IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/25/22

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background
IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do <u>not</u> assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 2/25/22 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

IEM's Modeling Lead
Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Ohio State Projections
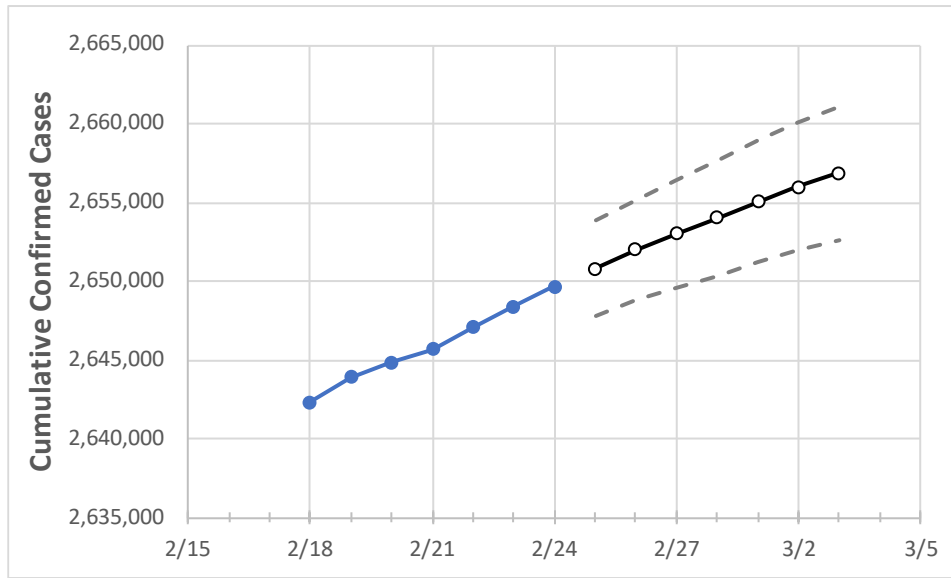
	Actual Confirmed Cases On:				Projected Cases For:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Ohio	2,645,679	2,647,048	2,648,371	2,649,692	2,650,821	2,651,976	2,653,038	2,654,022	2,655,023	2,655,974	2,656,868

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Ohio Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Athens	14,194	14,205	14,228	14,245	14,266	14,288	14,309	14,327	14,345	14,365	14,384
Cuyahoga	265,865	265,948	266,013	266,110	266,188	266,262	266,332	266,402	266,470	266,541	266,602
Franklin	285,377	285,519	285,667	285,818	285,944	286,068	286,182	286,295	286,401	286,507	286,605
Hamilton	185,294	185,367	185,454	185,527	185,599	185,668	185,730	185,792	185,849	185,905	185,954
Lake	48,466	48,479	48,497	48,513	48,526	48,540	48,552	48,565	48,576	48,588	48,598
Lorain	65,984	66,017	66,049	66,076	66,094	66,112	66,129	66,146	66,161	66,178	66,192
Lucas	98,468	98,532	98,587	98,628	98,696	98,752	98,815	98,869	98,927	98,981	99,029
Mahoning	52,955	52,981	52,992	53,008	53,026	53,044	53,060	53,076	53,091	53,105	53,119
Medina	39,683	39,694	39,699	39,718	39,728	39,738	39,747	39,756	39,764	39,772	39,780
Miami	25,556	25,570	25,578	25,586	25,594	25,603	25,610	25,618	25,625	25,632	25,638
Summit	111,397	111,433	111,463	111,485	111,513	111,539	111,564	111,589	111,613	111,637	111,658

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

Ohio Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	2/21	2/22	2/23	2/24	2/26	2/28	3/2
Athens	14,194	14,205	14,228	14,245	14,288 (2,858) [686] {343}	14,327 (2,865) [688] {344}	14,365 (2,873) [690] {345}
Cuyahoga	265,865	265,948	266,013	266,110	266,262 (53,252) [12,781] {6,390}	266,402 (53,280) [12,787] {6,394}	266,541 (53,308) [12,794] {6,397}
Franklin	285,377	285,519	285,667	285,818	286,068 (57,214) [13,731] {6,866}	286,295 (57,259) [13,742] {6,871}	286,507 (57,301) [13,752] {6,876}
Hamilton	185,294	185,367	185,454	185,527	185,668 (37,134) [8,912] {4,456}	185,792 (37,158) [8,918] {4,459}	185,905 (37,181) [8,923] {4,462}
Lake	48,466	48,479	48,497	48,513	48,540 (9,708) [2,330] {1,165}	48,565 (9,713) [2,331] {1,166}	48,588 (9,718) [2,332] {1,166}
Lorain	65,984	66,017	66,049	66,076	66,112 (13,222) [3,173] {1,587}	66,146 (13,229) [3,175] {1,588}	66,178 (13,236) [3,177] {1,588}
Lucas	98,468	98,532	98,587	98,628	98,752 (19,750) [4,740] {2,370}	98,869 (19,774) [4,746] {2,373}	98,981 (19,796) [4,751] {2,376}
Mahoning	52,955	52,981	52,992	53,008	53,044 (10,609) [2,546] {1,273}	53,076 (10,615) [2,548] {1,274}	53,105 (10,621) [2,549] {1,275}
Medina	39,683	39,694	39,699	39,718	39,738 (7,948) [1,907] {954}	39,756 (7,951) [1,908] {954}	39,772 (7,954) [1,909] {955}
Miami	25,556	25,570	25,578	25,586	25,603 (5,121) [1,229] {614}	25,618 (5,124) [1,230] {615}	25,632 (5,126) [1,230] {615}
Summit	111,397	111,433	111,463	111,485	111,539 (22,308) [5,354] {2,677}	111,589 (22,318) [5,356] {2,678}	111,637 (22,327) [5,359] {2,679}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.