**A Global Tracker of Antibody Therapeutics for the Prevention and Treatment of COVID-19**

**Abstract (**in 250 words**)**

Facing COVID-19 pandemic as a major global healthcare crisis, scientists worldwide are collaborating to prevent or treat COVID-19.  Antibody therapeutics hold enormous promise for treatment of COVID-19. Chinese Antibody Society, in collaboration with [The](https://www.antibodysociety.org/) [Antibody Society](https://www.antibodysociety.org/), developed the “COVID-19 Therapeutic Antibody Tracker” (“Tracker”) to track the worldwide antibody-based COVID-19 therapeutics in preclinical and clinical development. All the data were collected from the public domain and cross verified manually by volunteers.

The tracker is integrated into Chinese Antibody Society’s website using WordPress system. The data is regularly updated and proofread, and we also conducted exploratory data analysis and present visualizations of the latest trends on the tracker.

We categorized the data mainly depending on their targets, formats, status of development, developers and countries. Among the programs and molecules, over half of the COVID-19 antibody therapeutic candidates are targeting the SARS-COV-2 S protein and in mAb format. However, most of them are still in discovery or preclinical stage. USA and China are the two pioneer countries in developing COVID-19 antibody therapeutics. Most of the current COVID-19 antibody therapeutic candidates in clinical trials are repurposing drugs aimed at other targets, rather than the virus-specific protein.

**Statement of Significance (**in 50 words**)**

Chinese Antibody Society, in collaboration with [The](https://www.antibodysociety.org/)[Antibody Society](https://www.antibodysociety.org/)**,** developedthe “COVID-19 Therapeutic Antibody Tracker” (“Tracker”) to track the worldwide antibody-based therapeutics for prevention and treatment of COVID-19. The “Tracker” provides a useful tool for researchers and the general public to track current progress of drug development for COVID-19.

**Introduction**

The recent outbreak of COVID-19 has emerged from a public health emergency to a major global pandemic. As the COVID-19 pandemic is the global healthcare crisis, scientists worldwide are collaborating to prevent or treat COVID-19.  Antibody therapeutics hold enormous promise for treatment of COVID-19. To contribute our expertise to the globally joint efforts against the pandemic, Chinese Antibody Society, in collaboration with [The](https://www.antibodysociety.org/)[Antibody Society](https://www.antibodysociety.org/)**,** developedthe “COVID-19 Therapeutic Antibody Tracker” (“Tracker”) to track the worldwide antibody-based COVID-19 therapeutics in preclinical and clinical development.

**Establishment of the “Tracker”**

**To collect the data for building the “Tracker”, volunteers from** [**The**](https://www.antibodysociety.org/)[**Antibody Society**](https://www.antibodysociety.org/) **and the Chinese Antibody Societies collected all relevant data from public domain. As shown in Figure 1, in one way, we manually summarized the data from published literatures, search engines, company websites, biotech newsfeed, social media, government databases, etc. In another way, we automatically retrieve data from online databases such as ClinicalTrials.gov,** **the** [**Chinese Clinical Trial Registry**](http://www.chictr.org.cn/hvshowproject.aspx?id=23816)**,** the European Medicines Agency **and** the International Clinical Trials Registry Platform**. Unrelated information such as** diagnostic antibodies, polyclonal antibodies, clinical trials without specific indications to COVID-19 patients in experimental design, etc., were filtered out. For quality evaluation, all the final data used to build the “Tracker” were cross validated manually by at least two independent volunteers. We categorized the data as: target, format, status of development, developer and country, as well as references.

To build the “Tracker”, the data table containing filtered results was uploaded to the website of Chinese Antibody Society, which was build using WordPress system. We used WPDatatable Plugin to integrate the data table from backend to front end of the webpage. The integration established a connection between data source and website front end that allows real-time refreshing as the data are updated. On our “Tracker” website, we displayed the whole dataset as an interactive table, and grouped them by the target, format and status of development. We also performed data visualization and analysis based on the key features of the collected antibody therapeutic information that are most relevant to the scientific community and general public. These include visualization of the numbers of different targets, format and clinical status of the antibody therapeutics. In addition, we plotted the distribution of clinical status by country to visualize the progress of clinical trials among countries.

**Other functions of the “Tracker” or other potential analysis we can offer? (Weihan/Xing)**

**Data analysis and visualization**

To further elaborate the function of the “Tracker”, we performed data visualization and analysis based on the key features of the collected antibody therapeutic information. As shown in **Figure 2**, the “Tracker” is currently tracking 147 programs and molecules for COVID-19 interventions in preclinical and clinical development. Among the programs and molecules, 83 are targeting the SARS-COV-2 S protein. 60 were developed to target the host immune system for other diseases initially and now repurposed to treat COVID-19, which could alleviate some COVID-19 symptoms such as cytokine storm and inflammation instead of directly killing the viruses (Figure 2A). As shown in Figure 2B, over 81.63% of these therapeutics are in conventional mAb format, and the rest are either in bi- or tri-specific Ab, single domain Ab, fusion protein, or mRNA formats.

A close up of a logo

Description automatically generated

Figure 2A): Distribution of proteins targeted by therapeutic antibodies under development for Covid-19. For each target, the numbers shown are amount, followed by proportion of its amount compared to the total number of targets in development. 2B).Distribution of the formats for therapeutic antibodies under development for Covid-19. Only the top five formats by amounts are shown.

Among the programs and molecules we are tracking, over 61.9% are in preclinical and discovery stages (Figure 3A). Notably, most of the current COVID-19 antibody therapeutic candidates in clinical trials are repurposing drugs aimed at other targets rather than the S protein. Majority of the ones that specifically target the virus are currently in preclinical development, except four antibody candidates in clinical trials are targeting the SARS-COV-2 S protein and blocking the virus entry (see detail information in “Tracker”). USA and China are the two leading countries in developing COVID-19 antibody therapeutics (Figure 3B).

A screenshot of a cell phone

Description automatically generated

Figure 3A).Distribution of clinical trial status for all Covid-19 therapeutic antibodies being developed worldwide. The status are divided into discovery, preclinical, clinical pending, phase I, phase I/II, phase I/II/III, phase II, phase II/III, phase III and approved. 3B).Stacked bar chart showing the status of clinical trials by country. Color-coded are the status of clinical trials from dark blue(the earliest phase) to dark red(the latest phase). Notably, there are several therapeutic candidates being developed across multiple countries, so each participating country for those candidates receives a count in this chart.

**Conclusion and Perspectives**

While we are developing the “Tracker” and writing this review, the COVID-19 pandemic is evolving globally and resulting in unprecedented impacts on the worldwide healthcare, research and economy. COVID-19 requires urgent development of effective treatment. To help addressing the emergent needs, we developed the “Tracker” as a useful tool for researchers and public society to track current progress of drug development for COVID-19.

Acknowledgment

References