IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/28/21

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 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 1/28/21 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
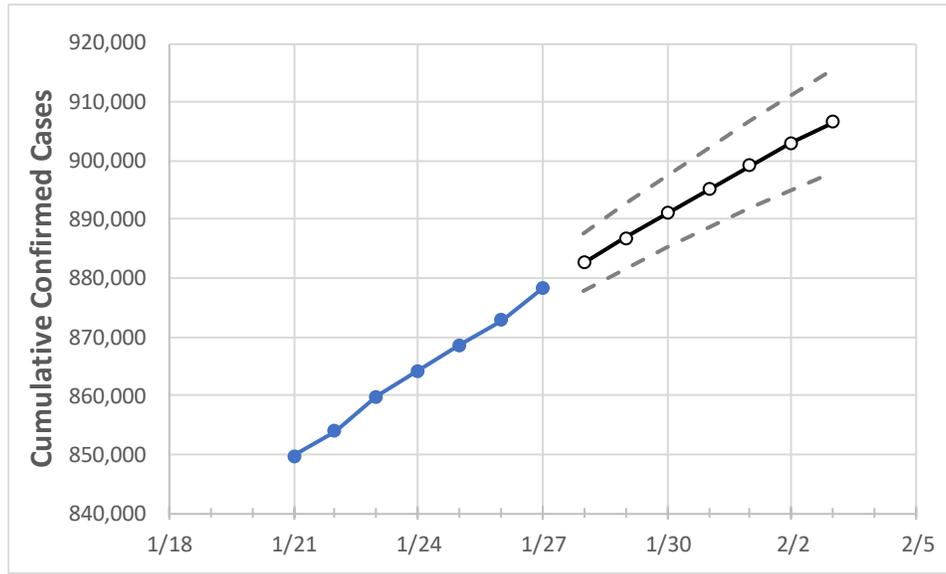
	Actual Confirmed Cases On:				Projected Cases For:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Ohio	864,322	868,656	872,918	878,284	882,689	886,945	891,148	895,189	899,156	903,029	906,680

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Athens	3,812	3,838	3,861	3,904	3,929	3,954	3,978	4,002	4,025	4,049	4,072
Cuyahoga	86,066	86,520	86,893	87,464	87,934	88,401	88,841	89,283	89,706	90,136	90,552
Franklin	101,705	102,154	102,616	103,088	103,555	104,001	104,441	104,870	105,284	105,686	106,064
Hamilton	64,392	64,744	65,148	65,638	66,028	66,397	66,764	67,126	67,469	67,811	68,147
Lake	16,178	16,250	16,350	16,452	16,542	16,628	16,712	16,792	16,870	16,948	17,020
Lorain	19,165	19,296	19,378	19,563	19,694	19,817	19,942	20,061	20,173	20,285	20,398
Lucas	31,500	31,663	31,794	31,968	32,118	32,268	32,415	32,558	32,699	32,828	32,954
Mahoning	17,383	17,471	17,561	17,654	17,733	17,811	17,885	17,960	18,031	18,101	18,170
Medina	11,666	11,732	11,798	11,865	11,929	11,990	12,049	12,107	12,164	12,219	12,270
Miami	9,210	9,244	9,272	9,321	9,361	9,398	9,436	9,471	9,506	9,539	9,572
Summit	35,063	35,250	35,411	35,631	35,823	36,007	36,185	36,361	36,533	36,696	36,852

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:		
	1/24	1/25	1/26	1/27	1/29	1/31	2/2
Athens	3,812	3,838	3,861	3,904	3,954 (791) [190] {95}	4,002 (800) [192] {96}	4,049 (810) [194] {97}
Cuyahoga	86,066	86,520	86,893	87,464	88,401 (17,680) [4,243] {2,122}	89,283 (17,857) [4,286] {2,143}	90,136 (18,027) [4,327] {2,163}
Franklin	101,705	102,154	102,616	103,088	104,001 (20,800) [4,992] {2,496}	104,870 (20,974) [5,034] {2,517}	105,686 (21,137) [5,073] {2,536}
Hamilton	64,392	64,744	65,148	65,638	66,397 (13,279) [3,187] {1,594}	67,126 (13,425) [3,222] {1,611}	67,811 (13,562) [3,255] {1,627}
Lake	16,178	16,250	16,350	16,452	16,628 (3,326) [798] {399}	16,792 (3,358) [806] {403}	16,948 (3,390) [813] {407}
Lorain	19,165	19,296	19,378	19,563	19,817 (3,963) [951] {476}	20,061 (4,012) [963] {481}	20,285 (4,057) [974] {487}
Lucas	31,500	31,663	31,794	31,968	32,268 (6,454) [1,549] {774}	32,558 (6,512) [1,563] {781}	32,828 (6,566) [1,576] {788}
Mahoning	17,383	17,471	17,561	17,654	17,811 (3,562) [855] {427}	17,960 (3,592) [862] {431}	18,101 (3,620) [869] {434}
Medina	11,666	11,732	11,798	11,865	11,990 (2,398) [576] {288}	12,107 (2,421) [581] {291}	12,219 (2,444) [587] {293}
Miami	9,210	9,244	9,272	9,321	9,398 (1,880) [451] {226}	9,471 (1,894) [455] {227}	9,539 (1,908) [458] {229}
Summit	35,063	35,250	35,411	35,631	36,007 (7,201) [1,728] {864}	36,361 (7,272) [1,745] {873}	36,696 (7,339) [1,761] {881}

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.