IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/18/21

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 3/18/21 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
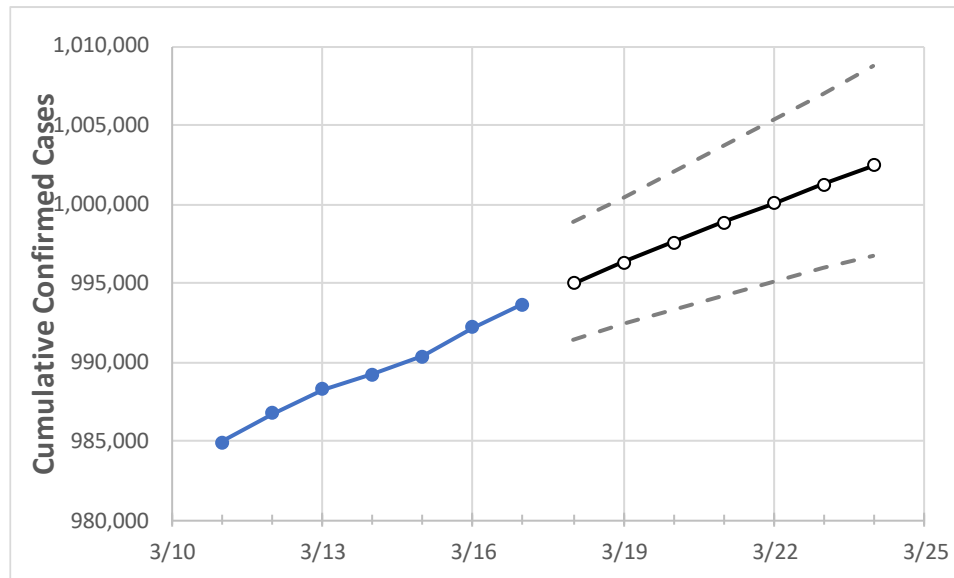
	Actual Confirmed Cases On:				Projected Cases For:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Ohio	989,191	990,340	992,223	993,681	994,997	996,311	997,572	998,844	1,000,071	1,001,274	1,002,458

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:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Athens	4,710	4,711	4,721	4,728	4,732	4,737	4,741	4,745	4,748	4,752	4,756
Cuyahoga	98,295	98,473	98,710	98,905	99,101	99,298	99,494	99,686	99,879	100,067	100,260
Franklin	114,335	114,458	114,675	114,839	115,003	115,167	115,330	115,492	115,655	115,814	115,972
Hamilton	74,636	74,704	74,809	74,922	75,003	75,083	75,159	75,235	75,309	75,382	75,454
Lake	18,789	18,809	18,831	18,853	18,877	18,901	18,924	18,948	18,970	18,991	19,012
Lorain	22,477	22,504	22,535	22,549	22,576	22,602	22,628	22,652	22,675	22,699	22,721
Lucas	36,357	36,422	36,507	36,570	36,642	36,713	36,782	36,852	36,920	36,993	37,061
Mahoning	19,751	19,777	19,798	19,811	19,828	19,846	19,863	19,880	19,896	19,912	19,927
Medina	13,799	13,818	13,882	13,918	13,952	13,985	14,019	14,053	14,087	14,122	14,156
Miami	10,116	10,130	10,151	10,164	10,172	10,181	10,189	10,197	10,205	10,213	10,221
Summit	41,378	41,459	41,584	41,674	41,764	41,854	41,943	42,032	42,121	42,207	42,295

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:		
	3/14	3/15	3/16	3/17	3/19	3/21	3/23
Athens	4,710	4,711	4,721	4,728	4,737 (947) [227] {114}	4,745 (949) [228] {114}	4,752 (950) [228] {114}
Cuyahoga	98,295	98,473	98,710	98,905	99,298 (19,860) [4,766] {2,383}	99,686 (19,937) [4,785] {2,392}	100,067 (20,013) [4,803] {2,402}
Franklin	114,335	114,458	114,675	114,839	115,167 (23,033) [5,528] {2,764}	115,492 (23,098) [5,544] {2,772}	115,814 (23,163) [5,559] {2,780}
Hamilton	74,636	74,704	74,809	74,922	75,083 (15,017) [3,604] {1,802}	75,235 (15,047) [3,611] {1,806}	75,382 (15,076) [3,618] {1,809}
Lake	18,789	18,809	18,831	18,853	18,901 (3,780) [907] {454}	18,948 (3,790) [909] {455}	18,991 (3,798) [912] {456}
Lorain	22,477	22,504	22,535	22,549	22,602 (4,520) [1,085] {542}	22,652 (4,530) [1,087] {544}	22,699 (4,540) [1,090] {545}
Lucas	36,357	36,422	36,507	36,570	36,713 (7,343) [1,762] {881}	36,852 (7,370) [1,769] {884}	36,993 (7,399) [1,776] {888}
Mahoning	19,751	19,777	19,798	19,811	19,846 (3,969) [953] {476}	19,880 (3,976) [954] {477}	19,912 (3,982) [956] {478}
Medina	13,799	13,818	13,882	13,918	13,985 (2,797) [671] {336}	14,053 (2,811) [675] {337}	14,122 (2,824) [678] {339}
Miami	10,116	10,130	10,151	10,164	10,181 (2,036) [489] {244}	10,197 (2,039) [489] {245}	10,213 (2,043) [490] {245}
Summit	41,378	41,459	41,584	41,674	41,854 (8,371) [2,009] {1,004}	42,032 (8,406) [2,018] {1,009}	42,207 (8,441) [2,026] {1,013}

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.