IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/22/22

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 not 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 3/22/22 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
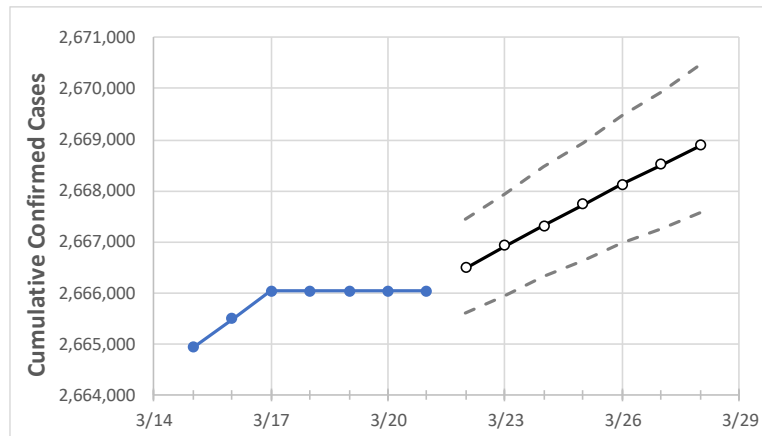
	Actual Confirmed Cases On:				Projected Cases For:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Ohio	2,666,030	2,666,030	2,666,030	2,666,030	2,666,479	2,666,914	2,667,313	2,667,728	2,668,126	2,668,516	2,668,888

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Athens	14,425	14,425	14,425	14,425	14,430	14,435	14,439	14,444	14,448	14,453	14,457
Cuyahoga	267,450	267,450	267,450	267,450	267,490	267,529	267,567	267,605	267,640	267,676	267,712
Franklin	287,443	287,443	287,443	287,443	287,502	287,560	287,615	287,670	287,723	287,780	287,832
Hamilton	186,696	186,696	186,696	186,696	186,736	186,775	186,812	186,852	186,889	186,926	186,961
Lake	48,723	48,723	48,723	48,723	48,731	48,738	48,746	48,754	48,761	48,769	48,776
Lorain	66,311	66,311	66,311	66,311	66,317	66,323	66,328	66,333	66,339	66,343	66,348
Lucas	99,438	99,438	99,438	99,438	99,468	99,496	99,523	99,551	99,576	99,603	99,626
Mahoning	53,217	53,217	53,217	53,217	53,223	53,229	53,234	53,240	53,245	53,251	53,256
Medina	39,906	39,906	39,906	39,906	39,910	39,915	39,919	39,923	39,927	39,931	39,935
Miami	25,671	25,671	25,671	25,671	25,672	25,674	25,675	25,676	25,678	25,679	25,680
Summit	111,887	111,887	111,887	111,887	111,899	111,910	111,921	111,932	111,942	111,953	111,963

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:		
	3/18	3/19	3/20	3/21	3/23	3/25	3/27
Athens	14,425	14,425	14,425	14,425	14,435 (2,887) [693] {346}	14,444 (2,889) [693] {347}	14,453 (2,891) [694] {347}
Cuyahoga	267,450	267,450	267,450	267,450	267,529 (53,506) [12,841] {6,421}	267,605 (53,521) [12,845] {6,423}	267,676 (53,535) [12,848] {6,424}
Franklin	287,443	287,443	287,443	287,443	287,560 (57,512) [13,803] {6,901}	287,670 (57,534) [13,808] {6,904}	287,780 (57,556) [13,813] {6,907}
Hamilton	186,696	186,696	186,696	186,696	186,775 (37,355) [8,965] {4,483}	186,852 (37,370) [8,969] {4,484}	186,926 (37,385) [8,972] {4,486}
Lake	48,723	48,723	48,723	48,723	48,738 (9,748) [2,339] {1,170}	48,754 (9,751) [2,340] {1,170}	48,769 (9,754) [2,341] {1,170}
Lorain	66,311	66,311	66,311	66,311	66,323 (13,265) [3,183] {1,592}	66,333 (13,267) [3,184] {1,592}	66,343 (13,269) [3,184] {1,592}
Lucas	99,438	99,438	99,438	99,438	99,496 (19,899) [4,776] {2,388}	99,551 (19,910) [4,778] {2,389}	99,603 (19,921) [4,781] {2,390}
Mahoning	53,217	53,217	53,217	53,217	53,229 (10,646) [2,555] {1,277}	53,240 (10,648) [2,556] {1,278}	53,251 (10,650) [2,556] {1,278}
Medina	39,906	39,906	39,906	39,906	39,915 (7,983) [1,916] {958}	39,923 (7,985) [1,916] {958}	39,931 (7,986) [1,917] {958}
Miami	25,671	25,671	25,671	25,671	25,674 (5,135) [1,232] {616}	25,676 (5,135) [1,232] {616}	25,679 (5,136) [1,233] {616}
Summit	111,887	111,887	111,887	111,887	111,910 (22,382) [5,372] {2,686}	111,932 (22,386) [5,373] {2,686}	111,953 (22,391) [5,374] {2,687}

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.