D-VIDE: A Dashboard for Visualizing Infectious Disease Epidemiology and its Applications to COVID-19 for Local Counties

Osman N Yogurtcu[1a], Artur A Belov[1a], Richard A Forshee[1], Carolyn A Wilson[2]

[1]Center for Biologics Evaluation and Research (CBER), Office of Biostatistics and Epidemiology (OBE), [2]Center for Biologics Evaluation and Research (CBER), Immediate Office of the Director (IOD)

[a]Equally contributed

Background

Need for Local Infectious Disease Surveillance

Surveillance of local infectious disease dynamics is a critical aspect of public health safety as it helps make personal and administrative decisions about the daily routines of life. For example, when FDA issued maximal work at home orders due to the SARS-CoV-2 outbreak, many laboratories were shut-down and lab-based Principal Investigators, support scientists and trainees were asked to work from home on non-laboratory-based assignments. In rapidly evolving disease outbreak situations, transparent and easily accessible local epidemiological surveillance tools are much needed.

D-VIDE: Visualizing Infectious Disease Epidemiology

We developed D-VIDE, a versatile data visualization and analysis tool, to raise awareness on local infectious disease trends based on real-time epidemiological data. D-VIDE may be instrumental in identifying emerging public health risks early and accordingly taking mitigatory actions such as those about allowing employees or students to return to their laboratories, workplace, and college campuses. D-VIDE can be quickly customized for any infectious disease and locality.

Method

1. **Import** data on local infectious disease cases and deaths.
2. **Analyze** the data to determine whether certain guidelines have been met regarding relaxation of non-therapeutic risk mitigations.
3. **Present** data and analysis in a daily updating dashboard.

The front end of our framework is written in Python/Dash and served through Heroku. The statistical analysis back end code is written in R and updated automatically to the dashboard. D-VIDE has both a public-facing side and a private side to help keep confidential information and data analysis private to the institution using D-VIDE.

Disclaimer: The views expressed in the article are those of the authors and may not reflect the views of the FDA.

Outbreak surveillance made easy.

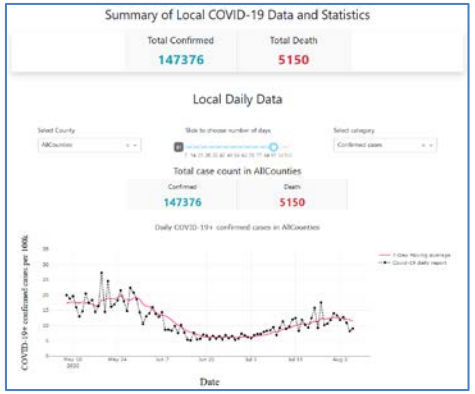
Powerful statistical analyses and visualization for infectious disease epidemiology in your web browser.

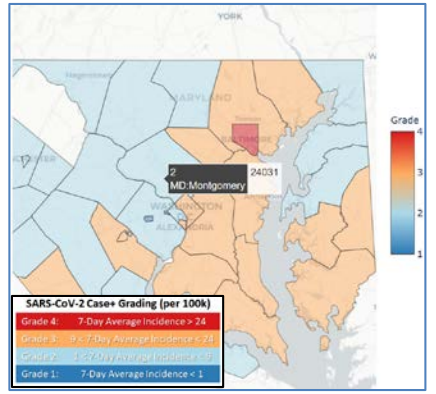
Scan QR code to access additional information online

Results

The first D-VIDE application focused on analysis of DC-Maryland-Virginia (DMV) local COVID-19 trends

The US county-level data are taken from New York Times COVID-19 database[1]. DMV area county populations were obtained from US Census Bureau (2019 Data[2]). Color scheme of the dashboard was selected such that it is red-green colorblind safe[3].





Conclusions & Next Steps

- ☑ D-VIDE framework is flexible. It has public and private sides to secure confidential information while having data transparency.
- ☑ Powerful statistics-based epidemiological data analysis & visualization.
- ☐ Next Step: Incorporate model forecasts based on adaptations to best performing approaches.
- ☐ D-VIDE for other important infectious diseases (e.g. Influenza).

References

1. https://www.nytimes.com/interactive/2020/us/coronavirus-us-cases.html
2. U.S. Census Bureau, Economics and Statistics Administration
3. Color scheme choice: colorbrewer2.org.

ANALYSIS OF DMV AREA LOCAL COVID-19 TRENDLINES

This dashboard presents an analysis of the COVID-19 infection trendlines in the DC-Maryland-Virginia area. This analysis concerns 40 counties in the DMV area - roughly 10 million inhabitants.

1. According to our statistical analysis, as of 2020-08-19, 28 of the 40 local counties have a downward trajectory of documented cases within the last 14-day period as suggested by the White House Opening up America Again Guidelines.

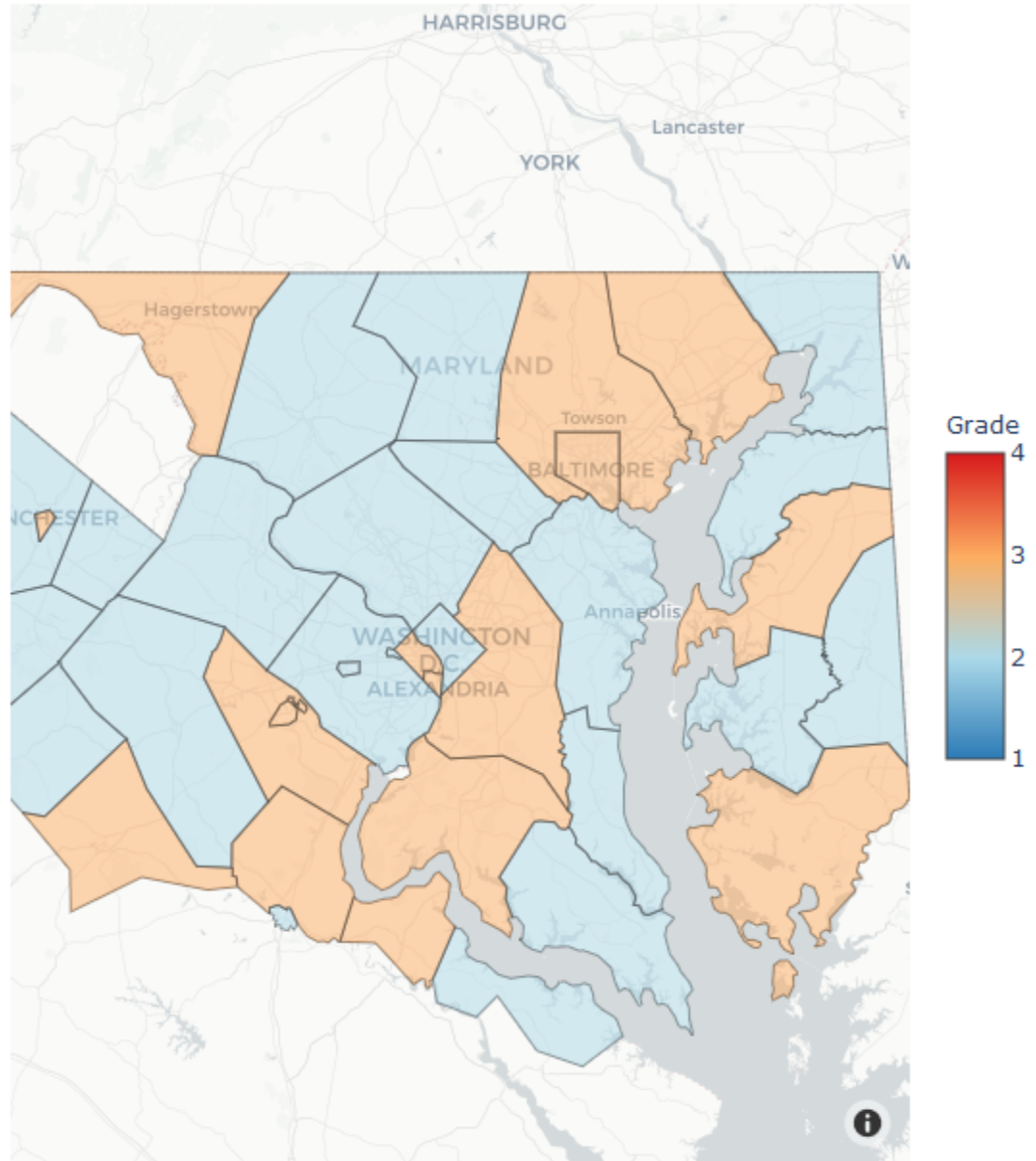
2. There is an overall 18.58% decrease in documented new positive cases today with respect to two weeks ago. This calculation is performed over 7-day rolling averages.

3. Details on our statistical analyses and data can be obtained from our PRIVATE REPORT.

The county risk levels are color-coded based on their 7-day average COVID-19 case+ incidences per 100,000 people as follows:

SARS-CoV-2 Case+ Grading (per 100k)

Grade 4:	7-Day Average Incidence > 24
Grade 3:	9 < 7-Day Average Incidence < 24
Grade 2:	1 < 7-Day Average Incidence < 9
Grade 1:	7-Day Average Incidence < 1



Total Confirmed	Total Death
160286	5295

Local Daily Data

Select County

Select...

- DC:District of Columbia
- MD:Anne Arundel
- MD:Baltimore
- MD:Baltimore city
- MD:Calvert
- MD:Caroline

Slide to choose number of days

105

7 21 35 49 63 77 91 105 119

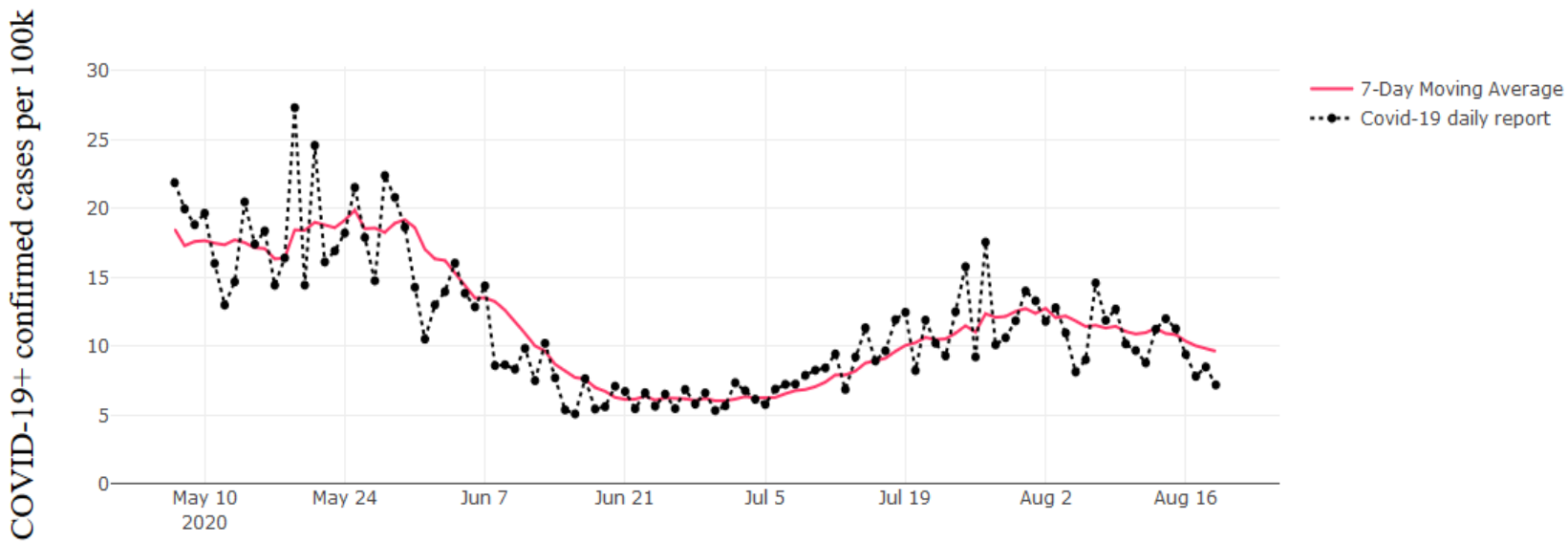
Select category

Confirmed cases

Total case count in AllCounties

Confirmed	Death
160286	5295

Daily COVID-19+ confirmed cases in AllCounties



New Positive Case Trends

County	Population	Jul 30-Aug 05	Aug 06-Aug 12	Aug 13-Aug 19
DC:District of Columbia	705749	444	516	395
MD:Anne Arundel	579234	516	366	303
MD:Baltimore	827370	1243	797	718
MD:Baltimore city	593490	1128	1039	651
MD:Calvert	92525	101	55	33
MD:Caroline	33406	23	13	17
MD:Carroll	168447	97	62	51
MD:Cecil	102855	60	42	25
MD:Charles	163257	151	137	129
MD:Dorchester	31929	34	25	30
MD:Frederick	259547	73	98	149
MD:Harford	255441	202	156	168
MD:Howard	325690	276	224	184
MD:Kent	19422	11	8	8
MD:Montgomery	1050688	671	665	540
MD:Prince George's	909327	1123	940	841
MD:Queen Anne's	50381	26	38	55
MD:St. Mary's	113510	82	67	52
MD:Talbot	37181	46	35	21
MD:Washington	151049	58	52	119
VA:Alexandria city	159428	113	142	151
VA:Arlington	236842	140	121	175
VA:Clarke	14619	3	3	3
VA:Culpeper	52605	30	48	38
VA:Fairfax	1147532	449	623	588

New COVID-19 Death Trends

County	Population	Jul 30-Aug 05	Aug 06-Aug 12	Aug 13-Aug 19
DC:District of Columbia	705749	3	6	7
MD:Anne Arundel	579234	6	8	1
MD:Baltimore	827370	17	12	14
MD:Baltimore city	593490	17	13	10
MD:Calvert	92525	1	0	0
MD:Caroline	33406	0	0	0
MD:Carroll	168447	1	1	1
MD:Cecil	102855	0	0	1
MD:Charles	163257	1	0	2
MD:Dorchester	31929	0	0	0
MD:Frederick	259547	0	0	0
MD:Harford	255441	2	0	0
MD:Howard	325690	4	6	5
MD:Kent	19422	0	0	0
MD:Montgomery	1050688	7	12	8
MD:Prince George's	909327	12	18	5
MD:Queen Anne's	50381	2	1	0
MD:St. Mary's	113510	0	0	0
MD:Talbot	37181	0	0	0
MD:Washington	151049	1	0	0
VA:Alexandria city	159428	3	0	1
VA:Arlington	236842	0	0	0
VA:Clarke	14619	0	0	0
VA:Culpeper	52605	0	0	1
VA:Fairfax	1147532	11	0	9