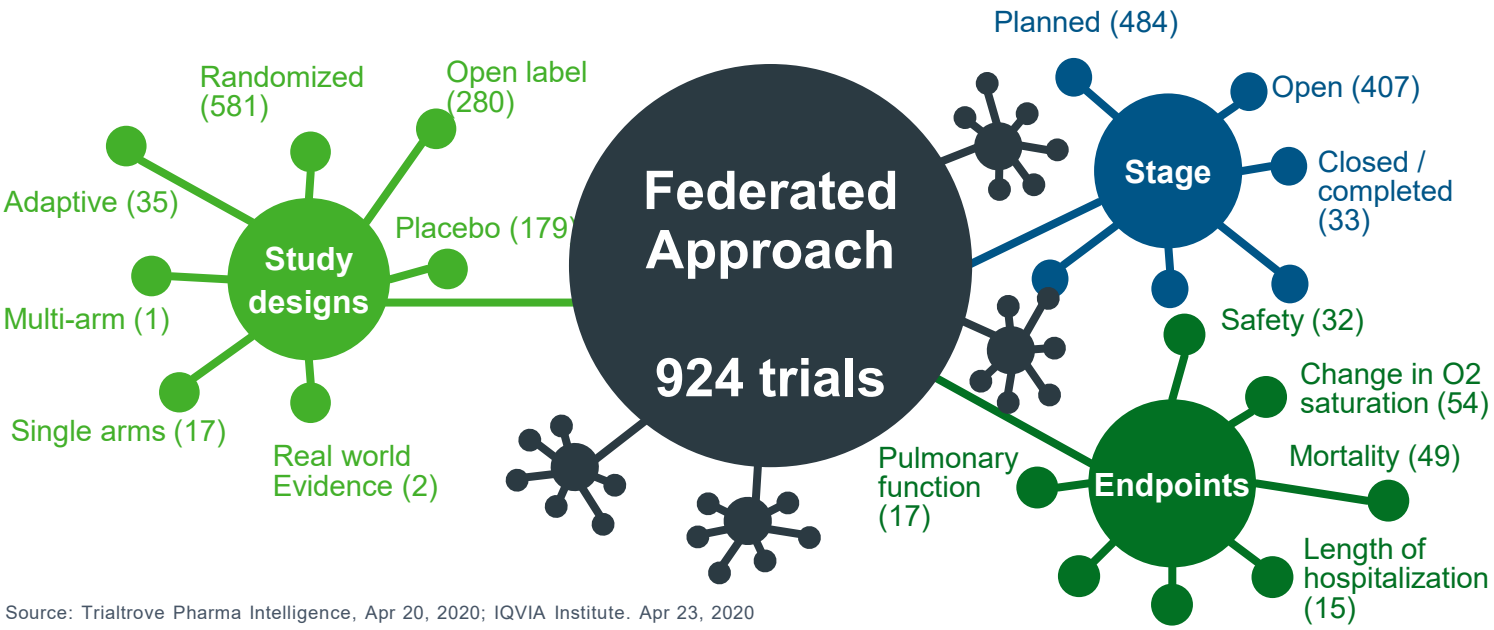
Source: AdisInsight; Trialtrove Pharma Intelligence, Apr 20, 2020; IQVIA Institute. Apr 23, 2020

- A surge of activity is underway in an effort to discover and develop effective therapeutics and vaccines for COVID-19.
- At least 182 drugs or regimens are in planned or active trials as therapeutics for patients diagnosed with COVID-19 or vaccines, covering a diverse range of mechanisms and largely focused on viral replication inhibition and immune system modulation.
- An additional 97 therapeutic drugs are not yet planned or in active trials, but are moving through early discovery and preclinical testing, providing longer-term possibilities.
- Fifty vaccines are in discovery or preclinical stages and intended to prevent infection or provide post-exposure prophylaxis for individuals at high risk. As of April 20, three vaccines were in Phase I investigation.
- At least 16 medicines with approval for non-COVID-19 indications are in clinical trials to assess their benefits in COVID-19 disease, including some that are already being used by providers through emergency authorization or compassionate use programs, notably hydroxychloroquine and remdesivir.

Exhibit notes: Drugs were counted within programs; Repurposed investigational medicines includes one registrational product. Clinical trials Phase I through IV. Includes interventional trials. Terminated trials were removed. Includes both academic, government, and industry sponsored trials

COVID-19 studies are targeting a variety of endpoints with over 400 active trials underway, all started this year

Exhibit 20: Number of Active and Planned Clinical Trials Related to COVID-19



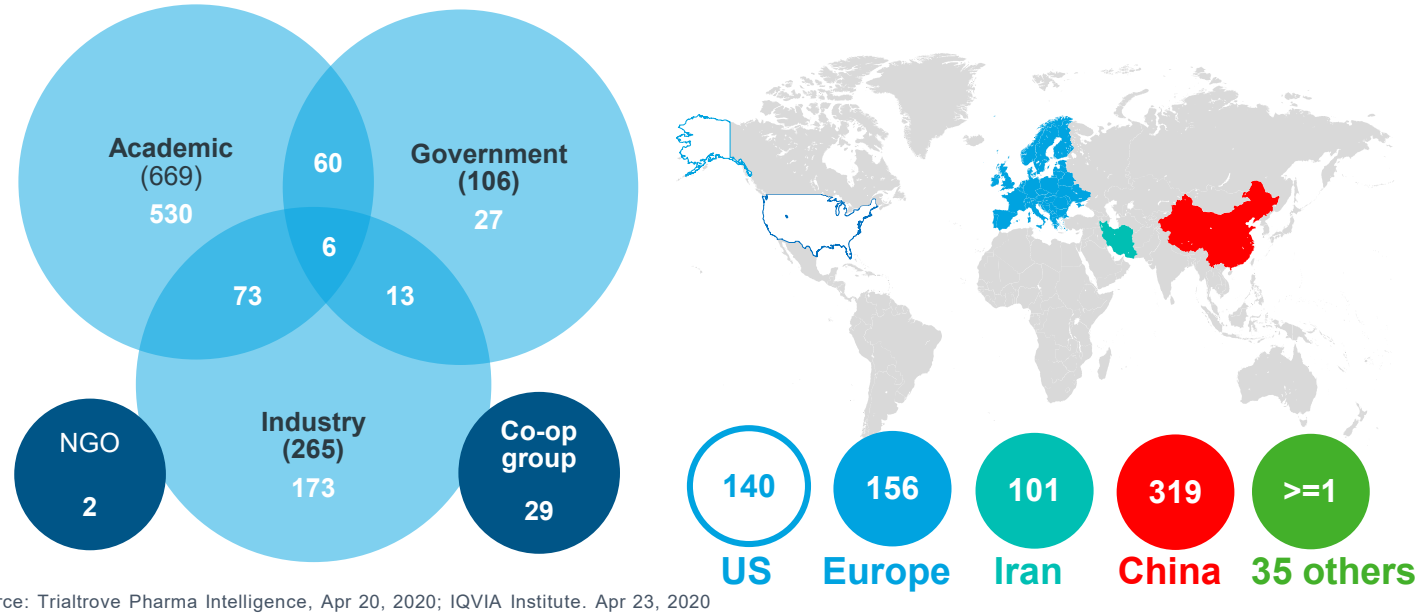
Source: Trialtrove Pharma Intelligence, Apr 20, 2020; IQVIA Institute. Apr 23, 2020

- Clinical research underway includes a wide variety of trial designs, endpoints, and timing. In many cases, these trials will result in findings that will be challenging to reconcile or compare in order to determine optimal therapeutics and vaccines for global use.
- About 40% of trials planned or underway are not randomized and therefore will be difficult to interpret when results are announced.
- Only about 15% of the trials are conventional randomized, double-blinded, multi-arm studies with an active or placebo comparator, reflecting the pragmatic approach taken by many investigators who have emphasized the need for data to be developed even in the absence of typical trial design parameters.

Exhibit notes: Clinical trials Phase I through IV. Includes interventional trials only. Terminated trials were removed. Includes academic, government, and industry sponsored trials

Over 900 clinical trials involving a wide array of sponsors and consortia are taking place around the world

Exhibit 21: Active and Planned Human Clinical Trials targeting COVID-19 vaccines, treatment or symptom relief



Source: Trialtrove Pharma Intelligence, Apr 20, 2020; IQVIA Institute. Apr 23, 2020

- About 924 trials are planned or underway for COVID-19-related medicines, under a federated model of development, with multiple sites across the globe and sponsored by academic, governmental and private sector entities.
- Almost 407 active trials are underway, with most being registered within the past six weeks, and the remainder are anticipated to be started in the next few weeks. This represents an unprecedented level of activity focused on a single disease. Thirty-three trials have been closed or completed.
- More than half of planned or underway trials are based in China, which preceded the rest of the world in research by several weeks.
- Over 30 trials are multi-country, reflecting the international focus on this disease and the lowering of national boundaries in an effort to accelerate development efforts and to draw from large populations of subjects.
- More than half of the trials have academic sponsors — sometimes supported by governments and industry — with the life sciences industry funding over 260 studies and co-operative and non-profit organizations also funding over 40 studies.

Exhibit notes: Clinical trials Phase I through IV. Includes interventional trials only. Terminated trials were removed. Includes academic, government, and industry sponsored trials. Number of trials in US, Europe (including any European country), Iran or China. Other countries with at least one trial active or planned have been counted (35 countries). All trials are COVID-19 related.

Human Data Science in the COVID-19 Era

In this report, we highlight six shifts in the COVID-19 era that take place in the intersection of human science, human health and data science, thus underscoring the urgency of a new approach, such as Human Data Science.

Tracking the COVID-19 pandemic — The significant variation in the number of active cases across state-levels can not be explained solely by the different demographics and levels of urban density. The difference in the levels of cases between states, such as New York and New Jersey, and states, such as California and Florida, calls into question the impact of highly different public health interventions among the states. Understanding what drives the divergence in outcomes will require an in-depth Human Data Science analysis of factors relating to the scope of nonpharmaceutical intervention, as well as a pharmaceutical approach to underlying comorbidities, the public health strategies driving change in human health behavior, and the application of human science and data science to detect, track, and monitor the pandemic.

Patient use of health services — The use of approved medicines within the indications and beyond has changed rapidly due to shifting demand dynamics. These changes are offering an extraordinary window of opportunity for assessing the efficacy and safety of multiple therapies utilizing a multidimensional Human Data Science approach that looks at the interconnection between COVID-19 infection, underlying patient comorbidities, and drug safety monitoring.

Impact on medicine use — While the mitigation of rigorous lockdown measures for most states and cities has yielded a successful decrease in the spread of coronavirus, there are significant unintended consequences in non-COVID-19-related healthcare, such as pre-isolation stockpiling of widely used medicines, decline in opioid use, and a drop in diagnostic visits and lab tests.

Care for cancer patients — While the increase in telemedicine has provided a useful alternative avenue for provider-patient interaction, there are deleterious consequences of the lockdown on important patient care, such as a decline in patient interactions with oncologists, causing a dramatic decrease in diagnostic assessment and subsequent therapeutic interventions that are likely to have negative impact on cancer patient survival rates. An integrated Human Data Science approach combining the management of infectious and chronic diseases, such as cancer, represents an opportunity to break this dilemma and avoid a trade-off between effective pandemic response and sustained non-COVID-19 patient care.

Patient insurance coverage and out-of-pocket costs — While there have been significant shifts in consumer sentiment and behavior during the pandemic, changes in insurance coverage and patient behavior have only begun to take effect. Using a Human Data Science approach, ongoing shifts in consumer and patient sentiment and behavior may be detected.

Research activity for therapeutics and vaccines — The pandemic has triggered a flurry of R&D efforts geared to identify and assess 113 drugs or regimens and 52 vaccines, which are currently in planned or active trials, as therapeutics or preventative interventions for patients diagnosed with COVID-19. Human Data Science offers an approach for earlier identification of pathogenic disease targets and an accelerated assessment of the efficacy and safety of new therapeutic medicines or vaccines.

Notes on Sources

THIS REPORT IS BASED ON THE IQVIA SERVICES DETAILED BELOW

The trends presented reflect United States activities only.

IQVIA's Longitudinal Prescription Data: IQVIA receives nearly 4 billion prescription claims per year with history from January 2006 with coverage over 90% for the retail channel, 60–85% for mail service, and 75–80% for long-term care. Longitudinal data derives from electronic data received from pharmacies, payers, software providers and transactional clearinghouses. This information represents activities that take place during the prescription transaction and contains information regarding the product, provider, payer, and geography. Rx data is longitudinally linked back to an anonymous patient token and is linkable to events within the data set itself and across other patient data assets.

IQVIA's Medical Claims Data: Dx data are pre-adjudicated claims collected from office-based physicians and specialists. These data are sourced from CMS-1500 form-based claim transactions, the standard reimbursement form for all non-cash claims. Medical claims data includes patient-level diagnosis and procedures for visits to U.S. office-based individual professionals, ambulatory and general healthcare sites. The medical claims data includes more than 205 million patients, over 1.7 billion claims and 3 billion service records obtained annually.

Diagnosis, telehealth and procedural claims have been derived based on IQVIA's medical claims database through the week ending 4/17/2020. Normal claims processing lags are adjusted for by IQVIA using a methodology called "date control" in order to estimate claim levels where the full number of claims has not yet been received. The methodology considers historic patterns of lag periods between service dates and receipt of claims to project missing claims.

Disruptions from COVID-19 may result in claim lags that differ from historic patterns. IQVIA's medical claims database is dynamic and IQVIA will always employ the latest available information to consider in its estimates — therefore estimates of growth may change from publication to publication.

IQVIA's National Prescription Audit (NPA): NPA is the industry standard source of national prescription activity for all pharmaceutical products. It measures demand for prescription drugs, including dispensed pharmaceuticals to consumers across three unique channels: retail, mail service, and long-term care pharmacies. From sample pharmacies, IQVIA collects new and refilled prescription data daily. NPA represents and captures over 92% of all outpatient prescription activity in the United States and covers all products, classes, and manufacturers.

IQVIA's National Prescription Audit: New To Brand (NPA NTB)

NPA New to Brand provides enhanced visibility into the volume of a patient's true, first-time use of a brand versus continued therapies. IQVIA's longitudinal data allows users to analyze new therapy starts, switched to/add-on products, as well as continued therapies. In addition to reporting the new or refill information from a prescription, the therapy history for the patient is taken into account in order to categorize that prescription. New to Brand RX (NBR) = New Therapy Start Rx + Switch/Add-On Rx

Notes on Sources

IQVIA Formulary Impact Analyzer (FIA)/Longitudinal Access and Adjudication Data

Volume of paid, rejected and reversed claims. FIA/LAAD tracks the adjudication between the pharmacy, payer, and patient at the point of sale. Additionally LAAD is a comprehensive patient longitudinal dataset built from a combination of IQVIA's longitudinal prescription, lifecycle and medical claims.

IQVIA COVID-19 ACTIVE CASES CURVE SIMULATOR

The core of this simulator developed by the IQVIA Data Science and Advanced Analytics team is the Susceptible-Exposed-Infected-Removed epidemiology model using inputs from publicly available sources and updated daily. The simulator focuses on total active cases and shows the number of active cases at a given time and the number of active cases per 100K population, shape of increase of the curve, timing of the apex of the curve and the shape and timing of the decline from the apex. The base scenario assumes that existing mitigation measures (nonpharmaceutical interventions) are maintained at current levels through the duration of the future period simulated. It does not predict or forecast when those measures might be relaxed or modified.

About the authors

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Murray Aitken is Executive Director, IQVIA Institute for Human Data Science, which provides policy setters and decisionmakers in the global health sector with objective insights into healthcare dynamics. He led the IMS Institute for Healthcare Informatics, now the IQVIA Institute, since its inception in January 2011. Murray previously was Senior Vice President, Healthcare Insight, leading IMS Health's thought leadership initiatives worldwide. Before that, he served as Senior Vice President, Corporate Strategy, from 2004 to 2007. Murray joined IMS Health in 2001 with responsibility for developing the company's consulting and services businesses. Prior to IMS Health, Murray had a 14-year career with McKinsey & Company, where he was a leader in the Pharmaceutical and Medical Products practice from 1997 to 2001. Murray writes and speaks regularly on the challenges facing the healthcare industry. He is editor of Health IQ, a publication focused on the value of information in advancing evidence-based healthcare, and also serves on the editorial advisory board of Pharmaceutical Executive. Murray holds a Master of Commerce degree from the University of Auckland in New Zealand, and received an M.B.A. degree with distinction from Harvard University.

MICHAEL KLEINROCK
Research Director, IQVIA Institute for Human Data Science

Michael Kleinrock serves as research director for the IQVIA Institute for Human Data Science, setting the research agenda for the Institute, leading the development of reports and projects focused on the current and future role of human data science in healthcare in the United States and globally. Kleinrock leads the research development included in Institute reports published throughout the year. The research is focused on advancing the understanding of healthcare and the complex systems and markets around the world that deliver it. Throughout his tenure at IMS Health, which began in 1999, he has held roles in customer service, marketing, product management, and in 2006 joined the Market Insights team, which is now the IQVIA Institute for Human Data Science. He holds a B.A. degree in History and Political Science from the University of Essex, Colchester, UK, and an M.A. in Journalism and Radio Production from Goldsmiths College, University of London, UK.

About the Institute

The IQVIA Institute for Human Data Science contributes to the advancement of human health globally through timely research, insightful analysis and scientific expertise applied to granular non-identified patient-level data.

Fulfilling an essential need within healthcare, the Institute delivers objective, relevant insights and research that accelerate understanding and innovation critical to sound decision making and improved human outcomes. With access to IQVIA's institutional knowledge, advanced analytics, technology and unparalleled data the Institute works in tandem with a broad set of healthcare stakeholders to drive a research agenda focused on Human Data Science including government agencies, academic institutions, the life sciences industry and payers.

Research Agenda

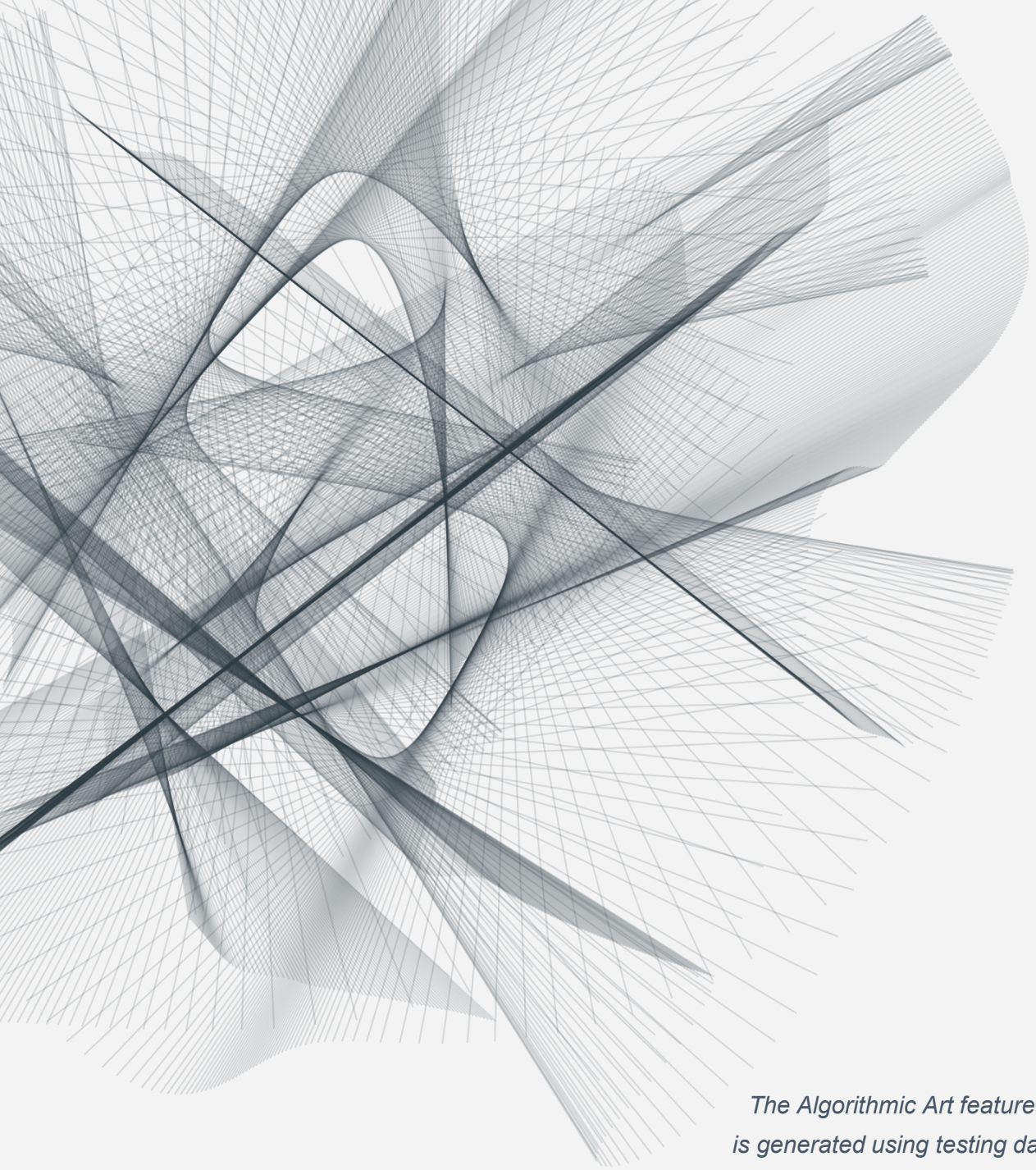
The research agenda for the Institute centers on 5 areas considered vital to contributing to the advancement of human health globally:

- Improving decision-making across health systems through the effective use of advanced analytics and methodologies applied to timely, relevant data.
- Addressing opportunities to improve clinical development productivity focused on innovative treatments that advance healthcare globally.
- Optimizing the performance of health systems by focusing on patient centricity, precision medicine and better understanding disease causes, treatment consequences and measures to improve quality and cost of healthcare delivered to patients.
- Understanding the future role for biopharmaceuticals in human health, market dynamics, and implications for manufacturers, public and private payers, providers, patients, pharmacists and distributors.
- Researching the role of technology in health system products, processes and delivery systems and the business and policy systems that drive innovation.

Guiding Principles

The Institute operates from a set of Guiding Principles:

- Healthcare solutions of the future require fact based scientific evidence, expert analysis of information, technology, ingenuity and a focus on individuals.
- Rigorous analysis must be applied to vast amounts of timely, high quality and relevant data to provide value and move healthcare forward.
- Collaboration across all stakeholders in the public and private sectors is critical to advancing healthcare solutions.
- Insights gained from information and analysis should be made widely available to healthcare stakeholders.
- Protecting individual privacy is essential, so research will be based on the use of non-identified patient information and provider information will be aggregated.
- Information will be used responsibly to advance research, inform discourse, achieve better healthcare and improve the health of all people.



The Algorithmic Art featured on this report is generated using testing data compiled by the COVID-19 Tracking Project and analyzed by the IQVIA Institute to assess rates of coronavirus testing by State.

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