

## LDA model results

Variant	Topic	Keyword	Theme
Wuhan	1	People / flight / virus / quarantine / death	Wuhan first identified unknown pneumonia.
Wuhan	2	People / case / travelled / China / world	This virus was found also in the rest of the Italy, UK, US etc. Case number has come into global attention.
Wuhan	3	People / case / Wuhan / new / school	Situation in Wuhan was still severe and international education was suspended.
Wuhan	4	Case / death / confirmed / infected / home	Death case appeared in the US and terrified people forcing them to stay home. And WHO officially confirmed transmissibility of COVID-19
Wuhan	5	City / disease / America / spread / lockdown	Wuhan has announced municipal lockdown and the virus continued spreading in North America and Europe.

Variant	Topic	Keyword	Theme
Alpha	1	Year / vaccination / mask / quarantine / UK	Pfizer and Moderna announced upcoming arrival of mRNA vaccine. Alpha was first detected at the end of 2020 in UK.
Alpha	2	Relief / positive / work / strain / flight	Positive cases doubled after alpha variant was discovered. China banned direct flights from UK.
Alpha	3	Death / case / vaccine / 2020 / safe	Death cases arose over 75% in UK. Majority of them were alpha cases.
Alpha	4	New / year / Christmas / lockdown / home	UK, France, Finland government announced lockdown during Christmas holiday.
Alpha	5	Government / help / care / work / testing	Testing of Covid in UK became mature and publicly available. Government started systematic pandemic data analysis.

Variant	Topic	Keyword	Theme
Delta	1	Stop / mask / another / sick / India	India reported first delta case in May 2020. Stop mask action is popular in Europe.
Delta	2	ICU / news / booster / died / patient	Booster vaccine from Pfizer was said to be available at September 2020.
Delta	3	Hospital / many / test / death / party	Hospitals were under extreme pressure in India after escalating cases of delta reported.
Delta	4	Transmission / rapid / restricted / online / health	WHO confirmed that the transmissibility of Delta was 30% higher than original variant. Many educational activities have gone online.
Delta	5	Due / vaccination / worker / rising / mandate	Social distancing and mask mandate were remained unchanged in US. Many local organizations refused.

Variant	Topic	Keyword	Theme
Omicron	1	Vaccination / mask / last / number / friend	65% of adults in US are doubly vaccinated at 2021 fall.
Omicron	2	Never / school / family / first / positive	Omicron cases continued arising, remaining education online.
Omicron	3	Booster / kid / kit / bed / breaking	Multiple kid death confirmed in London and New York.
Omicron	4	Outbreak / symptom / rise / normal / ICU	Symptoms of Omicron were different from previous variant like loss of taste and smell.
Omicron	5	Flu / economy / million / living / inactive	WHO and CDC compared covid and flu which arouse a huge impact online.

Using content of individual tweets from the Twitter based on corresponding strain and keywords from the LDA model at a weight of 7:3, final scores are concluded.

COVID-19 Wuhan strain receives a sentimental score of 44.92 out of 100.

COVID-19 Alpha strain receives a sentimental score of 47.14 out of 100.

COVID-19 Delta strain receives a sentimental score of 48.94 out of 100.

COVID-19 Omicron strain receives a sentimental score of 50.94 out of 100.

Now taking share/retweet/like into account using the formula: original score + share / 100000 + retweet / 100000 + like / 100000.

Refined score of Wuhan is 48.76 out of 100.

Refined score of Alpha is 53.16 out of 100.

Refined score of Delta is 56.8 out of 100.

Refined score of Omicron is 57.77 out of 100.

Based on these two types of scores, the scores are in ascending order, which is Wuhan strain the lowest sentiment, Omicron the highest sentiment. Public's sentiment arises as the virus mutates, meaning that they no longer worry that much about COVID-19. This trend has to do with governmental policies and the promotion of vaccination. During Wuhan outbreak, people didn't even have available testing to identify the virus, but during later of delta and Omicron, matured vaccination has built to serve the society. Improved technology advancement helps people to become more positive. It makes sense for Wuhan strain to leave the worst impression since it is more fatal, and people are less protective toward it. Alpha was widespread earlier than Delta so that also explains its lower score.