COVID-19 has changed the world since it was first discovered in Wuhan, China in December 2019. Many countries imposed lockdowns to reduce SARS-CoV-2 transmission and minimize the need for hospitalization and/or an ICU. Even though, by the end of June 2021, more than 181 million cases had been registered and more than 3.9 million people had died around in the world [1]. This health emergency gave rise to highly articulated systems of data collection in order to keep track of the advance of the disease in every country. One of the most used and cited of these systems was created and is maintained by Johns Hopkins University [1,2].

Lockdowns had a huge impact on people’s lives, making home-office the rule, closing schools, restaurants, and non-essential stores, and ultimately, saving millions of lives. The decrease in economic activities and transportation had a positive side effect, reducing air pollution in many cities/countries [3-5]. Air pollution causes more than 7 million deaths each year and particulate matter (PM) is the component most associated with health problems, such as ischaemic heart disease, lung cancer, cerebrovascular disease, chronic obstructive pulmonary disease and lower respiratory infections [6,7].

COVID-19 effects on air pollution levels raised a question about air quality data accessibility. The last update for the Air Quality Database from the World Health Organization (WHO) lists PM data for 4300 cities in 108 countries, comprising data from 9690 air quality monitoring stations [8]. Most stations are located in USA, Europe, Japan and China and the total number of stations and cities monitored in the world is, in fact higher comprising more than 15 000 air quality monitoring stations in over 6000 cities [9]. At least partly, the differences between the numbers in these two reports may reflect data accessibility. Access to historical air pollution data varies widely and many cities around the world do not make data readily available. For those cities which have historical air pollution data and make them available, the way they are provided, and their accessibility is highly variable. Table 1 compares air quality data availability for 23 selected cities, in different regions of the world and different levels of air pollution. Islamabad has no city-specific website and the national one.

According to WHO, air pollution causes 7 million deaths a year, however many cities do not monitor air pollution or do not make data available.

| Table 1 | Comparing Air Quality Data Availability for Selected Cities |
|-----------------|-----------------------------------------------|
| City            | Country          | Data Availability | Remarks                  |
| Islamabad      | Pakistan         | No               | City-specific website    |
| Beijing        | China            | Yes              | National website          |
| Los Angeles    | USA              | Yes              | County website            |
| Mexico City    | Mexico           | Yes              | State website             |
| Tokyo          | Japan            | Yes              | City website              |

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| City/PM$_{2.5}$ Annual Mean (µg/m$^3$) | Live Data/Historical Data Sets | Data Sets for Individual Stations | Search for all Stations/Pollutants at Once | Time Frame Availability (PM$_{2.5}$)† | Restriction for Time Frame Search | Page in English/Data Search | Additional Features/Issues | Website |
|----------------------------------------|---------------------------------|----------------------------------|--------------------------------|-------------------------------|---------------------------------|-----------------|---------------------------|---------|
| Adelaide (7)                           | Yes/Yes (csv files)             | Yes                              | No                        | 2013-To date                  | None                            | NA              | Not evaluated              | https://www.epa.sa.gov.au |
| Auckland (6)                           | Yes/Yes (csv files)             | Yes                              | No/No                     | Not evaluated                 | None                            | NA              | Website not user friendly | https://environmentauckland.org.nz |
| Beijing (73)                           | Yes/Not evaluated               | Not evaluated                    | Not evaluated             | Not evaluated                 | No/NA                           | Website cannot be translated | http://tx.bjymmc.com.cn |
| Berlin (16)                            | Yes/Yes (csv files)             | Yes                              | No/Yes                    | 2016-To date                  | 1 y at a time                   | Yes/No          | Data in graphs             | http://ufstdaten.berlin.de/lqi |
| Buenos Aires (N/A)                     | No/Yes (pdf files)              | Yes                              | No/Yes                    | 2010-To date                  | 1 mo at a time                  | No              | 2-mo delay on reports      | https://www.buenosaires.gob.ar/ambiental |
| Dubai (54)                             | Yes/Upon payment                | Not evaluated                    | Not evaluated             | Not evaluated                 | Yes/NA                          | None            |                           | http://www.dubaiairengov.org |
| Islamabad (66)                         | No/No                           | NA                               | NA                        | NA                            | NA                              | Yes/No          |                           | http://www.environment.gov.pk/index.php |
| Johannesburg (41)                     | Yes (AQI)/Yes (xls files)       | Yes                              | Yes/Yes                   | 2016-To date                  | None                            | NA              | Lack of continuous data    | https://naagis.environment.gov.za/home/index |
| London (12)                            | Yes/Yes (csv files)             | Yes                              | Up to 6 stations/No       | 2009-To date                  | None                            | NA              | Data in graphs, different times (15'-24 h) | https://www.londonair.org.uk |
| Los Angeles (12)                       | Yes/Yes (csv files)             | Yes                              | Yes/No                    | 1999-To date                  | 1 y at a time                   | NA              |                           | https://ww2.arb.ca.gov |
| Mexico City (22)                       | Yes/Yes (csv files)             | Data sets contain all stations   | Yes/Yes                   | 2003-To date                  | None                            | No/NA           |                           | http://www.aire.cdmx.gob.mx |
| Milan (27)                             | Yes/Yes (csv files)             | Yes                              | No/5 pollutants at a time | 2007-To date                  | 1 y at a time                   | No/NA           | Data sent by email; search is troublesome | https://www.arpalombardia.it |
| Moscow (14)                            | Yes/Yes (csv files)             | Data sets contain all stations   | Yes/Yes                   | 2007-To date                  | None                            | Yes/NA          | Data in graphs, search is troublesome. | https://mosecom.mos.ru/ (live data) |
| New Delhi (143)                        | Yes/Yes (csv files)             | Yes                              | Yes/Yes                   | 2014-To date                  | None                            | Yes/Yes         | Data at different times (15min-24 h) | https://app.cpcbccr.com |
| New York (7)                           | Yes/Yes (xls files)             | Yes                              | Yes/Yes                   | 2015-To date                  | None                            | NA              | Older data: US EPA website | http://www.epa.gov/airquality-data (older data) |
| Paris (16)                             | Yes/Yes (csv files)             | Data sets contain all stations   | Yes, download station or pollutant data | 1999-To date                  | None                            | No/No           |                           | https://www.airparif.asso.fr |
| Rome (15)                              | Yes/Yes (pdf files)             | Only for real-time data          | Yes/No                    | 1999-To date                  | 1 y at a time                   | Yes/NA          | Search is troublesome.     | http://www.airpalazio.gov.it |
| Santiago (29)                          | Yes/Yes (csv files)             | Yes                              | No/No downloaded separately | 1997-To date                  | None                            | No              | Data in graphs             | https://sinca.mma.gob.cl |
| São Paulo (17)                         | Yes/Yes (csv files)             | Yes                              | 1 station/3 pollutants a time | Not evaluated                 | 1 y at a time                   | No              | Requires registration      | https://qualar.cetesb.sp.gov.br |
| Seoul (26)                             | Yes/Yes (CSV files), but in Korean | Yes                              | No/Yes                    | 2013-To date                  | 2 mo at a time                  | Yes/No          | Hard to navigate; search is troublesome. | https://www.arkorea.or.kr |
| Sydney (8)                             | Yes/Yes (csv files)             | Yes                              | Yes/Yes                   | 2012-To date                  | None                            | NA              |                           | https://www.dpie.nsw.gov.au |
| Tokyo (17)                             | Yes/Yes but in Japanese         | Not evaluated                    | Not evaluated             | 2000-To date                  | None                            | Yes/No          | 6-mo delay on reports; website cannot be translated | https://www.j (:kankyo.metro- tokyo.lg.jp |
| Venice (26)                            | Yes/Only daily bulletins        | Yes                              | Yes/Yes                   | 2010-To date                  | Not evaluated                   | No/NA           | Data upon request (csv files) | https://www.arpa.veneto.it |

N/A – not applicable, y – year, mo – months, min – minutes
*PM$_{2.5}$ data from WHO Global Ambient Air Quality Database, 2018, https://www.who.int/airpollution/data/cities/en/, except for Dubai, which was calculated from [8].
†Time frame availability was analysed for PM$_{2.5}$ data. Data for other pollutants usually have larger time coverage.
Detailed air quality data should be freely available to improve transparency and data availability. Cities/countries should work on providing either an English webpage or a website which can be translated by common web browsers. A global service with historical data from all the available stations on the world would be the ideal solution.

In some cases, the absence of an English webpage or its limited functionality is a real problem. This issue can sometimes be overcome with automatic translation functions available in internet browsers. However, it is often impossible to access air pollution data. This is the case for Beijing. The information is apparently there, but translation engines are not able to translate them. In this case, websites that mirror some air pollution data in China and can be automatically translated, such as China’s air quality online monitoring and analysis platform-AQI [10] may be a way to get some data. Japan is the country with the largest coverage of air quality stations per area [9]. However, Tokyo air quality website makes it virtually impossible to access the data without knowing Japanese. There is an English webpage but with only limited functions. For Seoul, the English webpage has no data search function. The Korean website, when accessed by browser translation, is difficult to navigate and find the data, especially for individual air monitoring stations. For Moscow, interestingly, current year data can be visualized in graphs for each air quality monitoring stations and air pollutant but cannot be downloaded. Data download is possible in another website which has an English webpage. However, search is troublesome, and data are downloaded partially in English and partially in Russian.

Despite the absence of English versions, some websites work well with browser translation and may be accessible for people who do not speak the original language. This is the case for Venice, Milan, Rome, Madrid, Mexico City, Buenos Aires, and São Paulo. Berlin has an English webpage but with no data search function though the German website can be translated enabling data search. For Paris, the website available until early 2021, had an English webpage with the same functions as the French website. Unfortunately, the new website does not have an English version anymore. Finally, São Paulo is the only city which requires registration to access the data. As examples of data availability and accessibility, it is noteworthy to mention London and New Delhi websites which are easy to navigate and allow download of data with different time intervals from 15 minutes to 24 hours.

The purpose here was to compare air pollution data accessibility in different cities around the world. Despite some good examples, many cities need to improve data accessibility. Seoul, Tokyo, and Beijing, some of the cities with major problems in air pollution data accessibility due to language issues, would benefit from the experience from cities like London and New Delhi. Islamabad, one of the most polluted capitals in the world, should give priority to improving data transparency. Besides Islamabad, many other highly polluted cities in Southeast Asia or the Middle East do not have any record of official air quality monitoring. These include Peshawar, another Pakistan city, Ulaanbaatar, Kabul, Manama, and Kathmandu. For all of them, except Kabul, US Embassies and Consulates are a helpful alternative data source since they have their own air quality monitoring [11]. Other agencies like US Environmental Protection Agency (EPA) and European Environmental Agency (EEA) provide data access for several US and European cities, respectively [12,13]. Despite their value, it is not always possible to search for specific air quality monitoring stations or identify them.
Air quality depends on monitoring, data availability, and policies to decrease air pollution levels, which help to reduce health problems and deaths caused by air pollution. Changes in air pollution, caused by COVID-19 pandemics, brought air quality to attention of the public and governments, which should be used to speed up the adaptation of agencies like US EPA and EEA to allow more detailed air quality data search. Besides this, it should also induce cities/countries to improve transparency and provide English webpages with full data access. Finally, a global service which would be updated in real-time with historical data from air quality monitoring stations from all over the world, like the Johns Hopkins University website for COVID-19, would be a really useful tool, which would greatly increase transparency and accessibility to air quality data.

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1. Johns Hopkins University & Medicine. Coronavirus Resource Center. Available: https://coronavirus.jhu.edu/map.html. Accessed: 28 June 2021.
2. Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time. Lancet Infect Dis. 2020;20:533-4. Medline:32087114 doi:10.1016/S1473-3099(20)30120-1
3. European Space Agency. 2020. Coronavirus lockdown leading to drop in pollution across Europe. Available: https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-5P/Coronavirus_lockdown_leading_to_drop_in_pollution_across_Europe. Accessed: 25 May 2021.
4. Mahato S, Pal S, Ghosh KG. Effect of lockdown amid COVID-19 pandemic on air quality of the megacity Delhi, India. Sci Total Environ. 2020;730:139086. Medline:32375105 doi:10.1016/j.scitotenv.2020.139086
5. Chen K, Wang M, Huang C, Kimney PL, Anastas PT. Air pollution reduction and mortality benefit during the COVID-19 outbreak in China. Lancet Planet Health. 2020;4:e210-2. Medline:32411944 doi:10.1016/S2542-5199(20)30107-8
6. World Health Organization. Air Pollution. Available: https://www.who.int/health-topics/air-pollution#tab=tab_1. Accessed: 28 May 2021.
7. Cohen AJ, Brauer M, Burnett R, Anderson HR, Frostad J, Estep K, et al. Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015. Lancet. 2017;389:1907-18. Medline:28408086 doi:10.1016/S0140-6736(17)30505-6
8. World Health Organization. Air quality database (Update 2018). Available: https://www.who.int/data/gho/data/themes/air-pollution/who-air-quality-database. Accessed: 28 June 2021.
9. Carvalho H. The air we breathe: differentials in global air quality monitoring. Lancet Respir Med. 2016;4:603-5. Medline:27423918 doi:10.1016/S2213-2600(16)30180-1
10. AQI - China's air quality online monitoring and analysis platform. Available: https://www.aqistudy.cn/. Accessed date: 25 May 2021.
11. AirNow - US Department of State. Available: https://www.airnow.gov/international/us-embassies-and-consulates/. Accessed: 25 May 2021.
12. European Environmental Agency. Air pollution. Available: https://www.eea.europa.eu/themes/air. Accessed: 26 May 2021.
13. United States Environmental Protection Agency. Air Data: Air Quality Data Collected at Outdoor Monitors Across the US. Available: https://www.epa.gov/outdoor-air-quality-data. Accessed: 26 May 2021.

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