How to Prepare for the COVID-19 Recovery

ADELE CONCERT

LA COMEDY FESTIVAL

LA LAKERS GAME

How global companies are preparing now for the return of demand
Note from our cofounder

We’re all scrambling to create COVID-19 recovery strategies. In this chaotic environment, differentiating reliable signals among the noise can be hard but PredictHQ is here to help.

Demand forecasting has changed and every kind of demand has been impacted by COVID-19. Everyday commerce, seasonal trends and catalysts such as events all took a hit, but all will recover.

You’re not alone when it comes to building your best possible recovery plan. The PredictHQ team is working with global companies across retail, transport, accommodation and more as they update their models and prepare strategies to capture as much of the returning demand as they can.

Your coronavirus recovery team's job is to work out how to reliably forecast demand so you can make the most of every emerging opportunity in the new normal. To assist, we’ve put together some of our most relevant resources for the two stages of recovery planning into a single kit:

• Resources you can use right now to track lockdowns and shelter-in-place mandates at scale while updating your demand planning

• How to track events as indicators of demand to get early insight into when demand will recover and how to make the most of every opportunity

This kit is only the beginning. Our team is here to partner with you to ensure you get maximum value out of your access to PredictHQ's demand intelligence so you can build the smartest possible recovery plans.

Best wishes,
Campbell Brown
Track lockdowns and shelter-in-place mandates at scale
Understand how government restrictions are impacting your demand globally by tracking them in all relevant markets. Use this insight to prepare to meet pent up demand when they are lifted, or to optimize your lockdown demand strategies.

How our data scientists are calculating the recovery rate for event attendance
Identifying your coronavirus demand recovery rate is complex. Our chief data officer shares how the PredictHQ team is approaching it including outlining the challenges, frequency of iterations and how many new functions are needed to calculate accurate predicted attendance.

Don’t throw out your 2020 data - how to fix your data models to prepare for the recovery
Our chief data officer draws on decades of experience of time series modeling and anomaly detection to reveal why teams shouldn't abandon their 2020 data and shares how to update models to make sense of the COVID-19 anomaly to inform your recovery plans.

Five steps to overhaul your demand planning before the recovery begins
Times have changed and demand planning has to also. Typical aspects of demand planning won't be enough. Our COO explores the five steps coronavirus recovery teams need to take now so your demand forecasting process is fit for purpose to ensure your company has the optimal planning process and accurate forecasts for the COVID-19 recovery.

How to track new event dates and rescheduled dates at scale
One of the opportunities of the COVID-19 recovery period lies within the fact that most events were postponed rather than cancelled, especially in key categories such as sports. Events are useful indicators of demand and catalysts for it, causing people movement and purchasing, so your team needs to be able to track these at scale as they begin to return.

How to use our Aggregate Event Impact tool to understand the impact of canceled or postponed events
As demand recovers, you will need to understand your historical demand better as previous demand surges from events will need to be removed from your 2020 modeling, as well as new events added to your plans. Teams are actively tracking the impact of canceled and postponed events, as well as the many unscheduled events such as public holidays and observances are still taking place. As hundreds and then thousands of events start to return, you will need to track the combined impact of all events to inform how much stock and how many assets or staff you'll need on hand each day.

How to use events in demand forecasting models
We have created a guide for data scientists who are new to working with intelligent event data to enable them to quickly incorporate it into their demand models. Our guide includes reviewing a forecasting model using example customer demand data without events data as a baseline for comparison. We then incorporate our Aggregate Event Impact and holidays to build a second model with higher accuracy when predicting irregular demand spikes caused by events.
Track lockdowns and shelter-in-place mandates with this new feature

By Peter Jansen, Head of Product at PredictHQ

Shelter-in-place and lockdown restrictions have had unprecedented impact worldwide that is likely to continue for some months. Because these restrictions vary by country, and in many cases, state by state, keeping track of the status of every lockdown and shelter-in-place in your relevant markets is almost impossible to do manually.

PredictHQ now includes a feature allowing our customers to see lockdown or restriction events at both the country and the region or state level.

These are important to track for many reasons including:

1. Lockdown orders have created significant decremental demand for many businesses, while surges for some such as home delivery and ecommerce.

2. The lifting or easing of these lockdown or shelter-in-place orders will create an opportunity for pent-up demand that your team should be preparing for.

We are working closely with our customers to use real-world events effectively in their recovery strategies but we wanted to meet their immediate needs as quickly as possible. We know this demand intelligence is urgently needed because many of our customers have requested a way to track these at scale, so they can know immediately when restrictions are increased,
lightened or lifted. This has immediate demand forecasting benefits, as well as making it possible for machine learning models to make sense of these changes without significant manual updating by data science teams.

The shelter-in-place and lockdown events can be found in Control Center or via our API under the lockdown label as shown below:

The lockdown and shelter-in-place feature in PredictHQ’s Control Center. You can also view these events on a timescale with our Aggregate Event Impact tool. For example, here is Washington state’s lockdown mandate:
There are two key ways to use this feature: informing your recovery strategy and creating more intelligent models for future major demand anomalies.

At the time of release we have lockdown and shelter-in-place events in our system for the United States and Europe. We will soon be expanding this out to other countries and regions.

1. Inform your COVID-19 recovery strategy

Correlate the impact on your demand with restrictions across similar countries or states/regions to better understand their impact. Both the impact of their commencement and the easing of these restrictions will be powerful demand intelligence to inform recovery strategies.

Having a standardized and verified source of this information will enable you to better track and manage these changes. Whether you are creating COVID-19 and recovery dashboards or updating your forecasting, you can access the data through the Control Center tool and via our API, to incorporate it programmatically or into your dashboards. You can also use our Data Exporter or Tablaeu connector to help utilize the data.

Restrictions and lockdowns are not uniform in severity or timing across locations so your plans for each area require local data. For example, here are the active events in the state of New York and the state of Illinois.

If a team is relying on New York’s dates for your entire US strategy, they will waste weeks of stock and staff in Illinois as the lockdown is scheduled to end later. Both sets of dates may also change with government orders, which our systems will capture quickly and update in the API.
2. Create more intelligent machine learning models for predicting and adapting to future restrictions

While an almost global lockdown period is unlikely to occur again soon, shelter-in-place and similar restrictions are not as uncommon as many may imagine due to terrorism, severe weather and natural disasters.

By adding this feature into PredictHQ’s API of intelligent and verified event data, we have enabled our customers to begin to build models that can make sense of these events so they can improve their ability to bounce back efficiently and with minimal stress. This feature will also be useful for the coronavirus recovery teams that are overhauling their company’s demand planning processes in preparation.

How to use our lockdown and shelter-in-place feature

Data scientists and engineers can use this feature in our API or the Data Exporter, while non-technical users can access it through our Control Center search functionality.

**Control Center**

To find these events in Control Center, simply open up the search tab and:

1. Select the disasters category.

2. Enter the term lockdown into labels to search, and then tick the ‘lockdown’ label – this covers lockdowns, shelter-in-place and stay at home orders.

3. Select the country or state as the location.
This will cause Control Center Search to display the relevant restrictions. We recommend leaving the Date Range feature blank or broad ie 2020 to ensure you capture all the relevant COVID-19 restrictions.

How to get these events with our API

As in Control Center, you call the API and filter on the disasters category and the lockdown label. Then specify the country or state you want to see the lockdown events for. The example below retrieves all lockdown (and shelter-in-place) events that you have access to.

```bash
curl -X GET https://api.predicthq.com/v1/events/?country=US&category=disasters&label=lockdown \
   -H "Accept: application/json" \
   -H "Authorization: Bearer $ACCESS_TOKEN"
```

Aggregate Event Impact Graph

We also show lockdown and shelter-in-place warnings in our aggregate event impact graph in Control Center, as shown above with the graphs of New York, Washington and Illinois.
The graph shows you the total impact of events in a location per day. The shelter-in-place events show up on the graph as vertical lines showing the start and end dates (where known) of these directives. This provides our customers with more context on our event information and changes in demand.

Choose the location and time range in the graph to see shelter-in-place directives for different locations. These directives will show at the country, region or state level and at locations within the country and state.
How we’re calculating our COVID-19 recovery rate and ensuring accurate predicted attendance for conferences, sports games and more

By Dr Xuxu Wang, Chief Data Officer at PredictHQ

China, South Korea and New Zealand are exiting their lockdowns, with many more countries also heading steadily towards easing restrictions. As restrictions ease, suppressed demand will begin to be released and demand recoveries can begin.

Yet we all know demand recovery will be fragmented and varied, with new catalysts to uncover. Data scientists all over the world are hard at work in COVID-19 recovery teams striving to identify how their company’s demand is likely to recover, while their strategy peers identify additional levers they can work with to drive up demand directly.

This is a complex task. I want to share how my team is approaching it in case it would be useful for your recovery team.
Why companies need a coronavirus recovery rate

Building the data science capability to identify and iterate on coronavirus recovery rates is essential. For us, once our systems aggregate and verify millions of events, our models rank them all by predicted impact. While we have the world's deepest database of historical events, it is very unlikely a conference that used to draw 15,000 people will return at the same scale immediately. So we need to adjust our predicted attendance and our impact rankings models by adding a recovery ratio.

This is important because our customers use the combined impact of our event data. Rather than focusing only on the largest events (as identified by our rankings), which are log scaled from 0 to 100, many will look at all events—large and small—happening in aggregate on a specific day in a location. This aggregate event impact total enables companies to quickly understand demand for each day, to tailor their strategies for future demand with smarter stocking or staffing decisions.

This article focuses mostly on attended events - but we also track, verify and rank high impact events that are still taking place regardless of the lockdown orders, such as public holidays, observances, school holidays and closures, natural disasters, severe weather and terrorism. All of these events create demand impact – whether its incremental, decremental or suppressed demand. Tracking and preparing to meet suppressed demand is of particular importance right now as many businesses are experiencing surges in demand as restriction lift. As these restrictions vary considerably by state in the US and by country more broadly, we created a new feature to track these restrictions at scale which we explored earlier in this Recovery Guide.

Many of our customers ingest our data directly into their demand forecasting models, so our rankings have to be accurate. During the coronavirus recovery, we need a robust, iterative and reliable way to update our event rankings at scale. We couldn't rely on the attendance of many of our event sources (we aggregate from hundreds), as those are usually based on venue capacity. Assuming every event will be at maximum capacity was misleading even before the pandemic and why we draw on so many more factors from our knowledge graph to calculate our rankings.

Our customers need our updated rankings to inform their own recovery rate identification and iteration. Many companies will need to re-hire or train up staff again to meet demand, as well as engage their supply chains before demand commences to ensure they are ready.

The challenges of identifying a coronavirus recovery rate

In total, we are building well over 50 additional functions to our models to make our event impact rankings ready for the post COVID-19 era. This breadth is necessary because we track so many different kinds of events and there are a range of factors that impact demand such as:

- Government restrictions and flight bans will be easier for our systems to track than say the willingness to spend,

- Human factors such as hesitancy to attend events, or the impact of the economic downturn on people's ability and purchase tickets to events will only become knowable as markets open. This means your models will need to update rapidly based on new information. This will impact both attended events such as conferences and sports games, but also non-attendance based events such as people celebrate public holidays, observances and school holidays.

- The impact of COVID-19 on events will vary substantially. Smaller attended events are coming back faster, such as local concerts or fun runs. Events attended by a lot of international visitors may look very different for a while, as international
travel is likely to be low for some time. It is important to be tracking the recovery rate of attended events, as well as how non-attendance based events will be impacted, including breaking events such as severe weather and natural disasters.

These are all complex challenges to decompose into discrete problems to build models to solve. And this is only the tip of the iceberg, we are also building models to source, verify and incorporate substantial amounts of new data such as public transport data, trends data and much more. While almost every company out there is watching its spending, chief data officers shouldn't be reluctant to invest in high quality data sources - this is exactly the time when your strategies need to be data-driven to filter out all of the noise.

**Identifying a recovery ratio for each event subgroup in each category at a state or country level**

Like many businesses, we offer a range of products or types. In our case, we offer 16 categories of events and they have been impacted by the novel coronavirus in different ways.

For example, some people mistakenly claim that events aren't happening. While it is true scheduled attended events such as conferences, concerts and sports games are postponed with a small proportion canceled, other events that impact demand continue.

This includes school closures and holidays, public holidays and observances, as well as the unscheduled events mentioned above. It also increasingly includes community events such as farmers markets, which are continuing albeit in a more socially distanced way. These events can cause incremental, suppressed or decremental demand and should be tracked.

These complexities are why we have a custom built ranking for each event category. It's also why we needed to invest time into creating new functions and revised models to identify an event category’s specific recovery ratio starting point, paying particular attention to which events were driven by international attendees.

Fundamental to identifying impact is building models that can accurately identify and sort every attended event into one of three buckets: mostly domestic attendees, mostly international attendees and events with a good mix of both. Our proprietary entities system and extensive verified events metadata means we are able to sort millions of events by the percentage of international attendees. This is critical because international travel bans are likely to remain for some time and the airline industry has been hit particularly hard so we anticipate events attended by mostly international guests will take longer to recover.

Even then, not all events attended by mostly international visitors will recover at the same rate so we are building recovery rates per event subgroups for each state and country to ensure our rankings and predicted attendance are accurate.

Whereas events made up of mostly domestic attendees such as community events, but also massive sports events and concerts, are likely to recover earlier. We will be carefully tracking event limits and including these in our models. We are also on track to launch a new event category of TV events soon, for the many businesses that are impacted by televised sports games, such as those that receive a surge in demand such as groceries, CPG, and home delivery, or a wave of decremental demand such as restaurants.

Also worth noting for attended events such as conferences and expos, we anticipate many larger events may change location to territories with higher attendee limits for example, if a recovered San Francisco has a lower maximum attendee event than Las Vegas, we may see a shift of events into Las Vegas for the recovery.
Why coronavirus recovery rate models need to be updated constantly

The data science and analysis team at PredictHQ makes up more than half the company. This is good news as we are going to be even busier than usual in the coming months! As we build out these new logics and enhancements, we recognize that they will need to evolve as soon as new information is available.

That is why we are focusing on developing data science models that can iterate swiftly, and we will be reviewing every model each week. For attended events, this will involve noting the differences between search volume, ticket sales and actual attendance figures of events so we can build models to start to quantify the more human and fluid variables. These will of course need to keep iterating per market, based on latest information. For non-attendance based events, we will be drawing on similar data sources as well as some additional factors with custom-built models for each category.

As we prepare to bring these models online, our data assurance team will be manually checking the logic and updating major events. And as we start to scale these models, we will continue to crosscheck their impact manually.

I hope this article is helpful, and wish I could share more details with you all. If you are a PredictHQ customer, get in touch with our team to find out more. And if you are not yet a customer, please think carefully about how powerful intelligent event data would be to help you prepare for the recovery.
Don’t throw out your 2020 data – train your models to learn from the COVID-19 anomaly

By Dr Xuxu Wang, Chief Data Officer at PredictHQ

The COVID-19 pandemic has catapulted our world into unprecedented times. Beyond the terrifying health situation, the economic impact is stark. Companies are dealing with exceptional circumstances and today I want to share some insight into how your data science teams should be updating your models to prepare for the recovery.

The massive plummet in demand caused by restrictions as the pandemic threw communities and businesses worldwide into turmoil. While it is still too early to know when the economic recovery may start, we are supporting our customers to prepare their demand forecasting models and associated strategies – such as packaging, pricing, marketing, staffing plans and inventory management. Knowing when demand will start to recover in advance will be critical as many companies will need to rehire and up-skill their team, as well as re-engage their supply chain.

We published some analysis recently about the beginnings of a significant cluster of rescheduled events in September and October 2020. Many more new and rescheduled events will be logged over the coming months also. Events are very dynamic, so we will continue to update our API every minute to ensure it is always accurate.

This means companies need to be developing recovery plans now. This will require substantial updates to their models. The PredictHQ team has been working with our clients and as our Chief Data Officer, I have been tracking this support closely. I wanted to share the most common themes in our feedback on effective recovery planning.
Resist the temptation to throw out data from 2020

Most teams have decided not to invest much time into short-term demand forecasting for the second quarter of 2020. I agree with this as the next few months will be chaotic, because it is extremely difficult for models to forecast a key variable – government responses.

Most teams are instead focusing on updating their models for the final two quarters of this year, and into 2021. Several of the teams we have spoken with have mentioned dropping data from 2020 out of their demand forecasting models entirely and relying on 2019 and 2018 data.

As someone who has been working with time series modeling and anomaly detection for decades, I want to encourage you not to do this. This tactic is based on an incorrect assumption: that the world will return to exactly what it used to be prior to COVID-19.

Even if the world is very lucky and we can contain the virus as quickly as we hope to, recovery will take time. The ongoing fear of the virus, broken businesses and millions of unemployed people will have long-term impacts. Data-driven companies will be able to navigate this, but you can't build effective strategies on incorrect assumptions.

Don’t ignore anomalies – train your models to guide you through them

Training your models to recognize and understand anomalies builds its intelligence for when your company encounters a similar impact. While we are unlikely to face such a severe global impact anytime soon, city or regional shutdowns due to severe weather and natural disasters can have huge localized impact. PredictHQ tracks both, and they are far more common than pandemics.

Investing time into training your models to understand the impact, duration and recovery rate for your business during abnormal circumstances, such as shelter-in-place mandates, will enable your team to make smarter decisions at scale faster.

You will need to decompose the COVID-19 anomaly to be able to build models to steer your business through it. The COVID-19 anomaly has three main aspects. Understand each to enable you to build models that work.

1. The big drop in demand, so your model needs to detect the downward shift in the normal demand curve including long-term and short-term business trends as well as seasonalities.

2. Tracking the recovery rates and creating models to identify what your company's is likely to resemble so you can be prepared.

3. An increase of demand into the recovery, which will be spurred by the sizeable volume of rescheduled events. Your company needs to move swiftly to prepare for rescheduled events so your model needs to pick these up immediately and accurately.
Track demand data in recovering markets even if you don’t operate in them

In times of chaos and new situations, data scientists look to precedents and horizontal trends to construct new models or update their existing ones.

The novel coronavirus is different from every pandemic we’ve weathered before. As a data scientist and lover of history, I believe it is like a third world war that we’re all fighting together, this time against an invisible enemy. It is very unusual because other recent pandemics such as Ebola, SARS, Middle Eastern Respiratory Syndrome were not as widespread. The Spanish Flu may have been similar in Europe and the USA, but we don’t have data from then.

Therefore, the most valuable source of insight for the recovery rate in your key markets from the COVID-19 pandemic will be tracking how demand returns in economies that are further along in their recovery journey, such as China, South Korea and New Zealand. There are of course many variables, but as more countries recover, we will begin to gather insights into what revised baselines should be.

Key inputs for identifying your business’s recovery rate

- The Post-COVID19 recovery rate needs to be understood as a temporally dynamic changing feature. Data scientists will need to build this feature by learning from the national economies that appear to be recovering earlier than others such as China and South Korea.

- You will need to shift your expectations about the frequency of demand forecasting model iteration. The post-COVID-19 era will require a much higher frequency of updates and reviews of your models compared to normal demand forecasting models. Its requirements are likely to be closer in frequency to stock trading than set-and-forget demand forecasting algorithms from more productive and stable times.

- Industry-specific rebounds will be essential data sources because the scale and velocity of impacts of COVID-19 on different industries has been shown to vary considerably. We can assume that the recovery rates will be similarly different as well.

My team will be doing this work at scale as we update our ranking algorithms to reflect the impact of the COVID-19 recovery.

For example, an event scheduled in October that would have been ranked as 100 on our log-scaled impact of 0 to 100 in 2019 may this year be at 70 or 80. Including the coronavirus recovery impact into our rankings is essential, as many global companies rely on our events to refine their demand forecasts.
Update your baselines and identify your demand catalysts

Once you have an updated baseline for the first few weeks and months of the COVID-19 recovery, you will be able to re-engage with suppliers as well as re-hire or train staff to meet that demand.

I want to focus now on including events into your demand forecasting, as they are both indicators of demand you can prepare for in advance, as well as catalysts for demand. Optimizing for these is even more important when demand is low, and businesses have weathered months of dwindling revenue. If you have not attempted to include events in your forecasting, we recently published a guide for data scientists on how to do so, which is also in this Recovery Guide.

Once events begin to be rescheduled as well as new events planned, PredictHQ will publish weekly updates about the rate of event rescheduling, some of the key new events in major cities as well as insight on how to make the most of these events.

You need to be able to focus your efforts on the surges of demand that occur. Events drive these so tracking events from massive down to minor is key. Even the small events can cluster to create significant impact - we call these perfect storms of demand.

The easiest way to understand event impact at a glance is with our Aggregate Event Impact tool. Once you have correlated your historical demand with events and learned which ones (categories and scale) impact your business, you will be able to quickly see the impact in each of your markets. For example, the graph below is aggregated impact of events in Seattle in October 2019. You can also search by specific lat-longs, such as for each of your stores, properties, depots or warehouses.
Identifying new dates for significant and major events postponed during COVID-19

With hundreds of thousands of events postponed worldwide, you will need a programmatic way to know when events are rescheduled. Because there are so many events, it is impossible to track these manually, and a waste of data science team time to be finding, verifying and standardizing this data when they could be building and iterating on models.

My team is currently finalizing a series of models to link postponed event records with their new dates, so you can focus on inputting this into your models so you can target them. A quick overview of these models:

- Our systems already track and log when an event is postponed or cancelled almost instantly as we update the API every minute to ensure it is accurate.

- Our Data Science team is building machine learning models with advanced NLP techniques to be able to automatically identify when new dates are announced for postponed events. This will also be near instantaneously, so our customers can begin preparing as swiftly as possible.

- We are also building NLP models to create the auto-linkages between the event records that were postponed and the event records with new dates. Data scientists can use those linkages to forecast and track how much demand will shift, when and where.

Prepare for demand returning and more perfect storms of demand

This year and the coming recovery are probably the most dynamic time for events ever. Before the pandemic, thousands of high-impact events worldwide took place every week so they are impossible to track manually. This frequency of events will resume with time, but in the recovery the level of rescheduling and changes will make it particularly intense.

If you do not yet have access to our verified and ranked events, you can get in touch with our team now to ensure you have the demand intelligence you need to give your company the best possible shot at a strong recovery.
Demand planning for the COVID-19 recovery will be complex – five steps for coronavirus recovery teams to take now

By Richard Bray, Chief Operating Officer at PredictHQ

Demand planning is complex. It is based on historical transactional data, market research, surveys and more. So it’s no surprise many demand forecasting teams are feeling frustrated when it comes to planning for the COVID-19 recovery with so many unknowns and additional complexities.

How do you plan for going from the unprecedented downturn that caused next to no sales for many, to after the restrictions begin to lift and demand recovers? You can’t use your 2019 data as is, because this would force your models and business to assume the world will return to the new normal immediately.

The challenge in front of your coronavirus recovery team is three-fold:

1. Closely track and identify when the recovery is approaching so you can re-hire, re-train and re-engage your supply chain to ensure you can meet demand.
2. Once the recovery has commenced, follow data closely to track and estimate the recovery rate to inform a new and growing baseline for the immediate post-COVID-19 period.
3. Identify as many incremental demand opportunities as you can for your company to recover as quickly as possible.

When you consider many recovery teams will be doing a lot of this work with their company in survival mode and only a skeleton team, it’s daunting. To support your team, here are five simple steps to kick-start demand planning and your recovery preparation.

**Demand planning for the novel coronavirus recovery in five steps**

Times have changed and demand planning has to also. Typical aspects of demand planning such as product history, sales data, and seasonality won’t be enough to accurately conduct this process. Teams have to think about external data and events while planning. Implementing these steps to make your demand forecasting process fit for purpose ensures your demand analysis and planning are robust and flexible enough for the COVID-19 recovery.
1. Conduct an updated demand analysis that takes into consideration your new position, as well as cyclical demand and anomalies

Business as usual will return, but the route back to it will be bumpy. Two foundational factors have changed for almost every company: your resource and reserves position (and therefore flexibility and margins), as well as being in entirely uncharted territory for demand planning.

You need to take stock of where your company is today and re-assess core elements you've potentially not invested significant energy or team time into assessing in years. The key to this will be deconstructing your historical demand data to understand what drives it.

Decomposing your data and conducting time series modelling will identify the role of each of these major demand drivers:

- The exact impact of cyclical trends such as seasons or weekly patterns
- Weather
- Marketing campaigns by you or by competitors
- Events such as conferences, school holidays, sports games or severe weather
- Currency fluctuations for businesses with extensive international commerce

By investing the time to decompose your data, you'll be able to identify anomalies that contribute to both incremental and decremental impact. This means your company can create a more resilient and proactive recovery strategy. This work will require the investment of team time and potentially new data sources such as PredictHQ, but it will have a transformative impact on your demand forecasting in the recovery and for many years to come. McKinsey recently published a useful guide for chief data officers on utilizing new data sources, building secure data ecosystems and using both to inform your stress scenarios.

2. Establish a quantitative baseline and your temporally dynamic changing feature for the coronavirus recovery rate

The demand analysis outlined in the previous step will identify your updated quantitative baseline, as well as the levers you can pull to drive additional demand in the future.

You will now need to factor in your recovery rate. This will evolve rapidly, and differently for each industry and market. PredictHQ's chief data officer Dr Xuxu Wang explained more about how to formulate your coronavirus recovery rate as a temporally dynamic changing feature earlier in this guide.

This will influence your estimated baseline for demand recovery and enable your models to evolve accurately as new information becomes available such as restrictions lifting and sectors in lockdown re-opening.
3. Create data-driven triggers to understand and progress through the recovery phases

This updated demand analysis and baseline will guide your demand planning as the recovery nears. It will inform:

- **Workforce optimization:** How many staff, of which skill sets and what speed you will need to re-engage, re-hire or train them to meet demand.

- **Supply chain strategies:** When you would reach out to suppliers with orders and how swiftly to increase these. This will often include identifying which specific products are likely to be in high demand, so you can build resilience into the supply chain for key SKUs.

- **Company investment:** Changes to your team at this stage to set your business up for its best possible recovery.

These decisions are all time-based, which is better understood in these chaotic times as recovery progress based. Therefore, identifying triggers such as levels of restrictions or consumer confidence or booking/purchasing rates or stages for your team will bring clarity. This will inform decision making company-wide, and take the stress out of switching gears as your demand begins to grow again.

4. Proactively identify demand opportunities and prepare your strategies to make the most of them

While much of the world has to wait for the restrictions to lift, coronavirus recovery teams need to be proactive about identifying other catalysts of demand beyond the general demand, which will almost certainly be lower in the immediate pandemic aftermath. Hence why this process began with exploring the additional factors that can be harnessed to drive incremental demand for your business.

One clear indicator of demand recovery will be the rescheduling of postponed events as well as the scheduling of new events. These are useful because not only are they demand opportunities for your company, they also represent how communities are responding to restrictions at scale.

Plus, they will cause demand for many industries and are thus an opportunity, but only for prepared companies. For example, event impact on coronavirus recovery demand will include:

- **Conferences and expos** are likely to face attendee caps, but will recommence. PredictHQ is updating all of our event rankings to ensure our customers understand the reduced volume of attendees and will continue to verify and update events as the coronavirus recovery rate does.

- **Key observances** that people gather with family and friends for as this will impact food retail and transport, as well as potentially accommodation providers.

- **Sports games** have always been high impact drivers of people movement. While the sports industry won’t be able to fill their stadiums for a while (we will be publishing a blog post on sports recovery shortly) the impact on food retail, food delivery, transport, consumer packaged goods from people gathering at each other’s homes to watch the game or match has always been sizeable and is likely to grow.
• Community events such as fetes, fun runs and street fairs will have to maintain social distancing rules but will return and provide people with a much needed opportunity to connect and have fun.

5. Prepare your baseline recovery strategy with multiple reviews and opportunity to iterate as needed

No demand planning is complete without revision and assessment. The Coronavirus recovery is going to be an intense period of significant change, so you will need to review your demand forecasting and associated plans much more frequently than you would otherwise.

Establishing cross-functional review teams that can understand, analyze and act on new information will be critical. It may well require a wide range of staff, everyone from your data science teams tasked with forecast modelling, as well as operational staff who can provide feedback from the front line.

Making the most of your demand recovery planning

It’s critical to recognize that different markets will recover at different rates. Countries, states and cities will vary in how swiftly they bounce back, and each industry will have its own recovery rate and challenges.

To tap into the power of events as detailed above, it’s worth investing the time to work with the PredictHQ crew to correlate your historical transactional data with our verified and ranked event data so you can identify which events will drive demand in the recovery and beyond. Get in touch with our team to get access to the event categories and cities you need to understand better.

As restrictions ease and demand recovers, we will begin to share regular updates about the rate of events being rescheduled or new events being organized, as well as some of the highest impact events or clusters of events that are new each week. Make sure you receive these updates by signing up for our newsletter.
Only 33% of large events were canceled – most were postponed. How to track rescheduled dates now and into the COVID-19 recovery

By Richard Bray, Chief Operating Officer at PredictHQ

The novel coronavirus has caused devastating loss of life and significant economic stress. While we still have several months at least before we are able to resume normal life and an economic rebound begins, most companies are now working to update their demand forecasts to ensure they can access every incoming demand opportunity once restrictions lift.

For newcomers to PredictHQ – our systems aggregate and standardize millions of events worldwide, then we rank them by predicted impact. This gives us unique insight into how swiftly demand was evaporating last quarter. In February, the world experienced a record-breaking 500% increase in cancellations or postponements of significant and major events compared to the previous February. In March, this shot up even further to 825%, as many countries implemented lockdown or similar restrictions,
It's a tough time for business. If there is a silver lining in this monumental shift, it's that of the event changes only a third globally have been cancelled, compared to 66%, which have been postponed. For example, sports is one of our most impactful categories and in the US, only 11% of significant to major events have been cancelled, compared to 89% postponed.

For example, here are four major events in the USA that have been postponed rather than cancelled:

- The Boston Marathon in Boston
- Sun ‘n Fun Aerospace Expo in Florida
- The Sea Otter Classic (cycling + outdoor sports festival) in Monterey
- The New York International Auto Show in New York

Postponement rather than cancellations is good news in these difficult times because every rescheduled event will be an opportunity for your team when the recovery begins. But when are all these events being rescheduled? In this article we will explore what our data suggests as companies around the world try to make sense of these unprecedented times.

As soon as events begin to be rescheduled and new events scheduled at scale, we will be publishing weekly updates on the rate at which this is occurring in key markets as well as highlighting some of the highest impact events and clusters of events organized that week.

**When will the COVID-19 recovery begin?**

No one knows exactly when health authorities and countries will ease all their restrictions and begin to recover. But events will be useful indicators of demand and serve as catalysts for it, causing people movement and purchasing. They are complex to predict accurately as this requires hundreds of sources and many machine learning models to aggregate, standardize and verify them. But they are make-or-break for optimized demand forecasting, especially now when events are a leading indicator of demand recovery.

Below is a graph from our Aggregate Event Impact tool, which calculates and displays the combined impact of events on a particular location. Through this tool, our customers can track their relevant events in areas where they operated. Below is a visualization of the data in our Control Center, but most companies use the API endpoint directly in their modelling.

This graph displays the combined impact of all the world's events across seven key categories for this year. As you can see, the impact of events prior to COVID-19 was massive, and the negative impact of the pandemic was severe.

However, also evident is the growing impact of events currently clustered around September or October, when many rescheduled events have new tentative dates.
Many events don’t yet have new dates. Event data is very dynamic – it’s why we update our API every minute to ensure it’s always accurate. We anticipate that once recovery trajectories are clearer, there will be an even higher increase in events scheduled in the later quarters of this year. Of particular note are the hundreds of postponed large conferences and expos that will now be squeezed into three to six months rather than 12, as well as major sports events such as the postponed NBA, baseball and football.

How our Aggregate Event Impact tool works

Event reschedule rates will vary by country

It’s also important to note that the recovery commencement and duration will vary by country and state, potentially very significantly. Because so much is in flux at this stage, we are seeing most countries show a marked increase in events in late May but this is probably more to do with the CDC mass gathering advice. We urge people to be mindful that more event delays and postponements are likely for at least another three months. Because there will be thousands of impactful events being rescheduled or new events, manual tracking is simply impossible.

When the recovery begins, and demand and events return, we will begin sending out a weekly update of the rate of events that are rescheduled and new dates, as well as some of the highest impact events or clusters of events with new dates our systems have identified that week.

For example, China, the United States and Germany are all seeing a similar pattern of event dates, although they are likely to have quite different recovery trajectories based on when the virus peaked in each country.
Our systems check and verify every event constantly, and we also manually check the details of all events we rank at 90 or above. PredictHQ's ranking systems assign a log-scaled number between 0 to 100 to each event based on its predicted impact. Our data team is finalizing a new series of models that will link original dates to rescheduled dates, so companies are able to easily track the new dates for their most impactful events at scale.

For those charged with crafting strategies for when demand begins to recover, we encourage you to reach out to the PredictHQ team for support. We exist to help companies identify their demand catalysts and create more accurate forecasting models, and would love to help you.
See the combined impact of canceled or postponed events

By Peter Jansen, Head of Product at PredictHQ

Events are major catalysts of business. Even if you’re not tracking them and optimizing for them yet like our customers are, the huge surge in major event cancellations and postponements hit businesses worldwide in March and April, and lower rates of major events will impact demand for much of 2020.

PredictHQ aggregates and verifies millions of events worldwide, and ranks them by predicted impact. This means our customers know exactly which events are canceled or postponed, when they are rescheduled as well as details about the thousands significant and major events that are still planned over the next three months.

Many assume all attended events such as conferences and concerts have been canceled. But this is not accurate – the vast majority have been postponed and will be rescheduled once the virus’s trajectory is clearer. For example, looking at one of our categories of Sports we can see that while all major and significant events were impacted in March to May 2020, fewer than 15% have been canceled with around 85% postponed at the time of writing.

But how much does each event, cancellation and postponement impact locations where you operate? We recently launched our Aggregate Event Impact endpoint to enable teams to instantly see the combined impact of all events over a time period in their key areas. In April, we updated it to enable you to quantify the impact of canceled and postponed events.
When we launched this feature, it was focused purely on incremental demand so companies could identify their busiest days and weeks in advance. But as we worked closely with our customers as the impact of Covid-19 swept across the world, we realized we could turn it into a powerfully useful tool to track the impact of canceled and postponed events.

**How to use Aggregate Event Impact to understand the total event impact for a location**

The Aggregate Event Impact graph allows customers to see the total event impact for a location, such as a city, for a given time period. Simply choose the location and time from the filters to see the data visualized.

For example, let’s take a look at Seattle last year. Here is the Aggregate Event Impact graph for Seattle, USA, for April to June 2019:

![Aggregate Event Impact Graph](image)

This shows the total impact of all events happening in Seattle per day for this period. The impact figure is based on predicted attendance data, which is derived using many factors including venue capacity, historical attendance, the performers at an event and many other factors. It is not possible to rely simply on a listing of an event to identify the attendance. Using proxies such as the amount of tickets available or the venue capacity to get accurate predicted attendance numbers will be misleading.

The graph allows you to quickly identify peak days where many events are happening, as well as those days with lower demand. For example, on May 28, 2019 there were a number of events in Seattle such as:
- The Northwest Folklife Festival
- The Seattle International Film Festival
- A Texas Rangers vs Seattle Mariners baseball game
- The Annual Meeting of the Consortium of Multiple Sclerosis Centers and many more.

The Aggregate Event Impact value for the whole of Seattle using PHQ Rank™ on that day is around 97,000. This represents the total combined impact of all the events on that day. Please note this is an indicative number, not the exact total of expected attendees.

This value is designed to be used directly into your forecasting models once you have established correlation between your transactional data and our verified events data. Our customers use it to increase the accuracy of their demand forecasting, workforce optimization and dynamic pricing strategies. It will be a key tool for them to adapt their strategies week to week as the coronavirus impact continues, as well as to ensure their 2021 strategies have accounted for the coronavirus anomaly effectively.

**How to use Aggregate Event Impact to understand the total impact of event cancellations and postponements**

Our team made a series of updates to this tool in April, including a filter that allows you to choose canceled or postponed events to see the total impact of the canceled and postponed events in the selected time period. This shows the aggregate impact of those events for the original date they were scheduled on. For example, if a major event was canceled on March the 2nd the AEI value for that day would be 10,000 plus the impact values of the other events. The total shown is the total impact of all canceled or postponed events that were scheduled to happen on the selected days.

Choosing one of these options will show you the combined impact of all the canceled and postponed events for the selected location and time period. For example you can see postponed events in Italy over the month of April 2020 at the country level.
Aggregate Event Impact enables you to filter by active, postponed or cancelled, as well as by time, locations as well as by our rankings, which describe the predicted impact of events.

For example, the combined impact of event postponements in China in February to early March 2020 for events ranked significant i.e. PHQ Rank 60 to 80:

Here is combined impact of canceled significant events in the United States of America from February to early March 2020:
And here is the combined impact of cancellations for events ranked as important (PHQ Rank 40 to 60) in France for February to early March 2020:

![Graph showing aggregate event impact]

**Finding postponed and cancelled events with the PredictHQ API**

We recently shared a post about how you can find cancelled events in our API. You can also find postponed events with the API too by using the deleted_reason parameter. If you set `deleted_reason=postponed` in your query you will get all postponed events. If you choose `deleted_reason=cancelled,postponed` then you get both cancelled and postponed events. See our API documentation for more details.
Did you know you can export Aggregate Event Impact insights with our data exporter?

You can also export events into CSV or JSON format with our Data Exporter. In the Data Exporter choose “Deleted reason” of cancelled or postponed (or you can select both). Choose your standard criteria for the location you wish to see and the time period and then export your data.
This week we published a detailed demand forecasting guide on our technical documentation site and also as a Jupyter Notebook. It uses the Facebook Prophet to enable data scientists to identify the impact events have on demand and build more accurate forecasting models. Below is an excerpt and links to the full guide.

A key use of PredictHQ’s data is for use in demand forecasting. We provide APIs and tools for use in forecasting so you can model the impact of events on your demand. The goal is to increase your forecast accuracy by taking into account the impact of events on demand.

In this guide, we demonstrate how to use PredictHQ’s Aggregate Event Impact to improve the accuracy of a demand forecasting model. This guide shows you how to add features to your model that use the Aggregated Event Impact data.
We will first build a forecasting model using example customer demand data without events data as a baseline for comparison. We then incorporate our Aggregate Event Impact and holidays to build a second model with higher accuracy when predicting irregular demand spikes caused by events.

In this guide, we use the following open source technologies:

- Python 3
- Jupyter notebook for live coding and visualisation
- Pandas library for data manipulation
- Prophet library for demand forecasting from facebook
- Plotly for interactive visualisation

See also our API doc on how to Retrieve Aggregate Event Impact for more details on Aggregate Event Impact. You may also be interested in our getting started guide and correlation guide for data scientists. If you want to learn about our events data and learn how to correlate events with demand before diving into demand forecasting start with those guides.

**Example Scenario**

A hotel in Seattle has been performing demand forecasting using its historical data but found the model cannot predict the irregular demand spike patterns that may be caused by nearby events and holidays. They had found there is a correlation between their demand data and PredictHQ's aggregate event impact shown by using this correlation guide. Therefore the next logical step is to incorporate aggregate event impact (AEI) data into their forecasting model. After retraining their demand forecasting model using AEI and holiday data, an improvement in forecasting accuracy is observed.

Now let's dive in and get started!

In the following sample code we are going to show you how to use Facebook's Prophet OpenSource demand forecasting model to forecast future demand. First of all we will import a sample data set to get started with.

```python
import pandas as pd
import numpy as np
import plotly.graph_objects as go

# note: there an issues with prophet=0.5 and holidays=0.10.1
# follow here for a temp fix in hdays.py of the fbprophet package
# https://github.com/dr-prodigy/python-holidays/issues/277
from fbprophet import Prophet
```
Load demand data for 2017 to 2019:

```python
# Load demand data
```

The data should look like the following:

```python
In [3]:

demand_ts.head()
```

```markdown
<table>
<thead>
<tr>
<th>DATE</th>
<th>DEMAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-01-01</td>
<td>208.671460</td>
</tr>
<tr>
<td>2017-01-02</td>
<td>173.002159</td>
</tr>
<tr>
<td>2017-01-03</td>
<td>231.782956</td>
</tr>
<tr>
<td>2017-01-04</td>
<td>240.631985</td>
</tr>
<tr>
<td>2017-01-05</td>
<td>250.908314</td>
</tr>
</tbody>
</table>
```

Let's visualize the data.

```python
fig = go.Figure([go.Scatter(x=demand_ts.index, y=demand_ts['demand'], name='demand')])
fig.update_layout(title='Figure 1: Demand')
fig.show()
```
The diagram above shows three years of demand data that shows strong seasonality and irregular demand spikes patterns that may be caused by events and holidays.

Read the full guide in our Technical Documentation.