The characteristics and implications of epidemic reports during COVID-19 in the United States

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ABSTRACT

We summarized the basic practices and characteristics of epidemic reporting during the COVID-19 pandemic in the United States. Based on the analysis of the advantages and disadvantages of epidemic data reporting, we put forward some suggestions that should be used for reference and thus improve the epidemic data reports of infectious diseases.

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The reporting and warning system is critical for controlling the spread of infectious diseases at the onset of an epidemic. The system should be highly sensitive and efficient as the basis for saving lives and reducing human suffering. The World Health Organization, governments, and academic institutions are working to build and enhance infectious disease surveillance and early warning systems, and their most basic and critical task is infectious disease reporting. Here, we summarize the basic practices and characteristics of the US epidemic reporting system during COVID-19 and propose suggestions for improving infectious disease reports.

1. Basic practices and characteristics of epidemic reporting of COVID-19 outbreaks in the United States

After the outbreak of the epidemic in the United States, the number of confirmed cases and deaths quickly climbed to the first-place position globally. On October 1, 2020, the cumulative COVID-19 cases and deaths were 7,233,945 and 206,959, respectively. The number of COVID-19 cases in the United States ranks first and continues to grow, while the response to COVID-19 in America has been criticized. However, the federal and state professional infectious disease reporting work, which is methodical, accurate, efficient, and transparent to the public, has attracted world attention.[1,2] Monitoring and early warning provide a good data basis, and have also considerably promoted the enthusiasm of governments, social academic organizations (universities, scientific research institutes), non-governmental organizations, and individuals to participate in COVID-19 epidemic monitoring, early warning, and research and judgment. Mathematical models and analysis tools based on COVID-19 have promoted the academic progress of infectious disease monitoring and early warning technology.

1.1. Main body and channel of infectious disease epidemic report

In the United States, all state governments are responsible for reporting infectious diseases. Usually, when the infectious disease epidemic spreads across states or is listed as a national public health emergency, the health departments under the jurisdiction of the state governments rush to the front line of epidemic prevention and control, as per the legal authorization of "police power," and perform the responsibility of infectious disease epidemic information release. The local state government is not responsible to the Federal Department of Health and Human Services (HHS), and is not obligated to provide local epidemic data to the HHS and its affiliated Centers for Disease Control and Prevention (CDC), but only to the state legislature and voters. Therefore, the United States federal government and its CDC typically delay the release of epidemic data summary information by two to three days, and most American citizens do not pay much attention to the data released by the federal government and its CDC.

According to the comprehensive authorization of state constitution and laws, state governments in the US typically issue epidemic notifications in four ways.

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First, the state governments release epidemic data through their official Twitter accounts, making full use of the US social network and microblog service websites (www.twitter.com). The characteristics of "short message service" and "instant push" actively send epidemic information to the public. The purpose is to provide real-time and accurate epidemic data during the first time and avoid opaque, delayed information, and other uncertainties and rumors.

Second, all state governments use their official website or third-party data platforms to release the latest data update on the epidemic and become the best source for all sectors of society to obtain first-hand data of the epidemic. The data released in this manner must be released in the form of maps, data tables, data maps, and bulletin boards with "all elements," to allow the public and institutions to conveniently obtain authoritative and real-time data during the first time.

Third, the state governments use official government websites to publish specific information related to various forms of data and provide various epidemic notification pictures, which become the main source of detailed and in-depth epidemic information for all social parties (secondary data source). The purpose is to provide the public with further epidemic information and meet the needs of the public to forward information, which can greatly alleviate public anxiety.

In addition to the above three ways of releasing epidemic information, state governments also authorize third-party data service providers to provide the public with historical data services in the form of data tables. All states in the US can ensure that the public can obtain the latest data update on the epidemic from the above four channels.

1.2. Content and form of infectious disease epidemic report

The content and form of infectious disease epidemic reports differ according to the different information release channels.

Limited by the fact that Twitter can only provide text information of no more than 280 characters, on the "Official Twitter" account, each state regularly provides basic epidemic information such as the accumulative and new number of confirmed, suspected, hospitalized, and ICU patients, deaths, nucleic acid detection, and positive detection in its tweets. The links of HHS and the CDC of the federal government, as well as visualization modules of epidemic situations in the state and special websites, are also provided in these tweets. This way of publishing information by authorized message sending is more innovative, convenient, and refreshing than logging into the official website. It allows the public to get information right away, and provides further detailed guidance for understanding the epidemic situation. However, there are also some disadvantages. The text information of Twitter cannot be processed directly and cannot be automatically identified. At the same time, the amount of information available is limited.

The epidemic information on the "best current data source" release channel has the most complete content elements, the latest data update, and the most recognizable and visual application. The content of epidemic reports, in addition to basic epidemic information, also includes the result data based on statistical processing and mathematical model operation in the form of epidemic reporting. All data related to the epidemic must be published under the demand to be visualized, accessible, and available. All states use bulletin boards, data maps, data tables, statistical charts, and other methods to publish epidemic data. The most commonly used form of expression is the dashboard. This method solves the problem of text information being difficult to be automatically analyzed and judged by a machine, thus removing the obstacles of various data analysis models and tools to directly use epidemic data. It reduces manual intervention, improves the level of automation, and

ensures continuous monitoring and early warning of epidemic data. It is also necessary to make full use of epidemic data and give full play to its effectiveness, without setting up technical barriers for the public, greatly stimulating the wisdom and creativity of the people, and providing power for in-depth mining and analysis of epidemic data for more precious use.

The "secondary data source" release channel mainly provides detailed information about the latest update on epidemic data in the form of text, such as the basic information of typical cases, the cause of the disease, epidemiological investigation results, the infection chain, gathering places, epidemic evolution characteristics among others, as well as hierarchical data such as age, gender, occupation, and travel history. These contents can alleviate the public's anxiety about the epidemic situation of infectious diseases, provide the details of infectious disease transmission as far as possible, and meet the needs of those concerned about the epidemic situation. Simultaneously, each state government also provides various forms of epidemic data, epidemic situations, case details, and expert views of beautiful pictures for the public to download. This form of information can be easily forwarded by the public through a variety of new media, playing a key role in shielding the grapevine, eliminating rumors, increasing transparency, and striving for public cooperation.

On the "historical data" release channel, the third-party platforms for data sharing of each state provide concise and complete historical information of the basic epidemic situation in the form of data tables. According to the characteristics of the epidemic situation in different periods, they provide visual and bulletin board data screenshots of two to four time nodes of COVID-19 every day. This makes it possible for the public to trace and duplicate historical data.

1.3. Quality supervision and evaluation of infectious disease epidemic report

Although the information on infectious diseases in the United States is released by the state governments, federal agencies and third-party social organizations supervise and evaluate the quality of infectious disease reports in each state. During the outbreak of the epidemic in the United States, a complete and standardized evaluation system was established to evaluate the daily situation of the epidemic. In the United States, 16 independent indicators and elements, classified into five categories, are considered the COVID-19 epidemic reporting criteria (shown in Table 1). After the state government publishes the epidemic information every day, the computer system automatically studies and judges the information according to conditions such as whether the information is published in time, whether some information is missing (and if so, how much), whether the information meets the quality requirements, and gives the evaluation of five grades, including A+, A, B, C, and D, which is made transparent to the public in time. This makes the state governments deal with the epidemic release and reporting work in a timely, complete, scientific, and accurate manner, and take the initiative to accept the supervision and evaluation of the public.

2. Suggestions on reference and improvement of infectious disease epidemic report

2.1. Epidemic data of infectious diseases should be regarded as social public property

During the infectious disease pandemic, the supply of infectious disease epidemic data has the characteristics of "indivisibility of utility," "non-competitiveness of consumption," and "non-

Table 1
American COVID-19 Quality Evaluation Criteria for Epidemic Report.

Serial number	Category	Purpose	Metrics	Indicator Comments
1	Reporting	These factors evaluate how well states format and publish their COVID-19 data	Is the state's official COVID-19 website the best source that exists for that state's consistent, reliably- updated data?	
2			Does the state format its COVID-19 data in a machine-readable way?*	
3	Testing data completeness	These factors measure whether a state is publishing complete basic testing data.	Is the state reporting the total number of positive test results?	
4			Is the state reporting the total number of negative test results?	
5			Is the state reporting the total number of tests conducted?	
6	Patient outcomes	These factors evaluate whether a state is reporting on COVID-19's effects on patients and healthcare systems in their state.	Is the state reporting how many patients are hospitalized with COVID-19?	
7			Is the state reporting how many patients with COVID-19 are being treated in ICUs?	
8			Is the state reporting how many patients with COVID-19 are on ventilators?	
9			Is the state reporting how many patients have recovered from COVID-19?	
10	Demographics	These factors evaluate whether a state reports basic COVID-19 data (case count and deaths) for the demographic categories identified as most immediately useful by epidemiologists, data scientists, and reporters we have consulted with.	Is reported data broken down by patients' pre-existing conditions?	We asked states to distinguish between racial and ethnic categories to improve the usefulness of the resulting data. You can read more about that distinction on the project blog.
11			Does the state break down reported COVID-19 cases into racial categories?	
12			Does the state break down reported COVID-19 cases into ethnic categories?	
13			Does the state break down reported COVID-19 deaths into racial categories?	
14			Does the state break down reported COVID-19 deaths into ethnic categories?	
15	Other	These are two factors identified to us as immediately meaningful and relevant for researchers and the public that did not fit into the above categories, but form part of our grading factors.	Does the state report hospital capacity?	
16			Does the state report its medical data in the format of line lists?	

(*) Extra credit factor: the score for this factor can increase a state's grade, but is not required to achieve an A.

exclusiveness of benefit," so it has the basic attributes of social public properties.[3] The government has a natural advantage in the convenience of collecting and collating infectious disease epidemic information, and has the responsibility of reporting and providing epidemic data in response to major infectious diseases. In addition to the disclosure and reporting of epidemic data on infectious diseases other than COVID-19, the government should also adhere to the concepts of openness, transparency, sharing, and freedom, and fully make the epidemic data of infectious diseases open to society, instead of limiting the epidemic data of infectious diseases to professionals and institutions within the system, making it difficult for the public to effectively obtain relevant data.[4] While fully providing the public with the infectious disease epidemic data, we should provide professional and comprehensive data interpretation and analysis work at the same time. This guides the public to correctly understand and scientifically deal with the epidemic situation of infectious diseases, thus mastering the correct methods and means of dealing with the epidemic situation of infectious diseases, helping to prevent and control infectious diseases. In addition, the full supply of infectious disease epidemic data can greatly promote all sectors of society to carry out independent and innovative data mining and model calculation around

infectious disease epidemic data, which can effectively promote the progress and development of science and technology, and make up for the lack of "data sleep."

2.2. Infectious disease epidemic data should be released to the public in a more pro-people and convenient way

Countries all over the world have legislated to regulate the disclosure of epidemic data of infectious diseases, and the way this data is disclosed determines its effectiveness and its willingness to meet the public demand for epidemic data. One of the key evaluation indicators is how epidemic data on infectious diseases are published. This determines the value of the data available to the public. In general, public properties should serve the public without distinction. For infectious disease epidemic information, the public must first be able to directly and fully obtain these data. Second, the public must be able to correctly recognize the significance expressed by these data. Third, the public must have the convenience of scientific utilization, mining, and processing of these data. This indicates that the epidemic data of infectious diseases should be published and reported in a machine-readable manner with scientific and reasonable data density, the commonly used

statistical results, whose interpretation and available value should be provided as much as possible.

2.3. The release and reporting of epidemic data of infectious diseases should be supervised and evaluated

Generally, the perspectives that can be used to monitor and evaluate the data of infectious diseases are mainly focused on whether the data is timely, the data update cycle is in working order, the data elements are complete, the data are machine-readable, and whether the data relevant to the event background are available. This kind of evaluation and supervision standard will be welcomed by the public[5] and continually updated. It is also the supervision of the government's public release and reporting of infectious diseases,[6] so as to benefit the public more widely.

2.4. Society and individuals should be encouraged to actively participate in the innovative research of infectious disease epidemic data

The adequate, timely, and readable release and reporting of infectious disease epidemic data will inevitably bring social and personal forces to actively participate in the mining and research of infectious disease epidemic data, bringing about the prosperity of academic research and the continuous emergence of innovative achievements, which can significantly enlighten people's wisdom and exert folk wisdom. However, there should also be sufficient scientific power and rule of law capacity to avoid misuse, fallacy, and abuse of infectious disease epidemic data.[7]

2.5. The release and reporting of infectious disease epidemic data should become an opportunity for public science popularization and health education

Although the pandemic of infectious diseases damages people's lives and health, it is the best time for people to strengthen their cognition and understanding of the prevention and control of infectious diseases. The release and reporting of the infectious disease epidemic data is the most effective opportunity to attract public attention to epidemic indicators and the significance of data changes. The outbreak of COVID-19 has caught the global public unprepared. In the regular report of daily epidemic data, we pro-

foundly realized the great concern and demand of the public for the epidemic data of infectious diseases.[8] At the same time, it should also be seen that it is in this process that scientific knowledge, basic practices, and living habits of the prevention and control of the COVID-19 epidemic are rapidly mastered by the public, and it is applied in social life scientifically and reasonably.[9]

CRediT authorship contribution statement

Yi Han: Writing – original draft. **Jie Luan:** Investigation. **Xiongli Xu:** Supervision. **Shanshan Lu:** Supervision. **Meng Li:** Supervision. **Jianbo Ba:** Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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